Utah Department of Transportation

Metric Standard Specifications

For Road and Bridge Construction

CSI Format

1999

This document includes:

- Standard Specifications
- Supplemental Specifications
- Materials Minimum Sampling and Testing Changes
- Master Bid List
- Measurement and Payment Book

The Standard Specifications and Supplemental Specifications include cross-reference links:

- To sections within this document and to the Main Standard Drawing web page.
- Not included from the Specifications to the Master Bid List or the Measurement and Payment Book or within the Master Bid List or the Measurement and Payment Book.
- All main Sections that have been added or modified by Supplemental Specification link to that Supplemental.

Bookmarks are set within the document in order to provide a Table of Contents that links to various portions of the document.

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Introduction

This book is a compilation of Standard Specifications in metric units for insertion by reference into the Department's construction contracts.

The Standard Specifications are written to the Contractor. The Specifications define the Contractor's responsibility in meeting each specification, enumerate the Department's expectations, and explain what the Contractor is expected to provide. Unless otherwise noted, all actions are to be performed by the Contractor.

The requirements in these Specifications may be revised by Supplemental Specifications. A Special Provision may revise the Standard for a specific contract.

For copies of these Specifications, write or call:

Utah Department of Transportation
Construction Division Plans Desk
4501 South 2700 West
Salt Lake City, Utah 84119-5998

Telephone: (801) 965-4108

(Upon request, computer diskettes available in WordPerfect for Windows, Version 6.0a)

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 00120

INSTRUCTIONS TO BIDDERS - See Supplemental

PART 1 GENERAL

1.1 PREQUALIFICATION OF BIDDERS

A. Applies to all projects where the DEPARTMENT engineer's estimate is greater than or equal to $500,000.

B. Provide experience information on the "Contractor's Application for Prequalification" form and a confidential financial statement certified by a certified public accountant.
   1. Include a complete report of the bidder's financial resources and liabilities, equipment, past record, and personnel. DEPARTMENT will establish prequalification amount and classification.
   2. Allow a minimum of 10 days for DEPARTMENT approval of the "Contractor's Application for Prequalification."

C. Prequalify at least once a year.
   1. Prequalification amount may be changed during that period upon the submission of additional favorable reports or upon evidence of unsatisfactory performance.
   2. Prequalification amount limits bidding to individual contracts of a given size or for a particular type of work.

D. If bid exceeds prequalification amount, including work in progress, Contract may not be awarded except at DEPARTMENT discretion.

1.2 BIDDING DOCUMENTS

A. DEPARTMENT will provide bidding documents at cost plus tax to prequalified bidders.

B. Prequalification must be completed and approved by the DEPARTMENT prior to purchasing Bid Proposal. Plans are available to all interested parties.

C. Pay the DEPARTMENT the sum + tax (non refundable) as stated in the Advertisement for each copy of the Bid Documents and Plans.

1.3 JOINT VENTURE BIDDING

A. Prior to submitting a joint proposal on a single project, a letter of intent to the DEPARTMENT's Prequalification Board Secretary is required at least 4 calendar days before the bid opening. Individual prequalification amounts will be consolidated for the bid.

1.4 CONTENTS OF BID PROPOSALS

A. Contents:
   1. The location and description of the contemplated construction.
   2. The estimated quantities.
   3. A schedule of unit bid items.
   4. The time in which the work must be completed.
   5. The amount of the proposal guarantee.
   6. The date, time and place of the opening of proposals.

B. Papers bound with or attached to the Bid Proposal are considered a part of the Proposal and shall not be detached or altered when the Proposal is submitted.

C. The plans, supplemental specifications, specifications and other documents that accompany the Bid Proposal are considered a part of the Proposal whether attached or not and need not be returned with the Bid Proposal.

1.5 ISSUANCE OF BID PROPOSALS

A. The DEPARTMENT reserves the right to refuse to issue a Bid Proposal or award a Contract to a bidder for any or all of the following reasons:
   1. Lack of prequalification.
   2. Uncompleted work under contract that the DEPARTMENT determines will hinder or prevent the prompt completion of additional work if awarded.
   3. Failure to pay or settle claims.
   4. Failure to comply with any qualification regulations.
   5. Default under previous contracts.
   6. Unsatisfactory performance on previous or current Contract(s)
   7. Debarment by the DEPARTMENT.
   8. Serious misconduct that adversely affects the ability to perform future work.
   9. Failure to reimburse for monies owed on any previously awarded DEPARTMENT contracts including contracts where the prospective bidder was a party in a joint venture which failed to reimburse the DEPARTMENT.

B. If the DEPARTMENT refuses to issue a Bid Proposal for any of the foregoing reasons, bidder may appeal in writing to the UDOT Deputy Director.
   1. Specify the basis for the appeal in the written request.
   2. The Deputy Director may schedule either an informal or formal hearing.

1.6 INTERPRETATION OF QUANTITIES IN BID PROPOSAL

A. Proposal quantities are estimates used for comparison and may be increased, decreased, or be eliminated in their entirety. DEPARTMENT pays for actual work performed and accepted, and materials furnished.

1.7 EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS AND WORK SITE

A. Examine proposed work site and all documents before submitting a Bid Proposal.
   1. Bidder is responsible for all site conditions that should have been discovered had a reasonable site investigation been performed.
   2. Submitting a Bid Proposal will be considered conclusive evidence that the bidder knows the conditions to be encountered in performing the work and as to the requirements of the proposed Contract.

B. All DEPARTMENT Boring logs and other records of subsurface investigations are available for information purposes only and are not substitutes for bidder's own investigation, interpretation, or judgement. It is understood that such information was obtained and used for DEPARTMENT design and estimating purposes only.

C. Bidder is permitted to converse with DEPARTMENT personnel who know about the project, plans, specifications, materials sites, or conditions generally prevailing in the area of the proposed work to aid in pre-bid investigations.
   1. Bidder conducts independent investigation, including a visit to the site of the work.
   2. The ENGINEER is available by appointment.

D. The DEPARTMENT is bound by written statements or representations and descriptions of conditions and work only. No oral explanations or instructions are binding.

E. Submit requests for explanations of written proposal documents in 14 days to allow a reply before proposal submission. The DEPARTMENT will respond to written requests to all prospective bidders by certified letter or electronic communications before the specified time for opening proposals.

F. Bidder acknowledges that he/she has investigated the nature and location of the work and knows the general and local conditions that can affect the work or its cost, including but not limited to:
   1. Conditions bearing upon transportation, disposal, handling, and storage of materials.
   2. The availability of labor, water, electric power, and roads.
   3. Uncertainties of weather, river stages, irrigation channel flow, lake and reservoir levels, or similar physical conditions of the ground.
   4. The type of equipment and facilities needed preliminary to and during work performance.

G. The character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is ascertainable from an inspection of the site, as well as from the drawings and specifications and all exploratory work made available by the DEPARTMENT.

H. Failure to take the actions described and acknowledged in this Section, this paragraph (1.7) does not relieve the responsibility for estimating the difficulty and cost of successfully performing the work, or from proceeding to successfully perform the work without additional cost to the DEPARTMENT.

1.8 PROPOSAL PREPARATION

A. Use the DEPARTMENT's Bid Proposal forms.

B. Use the same name as when purchasing Bid Documents and as prequalified, if required.

C. Specify a unit price in figures for each pay item to which a quantity is given and show the products of the respective unit prices and quantities written in the column provided.
   1. The total amount of the Bid Proposal is a summation of the total of each item.
   2. Enter figures in ink or type.
   3. Initial any erasures or changes to unit prices or lump sums.

D. In the space provided on the signature sheet, confirm that all addenda have been received.

E. When the Bid Proposal permits a choice to be made, indicate the choice on the Bid Proposal. No further choice will be permitted.

F. The Bid Proposal submitted must be signed in ink by a representative of the bidder authorized to execute bid proposals. Provide the name and address of the individual signing the Proposal as well as the following names and addresses as applicable:

Type of Bidder:		**Names and Office Addresses Required:**
1.	Individual	Individual and post office address
2.	Partnership	Each Member of the Partnership and each Post office address
3.	Joint Venture	Each Member or Officer of Firms represented and each post office address
4.	Corporation	Corporation Name and corporate address

G. Signing the Bid Proposal **certifies compliance** with all provisions of this Section, paragraph: Non-Collusive Bidding Certification, and this Section, paragraph: "Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions."

1.9 IRREGULAR BID PROPOSALS

A. A Bid Proposal **will be** considered irregular and will be rejected as non-responsive if it:
   1. Is on a document other than that furnished by the DEPARTMENT; or if the document is altered or any part is detached or incomplete.
   2. Contains unauthorized additions, conditional or alternate bids, or irregularities that make the Bid Proposal incomplete, indefinite, or ambiguous.
   3. Contains added Provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
      a. This does not exclude a bid proposal limiting the maximum gross amount of awards acceptable to any one bidder at any one bid letting.
      b. Selection of awards will be made by the DEPARTMENT.
   4. Contains unit prices which are not typed or completed in ink, or are not legible.
   5. Does not contain a unit price for each pay item listed and the amount for each lump sum item, except in the case of authorized alternate pay items.
   6. Has changes in the unit prices such as erasures, strikeouts and white-outs that are not initialed in ink.

7. Is not properly signed.
8. Has a bid bond that is:
    a. Submitted on a form that is not furnished by the DEPARTMENT.
    b. Not properly signed.
9. Contains a “Status of Work Under Contract” standard form for contractors who are prequalified for less than Unlimited:
    a. Which is incomplete and improperly executed.
    b. Indicates the sum of the amount of **all** uncompleted work, plus the estimate of the amount of work to be bid upon, exceeds the amount for which the CONTRACTOR is prequalified.

B. Bid Proposal **may be** considered irregular and may be rejected as non-responsive if:
1. Any of the unit bid prices are significantly unbalanced to the potential detriment of the DEPARTMENT. The DEPARTMENT may require written justification for the basis for the unit prices before making a decision as to whether the bid is irregular.
2. Receipt of Addenda is not acknowledged.
3. Proposal does not comply with conditions of special provision for certification of Affirmative Action (DBE).

1.10 PROPOSAL GUARANTY

A. Bid Proposal will not be considered unless accompanied by a guaranty in the form of a certified check, cashier's check or guaranty bond for not less than 5 percent of the total amount of the bid made payable to the Utah Department of Transportation.

B. Make a proposal guaranty bond on the form included in the Bid Proposal.

1.11 DELIVERY OF BID PROPOSALS

A. Place Bid Proposals in a sealed envelope plainly marked to indicate a Bid Proposal. Include on envelope the project number, bid opening date, submitting contractor, and company address;

B. Address envelope to: Engineer for Construction and Materials, 4501 South 2700 West, Salt Lake City, UT, 84114-8220.

C. File the Bid Proposal before the time and at the place specified in the Advertisement.

D. Bid Proposals received after the time specified for opening will be returned unopened.

1.12 WITHDRAWAL OR REVISION OF BID PROPOSALS

A. Bid Proposal may be withdrawn or revised after receipt by the DEPARTMENT.

B. Provide the request for withdrawal or revision to the DEPARTMENT in writing or a telephone call followed by documented electronic communications before the time set for opening bid proposals.

1.13 COMBINATION OR CONDITIONAL BID PROPOSALS

A. Bid Proposals may be issued for projects in combination or separately.
   1. Bid Proposals may be submitted either on the combination or on separate units of the combination.
   2. The award of combination bid proposals or separate bid proposals will be made to the advantage of the DEPARTMENT.
   3. No combination bid proposals, other than those specifically set up in the Bid Proposal, will be considered.
   4. Separate contracts will be written for each individual project included in the combination.

B. Conditional bid proposals will be considered only when specified in the advertisement.

1.14 PUBLIC OPENING OF BID PROPOSALS

A. Bid Proposals will be opened and read publicly at the time and place indicated in the advertisement.

1.15 DISQUALIFICATION OF BIDDERS

A. DEPARTMENT will disqualify a bidder and reject a Bid Proposal for one or both of the following:
   1. More than one Proposal for the same work from an individual, firm, or corporation under the same or different names.
   2. Evidence of collusion among bidders. Collusion participants are not recognized as bidders for future work until they are reinstated as a qualified bidder.

1.16 NON-COLLUSIVE BIDDING CERTIFICATION

A. By submitting this Bid Proposal, each bidder and each person signing on behalf of any bidder certifies as to its own organization, under penalty of perjury, that to the best of their knowledge and belief:
   1. The prices in this Bid Proposal have been arrived at independently without collusion, consultation, communication, or agreement with any other bidder or with any competitor for the purpose of restricting competition.
   2. Unless required by law, the prices that have been quoted in this bid proposal have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before opening of Bid Proposals.
   3. No attempt has been made or will be made by the bidder to induce any other person, partnership, or corporation to submit or not to submit a Bid Proposal for the purpose of restricting competition.
   4. The signers of the Bid Proposal will tender to the DEPARTMENT a sworn statement that the named Contractor(s) has not, whether directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action to restrain free competitive bidding in connection with this Proposal.

B. No Bid Proposal will be considered for award, nor will any award be made where there has not been compliance with this paragraph, item A, except as follows:

1. If the bidder cannot make the foregoing certification, the bidder must furnish with the bid proposal a signed statement that describes in detail the reasons why the certification cannot be made.
2. The Executive Director, or designee, determines that such disclosure was not made for the purpose of restricting competition.

C. Any of the following does not constitute a disclosure within the meaning of this paragraph, item A.1:

1. A bidder has published price lists, rates, or tariffs covering items being procured.
2. A bidder has informed prospective customers of proposed or pending publication of new or revised price lists for such items.
3. A bidder has sold the same items to other customers at the same prices being bid.

D. A Bid Proposal made by a corporation is considered authorized by the board of directors of the bidder. Authorization is defined as signing and submitting the bid proposal, and includes the declaration of non-collusion on the part of the corporation.

E. **UTAH DEPARTMENT OF TRANSPORTATION NON-COLLUSIVE BIDDING CERTIFICATION**

"I declare under penalty of perjury under the laws of the United States and the State of Utah that neither I, nor to the best of my knowledge any member or members of my firm or company have either directly or indirectly restrained free and competitive bidding on this project by entering into any agreement, participating in any collusion, or otherwise taking any action unauthorized by the Utah Department of Transportation, with regard to this Contract."

F. Signing the Bid Proposal at the bottom of the Bid Schedule **certifies compliance** with all provisions of this Non-Collusive Bidding Certification.

1.17 DEBARMENT

A. The DEPARTMENT may debar a Contractor from performing any work on DEPARTMENT or DEPARTMENT administered projects if:

1. The CONTRACTOR or an affiliate (defined as an owner, director, manager, officer or fiscal agent of the CONTRACTOR) has been convicted of or entered a plea of guilty or *nolo contendere* to a bid-related or a contract-related crime in any Court of competent jurisdiction.
2. The CONTRACTOR or an affiliate has made a public admission of any bid-related or contract-related crime.
3. The CONTRACTOR or an affiliate has falsified information or submitted deceptive or fraudulent statements in connection with prequalification, bidding, or performance of a contract.
4. The CONTRACTOR or an affiliate has violated relevant antitrust laws covering bid rigging, collusion or restraint of free competition among contractors; (Violations covered by the Sherman Antitrust Act, 15 U.S.C. 1, *et seq.* and Title 76, Chapter 10, Section 911, *et se.,* U.C.A. 1953, as amended).

5. The CONTRACTOR or an affiliate has demonstrated willful wrongdoing reflecting a lack of integrity in bidding or performing public projects.
6. The CONTRACTOR, joint venturer, stockholder of 5 percent or more of the Contract, an affiliate, or any immediate relatives of the aforementioned, has been debarred or affiliated with another debarred person or contractors by the Federal Government or by another State government.
7. The UDOT Deputy Director has reasonable grounds to believe and finds that the CONTRACTOR has acted in collusion with others to perform work on a project that supposedly satisfies disadvantaged business enterprise goals or requirements through other than *bona fide* disadvantaged business entities in any combination of individuals, firms or corporations.
8. The CONTRACTOR or affiliate has defaulted under previous contracts.
9. The CONTRACTOR or affiliate has unsatisfactory performance on previous work or current Contract(s) consisting of, but not limited to:
    a. Noncompliance with Contract.
    b. Failure to complete work on time.
    c. Instances of substantial corrective work before acceptance.
    d. Instances of completed work that requires acceptance at reduced pay.
    e. Production of non-specification work or materials, and when applicable, required price reductions or corrective work.
    f. Failure to provide adequate safety measures and appropriate traffic control that endangered the safety of the work force and public.
10. The CONTRACTOR or an affiliate has questionable moral integrity as determined by the DEPARTMENT, the Attorney General of Utah or the Attorney General of the United States.
11. Failure to reimburse the State for monies owed on any previously awarded contract including those where the prospective bidder is a party to a joint venture and the joint venture has failed to reimburse the State for monies owed.
12. The UDOT Deputy Director has reasonable grounds to believe and finds that the public health, welfare or safety imperatively requires such action.

1.18 STATUS PENDING DEBARMENT

A. A CONTRACTOR notified of proposed debarment as provided above will not be permitted to contract with the DEPARTMENT, nor to act as a subcontractor unless a request for a either an information or formal hearing is pending.

B. The proposed debarment period will not commence until the DEPARTMENT decision has been issued following the said hearing or hearings.

1.19 LENGTH OF DEBARMENT

A. Debarment will be for a term of not less than 6 months and up to 3 years as determined by the Deputy Director.

B. The period of debarment may be adjusted for mitigating circumstances including but not limited to the following:
    1. Degree of culpability.

2. Restitution of damages to the State.
3. Cooperation in the investigation of other bidding crimes.
4. Disassociation with those involved in bidding crimes.
5. Protection of the State that may be required.
6. If such action would have unintended adverse consequences on competition.

C. Debarment will in no way affect the obligation of a CONTRACTOR to the DEPARTMENT to perform under existing contracts.

D. The DEPARTMENT also reserves the right to declare a debarred contractor in default on any existing contracts for adequate cause as provided in such contracts.

1.20 DEBARMENT - PROCEDURES

A. The procedure described in this Section, paragraph: Debarment will apply if it is found that a contractor or an affiliate thereof is violating the prohibited activities.

B. The Engineer for Construction and Materials will notify in writing and by certified mail the CONTRACTOR against whom action is contemplated of the DEPARTMENT's intention to debar. Written notice will specify:
1. The grounds for such intended debarment.
2. The date debarment becomes effective and the intended period of debarment.
3. The procedure to follow if the CONTRACTOR desires to challenge the debarment or to offer information to the DEPARTMENT in mitigation of its alleged actions.

C. Within 15 calendar days of receiving of the notice of intended debarment, the CONTRACTOR may request either:
1. An informal hearing before the Engineer for Construction and Materials.
2. A formal hearing before the UDOT Deputy Director.

D. The CONTRACTOR who elects to proceed at an informal hearing will have the opportunity to appear at a mutually agreed upon time and location.
1. CONTRACTOR may supply information in support of their position and will have the opportunity to review the DEPARTMENT's evidence, present evidence, and discuss matters informally.
2. No legal counsel will be permitted for either party at the informal hearing.

E. The UDOT Deputy Director of Transportation or designee will conduct a formal hearing with assistance from the State Attorney General's Office. The CONTRACTOR who appears may be represented by counsel and will have the opportunity to review the DEPARTMENT's evidence, and to present evidence in rebuttal either by sworn affidavit or by sworn testimony.

F. Following either a formal or informal hearing, the DEPARTMENT representative conducting the hearing will issue a written decision no later than 30 calendar days following the hearing.

G. The decision of the UDOT Deputy Director following a formal hearing will be administratively final and will specify the facts justifying the DEPARTMENT's actions and conclusion.

H. If the Engineer for Construction and Materials’s decision is to be appealed, the CONTRACTOR will file notice in writing with the UDOT Deputy Director within 20 calendar days after receiving the Engineer for Construction and Materials's decision. The Deputy Director will then schedule a formal hearing as specified above.

PART 2 **PRODUCTS** Not used.

PART 3 **EXECUTION** Not used.

END OF SECTION

SECTION 00515

AWARD AND EXECUTION OF CONTRACTS

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00570: Definitions.

1.2 CONSIDERATION OF BID PROPOSALS

A. The DEPARTMENT will open and read the Bid Proposals, and compare them on the basis of the summation of the products of the quantities and the unit bid prices.
   1. DEPARTMENT will make the results of the comparisons available to the public.
   2. The unit bid prices govern if a discrepancy exists between unit bid prices and extensions.

B. The DEPARTMENT reserves the right to reject any or all Bid Proposals, waive technicalities, advertise for new Bid Proposals or proceed to do the work.

C. The bidder can request withdrawal of a bid after bid opening by:
   1. Submitting a notarized affidavit within 24 hours after bid opening that declares a clerical or mathematical error in bid preparation.
   2. Submitting accompanying declaration with original work sheets used in bid preparation.
   3. Describing specific error(s) in detail.
   4. Verifying that error is of a significant monetary effect in the amount of 3 percent of the bid or greater.

D. **Judgmental errors are not grounds for requesting bid withdrawal.**

1.3 AWARD OF CONTRACT

A. Contract award will be to the lowest responsible bidder within 30 calendar days.

B. The DEPARTMENT may withhold award beyond the 30 days with the approval of the successful bidder.

C. If the award is not made within 30 calendar days, the bidder may withdraw the Bid Proposal without liability.

D. The successful bidder will be notified by letter mailed to the address shown on the Bid Proposal that the bid has been accepted and that the Contract has been awarded.

1.4 CANCELLATION OF AWARD

A. The DEPARTMENT reserves the right to cancel the award of any Contract before execution without liability.

1.5 RETURN OF PROPOSAL GUARANTY

A. All Proposal guaranties will be returned after a satisfactory contract bond has been furnished and the Contract has been executed.

B. A bidder will not be released from the bidding obligation because of an alleged error in the preparation of the Bid Proposal unless the DEPARTMENT returns the proposal guaranty.

1.6 CONTRACT BONDS

A. The DEPARTMENT will furnish necessary bond forms to the successful bidder.

B. Complete, execute and return forms to DEPARTMENT as required by the Utah Procurement Code.
   1. **Payment Bond** secures the payment of the claims of laborers, mechanics or materialmen employed on the work under the Contract.
   2. **Performance Bond** guarantees the faithful performance of the Contract.

C. Each bond must equal 100 percent of the contract price.

D. Underwriting Limitation is stated in the United States Department of Treasury Circular 570; "Surety Companies Acceptable on Federal Bonds." Only companies listed in the Department of Treasury Circular 570 are acceptable.

E. The DEPARTMENT will declare a bidder's Bid Proposal non-responsive if its surety company is not listed in the Department of Treasury Circular 570 or if co-insurance, reinsurance, or other acceptable method is not provided when a company's underwriting limitation is deemed insufficient.

F. Alterations, extensions of time, extra and additional work, and other changes authorized by the Contract may be made without securing the consent of the surety or sureties on the contract bonds.

G. If a CONTRACTOR's surety is unable to provide payment, the DEPARTMENT will cancel all work on the Contract, unless it is determined to be in the public interest to continue the work.

H. As an alternate contract bond, furnish a cash bond of two cashier’s checks, each in the amount of CONTRACTOR’s bid amount.
   1. This cash bond will be held by the DEPARTMENT and used when needed for correction of any non-performance or non-payment.
   2. Upon release by the ENGINEER for satisfactory completion of the work, one-half of the cash bond minus any cost against the bond will be returned to the CONTRACTOR.

3. If no payment claims have arisen within 90 days after release by the ENGINEER, the remaining cash bond will be released.
4. The DEPARTMENT will hold the cash bond until the non-performance and non-payment issues are resolved, and CONTRACTOR will accrue no liability during this time.
5. The DEPARTMENT will decide the need for withholding the cash bond.

1.7 EXECUTION AND APPROVAL OF CONTRACT

A. Return the signed Contract and contract bonds to the DEPARTMENT within 15 calendar days of notice of award.
   1. The bidder can withdraw the bid proposal without penalty if the Contract is not executed by the DEPARTMENT within 30 calendar days after receiving signed Contracts and Bonds.
   2. The Contract will not be considered in effect until executed by all parties.

1.8 MATERIALS GUARANTY

A. The successful bidder must:
   1. Furnish a complete statement of the origin, composition, and manufacturer of material proposed for use in the construction.
   2. Furnish samples to be tested and inspected for meeting the Contract.

B. CONTRACTOR may be required to furnish a written guaranty covering certain items of work for varying periods of time from the date of acceptance of the Contract.
   1. DEPARTMENT will specify in the Contract the work to be guaranteed, and the form and the time limit of the guaranty.
   2. Sign and deliver the guaranty to the ENGINEER before acceptance of the Contract in accordance with Section 00570, paragraph 1.2 A: Completion.
   3. Upon completion of the Contract, the required Performance Bond may be reduced to conform to the total amount of the contract bid prices for the items of work to be guaranteed. This amount continues in full force and effect for the duration of the guaranty period. Refer to this Section, paragraph: Contract Bonds.

1.9 FAILURE TO EXECUTE CONTRACT

A. The DEPARTMENT can cancel the notice of award and keep the proposal guaranty if the successful bidder fails to execute the Contract and file acceptable Bonds and insurance certificates evidencing coverage within 15 calendar days after the date of the Notice of Award.

B. Contract award may then be made to the next lowest responsible bidder, or the work may be readvertised.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 00555

PROSECUTION AND PROGRESS - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00750: Definitions.

B. Section 00727: Control of Work.

C. Section 01282: Payment.

D. Section 01355: Environmental Protection.

1.2 NOTICE TO PROCEED

A. Proceed with the work after receipt of written notice from the DEPARTMENT.

B. Notify the ENGINEER at least 5 calendar days before beginning work.

C. Contract time will begin 10 calendar days after the date of the Notice to Proceed.

D. Contract Time Option (when included in the proposal):
   1. Include a completed "Contract Time Option Form" stipulating the date for beginning contract time. Stipulate a beginning date within the construction season and not later than the date established on the form.
   2. Contract time will be on a working day basis under this Section paragraph: Determining Contract Time, and paragraph: Extending Contract Time.
   3. Contract time charges will begin on the date selected, and the original number of allowable working days will remain in effect.
   4. Request in writing to change the submitted Contract Time Option begin date a minimum of 15 calendar days before the submitted Contract Time Option begin date. Obtain written approval from the DEPARTMENT before deviating.

1.3 SUBLETTING CONTRACT

A. Obtain written approval of the DEPARTMENT before subletting, selling, transferring, assigning or disposing any portion of the Contract or Contracts.

B. Sublet no more than 50 percent of the total contract work bid amount.

C. Subcontracts or transfer of the Contract do not relieve liability under the Contract and bonds.

D. Do not allow subcontract work to begin until approved by ENGINEER.

E. In computing the percentage of subcontracted work, an item will be considered to be subcontracted in its entirety unless otherwise designated in the subcontract.
   1. The accumulated percentages of all approved subcontracts will be used to assure that the maximum subcontracted limitation is not exceeded.
   2. The total dollar amount of the items subcontracted, as specified in the Contract Bid Proposal, divided by the original contract amount, (less "specialty items"), will be used to determine the amount of work subcontracted.
   3. If a portion of an item is to be performed by the prime CONTRACTOR, the dollar amount of the item agreed to between the prime CONTRACTOR and the subcontractor, (excluding bonds, insurance, profit, and office transaction, etc. performed by the CONTRACTOR), will be used in determining the amount of work subcontracted.

F. Provide for a reduction in retained monies commensurate with the percentage held as retainage as provided for in Section 01282, paragraph: Progress Payments.

G. Include a statement agreeing on a method of distribution of any adjustments due to price increases or decreases using applicable price adjustment specifications for fuel, cement, common carrier rates, etc.

1.4 PROGRESS SCHEDULES

A. Submit a progress schedule which will be the basis for establishing critical construction operations and monitoring project progress.

B. Use the form specified in this Section, paragraph: Critical Path Method Schedule Prepared by the CONTRACTOR, unless otherwise specified.

1.5 CRITICAL PATH METHOD SCHEDULE PREPARED BY THE CONTRACTOR

A. Required for all contracts unless otherwise specified in special provision.

B. Plan and record project construction with conventional Critical Path Method (CPM) schedule.
   1. Use for coordinating and monitoring all work under the Contract including all activities of subcontractors, vendors, and suppliers.

C. The DEPARTMENT will use the schedule to:
   1. Monitor the progress of construction
   2. Compare the work performed to the contract time and phasing requirements
   3. Assign necessary resources for inspection and administration of the Contract.

1.6 CRITICAL PATH - INTERIM BASELINE SCHEDULE

A. Submit an interim baseline schedule to the ENGINEER at or before the pre-construction meeting describing the activities which will occur during the first 60 days of the project.

B. Provide two (2) prints and one (1) 3-1/2 inch diskette compatible with Primavera Project Planner or Suretrak project Manager or in a form that can be restored into Primavera without requiring a conversion program.

C. Provide:
   1. Detail plan of work in accordance with the Contract time and phasing requirements specified in the Contract.
   2. Sequence of early operations, submittals, working drawings and procurement of materials.
   3. Describe the activities to be accomplished and their interdependencies.
   4. Assign a responsibility code to each activity corresponding to the subcontractor or trade responsible for performing the work.
   5. Assign a phase code to each activity corresponding to the location of sub-parts or phases of the work.

D. Do not use the Interim Baseline Schedule for time extension analysis. All data supporting any time extension requests will be derived from the Baseline CPM Schedule.

E. ENGINEER will review the Interim Baseline Schedule and give comments within seven (7) calendar days of receiving.

F. Use the Interim Baseline Schedule and the ENGINEER's comments to prepare the Baseline CPM Schedule.

G. After receiving Notice to Proceed, CONTRACTOR may proceed with work described in the 60-day preliminary schedule that does not conflict with the contract time and progress requirements.

1.7 CRITICAL PATH - BASELINE CPM SCHEDULE

A. Submit a Baseline CPM Schedule for approval on or before the date established for the first partial payment.

B. Provide two (2) prints and one (1) 3 ½ " diskette compatible with Primavera Project Planner or Suretrak Project Manager or in a form that can be restored into Primavera without requiring a conversion program.

C. Include in the Baseline CPM Schedule:
   1. Critical Path using all allotted contract time. Submit a Resource loaded schedule if proposing an early completion date.
   2. Complete logical plan for executing the work. Establish relationships or dependencies between all activities.
      a. Activities must represent the detailed project scope of work.
      b. Show actual workdays estimated to perform each activity including consideration of weather impacts and seasonal limitations.
      c. Tie each activity to Contract Bid Items with coding in the Baseline CPM Schedule to establish the tie.
      d. Describe work activities so that each item is easily identified. For each activity:

- **!** Assign a **Responsibility** code and **Phase** code
- **!** Identify the trade or entity performing the work
- **!** Identify the proposed number of work days
- **!** Identify manpower involved by trade and work location

3. Include Calender(s) used to develop CPM schedule (description of workdays per week, hours per shift, shifts per day)
4. Designate the scheduled "Data Date" as the day prior to the first working day of the contract.

D. The ENGINEER will review the schedule within seven (7) calendar days of submission and, if needed, arrange for a job site meeting with the CONTRACTOR for discussion of the schedule.

1. Failure to provide a baseline schedule may result in withholding all Contract payments until an acceptable schedule is received.
2. Review of the schedule does not bind the DEPARTMENT or constitute acceptance of any individual time period for scheduled activities.

1.8 CRITICAL PATH - SCHEDULE UPDATES

A. ENGINEER and CONTRACTOR will hold monthly job site progress meetings to update the Baseline CPM schedule. They will review progress to verify actual start and finish dates of completed activities, remaining duration of uncompleted activities, and the sequence of activities.

1. Submit the following:
   a. A bar chart grouped by PHASE listing all activities, their early/late and actual start and finish dates, remaining durations, percent complete and Total Float.
   b. A pure logic or PERT diagram on standard, individual D-size sheets (610mm by 910mm).
   c. A narrative report with progress analysis. Include a description of problem areas, current and anticipated delaying factors and their impact, if necessary. Explain corrective actions taken and proposed recovery plan, if requested by the ENGINEER.
   d. A backup of the schedule on 3 ½" computer diskette.

1.9 CRITICAL PATH - SCHEDULE REVISIONS

A. Either CONTRACTOR or DEPARTMENT may request revisions to the accepted Baseline CPM Schedule. Baseline CPM Schedule revisions will not be made without the ENGINEER's prior written approval.

B. A revised baseline schedule is considered necessary under the following conditions.

1. The ENGINEER determines there is reasonable doubt that milestones or the Contract completion date will not be met.
2. There is a significant change in the CONTRACTOR'S operations that will affect the critical path.
3. Actual prosecution of the work differs from that represented on the latest schedule update.

4. There are additions, deletions, or revisions to activities required by Contract modification.

C. The ENGINEER will review the revised baseline schedule within (7) seven calendar days of submission. If rejected by the ENGINEER, submit again within (7) seven calendar days. When approved, the revised Baseline Schedule will become the basis for the next schedule update submitted by the CONTRACTOR.

1.10 CRITICAL PATH - REQUIREMENTS

A. Failure to provide schedule updates or a revised baseline schedule may result in withholding all subsequent Contract payments until an acceptable schedule is received.

B. As determined by CPM analysis, only DEPARTMENT caused delays in activities that affect milestone dates or contract completion dates will be considered for a time extension.

C. If the CONTRACTOR requests a time extension of any milestone or contract completion date, documentation shall be furnished to enable the ENGINEER to determine whether a time extension is appropriate under the terms of the Contract.

D. Adjust contract completion time under this Section, paragraphs: Determining Contract Time, and Extending Contract Time.

E. Float time in the schedule is a shared commodity between the DEPARTMENT and the CONTRACTOR.

1.11 LIMITATION OF OPERATIONS

A. Minimize traffic interference:
1. Conduct the work to minimize interfering with traffic.
2. Finish a section of roadway if it is essential to public convenience before starting work on any additional sections as specified in the Contract.

B. Sundays or holidays: Perform no work without written approval except repair or servicing of equipment, protection of work, maintenance or curing of concrete, or maintenance of traffic.

C. Night work:
1. Give 5 calendar days notice before starting night work.
2. Provide adequate lighting for performing satisfactory inspection and construction operations.
3. Control noise and vibration under the provisions of Section 01355, paragraph: Noise and Vibration Control.

1.12 CHARACTER OF WORKERS

A. Provide sufficient resources to complete all work of the Contract and employ workers with the skill and experience necessary to perform the work.

B. Remove any person employed who performs the work in an improper or unskilled manner, or who is intemperate or disorderly. Rehire these employees only with the ENGINEER's written permission.

C. Failure to remove any employee(s) or to furnish suitable and sufficient personnel to perform the work may result in a written notice to suspend the work.

1.13 METHODS AND EQUIPMENT

A. Use equipment of the size and mechanical condition to perform and produce the specified work.

B. Do not damage the roadway, adjacent property, or other highways.

C. Use methods or equipment other than those specified only with the ENGINEER's written permission.
   1. Describe in writing the proposed methods and equipment to be used and the reasons for the change.
   2. Once approval is received, produce work that meets project requirements.
   3. Discontinue use of alternate methods or equipment if the ENGINEER determines that the work does not meet contract requirements.
   4. Remove and replace or repair deficient work to return it to specified quality at no cost to the DEPARTMENT.
   5. DEPARTMENT will not change the basis of payment for a change in methods or equipment.

1.14 DETERMINING CONTRACT TIME

A. The Bid Documents and Contract will state the "Contract Time," which is days allowed for completing the Contract.
   1. The ENGINEER will furnish a monthly statement showing the number of days charged to the Contract for the preceding month and the number of days remaining for completion of the Contract.
   2. The statement will be considered correct and accepted unless a written protest is submitted to the ENGINEER before the next monthly statement documenting the reasons that the monthly statement is considered incorrect.
   3. Immediately review and resolve any dispute with the ENGINEER.

B. Determining Contract Time
   1. Working Day: Contract time on a working day basis will be determined under Section 00570, paragraph 1.2.A: Working Day.
   2. Calendar Day: Contract time on a calendar day basis will be determined under Section 00570, paragraph 1.2.A: Calendar Day.
      a. DEPARTMENT will exclude Calendar days elapsing between the effective dates of any orders of the ENGINEER to suspend and resume work that are not the fault of the CONTRACTOR.
      b. Weather is not considered an authorized suspension.

3. **Completion Date:** Calendar completion date is the date the ENGINEER completes final acceptance under Section 00727, paragraph: Project Acceptance - Final. No time extension will be considered:
   a. If the Notice to Proceed is made within 30 calendar days after the opening of Bid Proposals, or
   b. The Notice to Proceed is delayed due to the CONTRACTOR's failure to submit required information or return the signed Contract.
4. **Terminating Contract Time Charges:** Daily time charge will cease when substantial completion is accepted per Section 00570, paragraph 1.2.A: Substantial Completion.
5. Time charges will resume if items covered by "Substantial Completion" or work identified during final inspection are not completed within an agreed period of time or at the discretion of the ENGINEER.

1.15 EXTENDING CONTRACT TIME

A. **Overruns:** DEPARTMENT will increase contract time commensurate with the amount of added work as determined by the final estimate.

B. **Extra Work:** Additional contract time may be included on approved change orders. Added time covered by change order will be excluded from the Overrun computation on the final estimate.
   1. Request in writing to add "Contract Time" due to extra work in writing. This is included in a "Change Order" covering the proposed extra work if approved by the ENGINEER.
   2. Time added to calendar day and completion date contracts will be in calendar days.
   3. Time added to working day contracts will be in working days.

C. **Partial Suspension:** Suspension of work on some items as ordered by the ENGINEER is considered a partial suspension.
   1. Applicable only to working day or calendar day contracts.
   2. Time charged for each day on partial suspensions not the fault of the CONTRACTOR will be determined by the ENGINEER, as the greater of:
      a. 0.15 day
      b. The quotient (rounded to hundredths) obtained by dividing the sum of the bid amount for the specific items of work not suspended by the total value of original contract amount.

D. **Request for Time Extension:**
   1. Request in writing, providing justification for the extension before the expiration of the contract time.
   2. Delays beyond the control and fault of the CONTRACTOR including delivery of critical materials caused by national emergency, strikes, embargoes, area-wide shortages, or abnormal reasons may justify an extension.
   3. The following are not considered justification for an extension:
      a. Delay in material delivery due to financial considerations, delayed placement of orders, or other conditions within the CONTRACTOR's control.

b. Insufficient contract time or work suspension for non-compliance with the contract requirements.

1.16 INCENTIVE/DISINCENTIVE

A. An incentive/disincentive provision will be included in the Contract detailing applicable dates and work stages covered by the provision if the DEPARTMENT determines that it is in the public's interest to complete the project at the earliest possible date.

B. Payment will be increased or decreased by the amount established for each calendar or working day the project or phase is open to unrestricted continuous traffic as specified in the Contract.

C. Unrestricted continuous traffic will be determined under Section 00570, paragraph 1.2.A: Unrestricted Continuous Traffic.

D. Relating to liquidated damages, this Section, paragraph: Failure to Complete on Time, remains in effect and is applicable to the total contract time.

E. DEPARTMENT will pay the earned amount of incentive in the progress payment. The amount of disincentive will be deducted from progress payments.

F. Submit a check to the DEPARTMENT within 30 calendar days of notice that payment is due for the difference should the amount of disincentive or liquidated damages exceed the amount due for completed work.

G. No time extension will be granted for delays in material deliveries unless it can be shown that such delays are industry wide. No time extension will be granted for quantity overruns, or adverse weather conditions.

1.17 FAILURE TO COMPLETE ON TIME

A. DEPARTMENT will deduct from any money due the sum specified in the following Schedule of Liquidated Damages (Table 1) for each calendar day or working day that any work remains uncompleted after the specified contract time or approved extension has elapsed. See Section 00570, paragraph 1.2.A: Liquidated Damages.

B. Allowing the continuation and completion of the work after the specified contract completion time or approved extension has elapsed does not waive the DEPARTMENT's rights under the Contract.

C. Time charges may be suspended on working day or calendar day contract after the DEPARTMENT determines that the Contract is substantially complete under Section 00570, paragraph 1.2.A: Substantial Completion.

1. Assessment of liquidated damages will continue until all contract work is completed for a specified calendar completion date contract.
2. CONTRACTOR is not entitled to any reduction beyond the administrative review process in Section 00727, paragraph: Procedures for Resolutions of Disputes, and paragraph: Procedures for Resolution of Claims.

Table 1
Schedule of Liquidated Damages

Original Contract Amount		Daily Charge	
From more than	**To and including**	**Calendar Day Fixed Date**	**Work Day**
$0	$25,000	$150	$210
25,000	50,000	235	330
50,000	100,000	425	600
100,000	500,000	850	1170
500,000	1,000,000	1120	1560
1,000,000	2,000,000	1500	2100
2,000,000	5,000,000	2200	3100
5,000,000	10,000,000	2950	4100
10,000,000	20,000,000	3500	4900
20,000,000	30,000,000	3960	5540
30,000,000		4700	6570

1.18 TERMINATION FOR DEFAULT

A. Termination can occur if the CONTRACTOR:

1. Fails to begin the work under the Contract within the time specified.
2. Fails to perform the work with sufficient resources to assure the prompt completion of the work.
3. Fails to perform the work in accordance with the Contract requirements or neglects or refuses to remove and replace rejected materials or unacceptable work.
4. Discontinues the prosecution of the work.
5. Fails to resume work that has been discontinued within a reasonable time after notice to do so.
6. Becomes insolvent, or is declared bankrupt, or commits any act of bankruptcy or insolvency.
7. Allows any final judgment to remain unsatisfied for a period of 10 calendar days.
8. Makes an assignment for the benefit of creditors without the DEPARTMENT's approval.
9. Fails to comply with contract requirements including minimum wage payments or EEO requirements.
10. Is a party to fraud.

B. The ENGINEER may declare the Contract in default by written notice to the CONTRACTOR and the Surety advising them of the actions required for remedy.

C. Comply with the written notice within 10 calendar days of receipt or the DEPARTMENT has full power and authority to terminate the Contract.

D. The DEPARTMENT may appropriate or use any or all materials and equipment at the project site and enter into another contract for completion of the work according to the terms and provisions thereof, or use such methods as determined by the DEPARTMENT to complete the Contract.

E. All costs and charges incurred by the DEPARTMENT, including the cost of completing the work under the Contract, will be deducted from monies owed or that may be owed the CONTRACTOR. Should the expense exceed the sum that would have been payable under the Contract, the CONTRACTOR and SURETY are liable and must pay the DEPARTMENT the amount of the excess.

1.19 TERMINATION OF CONTRACT FOR CONVENIENCE OF THE DEPARTMENT

A. The DEPARTMENT may, by written order, terminate the Contract or any portion thereof after determining that for reasons beyond the CONTRACTOR's or the DEPARTMENT's control, the CONTRACTOR is prevented from proceeding with or completing the work and that termination would be in the public interest.

B. Reasons for termination may include, but are not limited to:
   1. Executive Orders of the President relating to prosecution of war or national defense.
   2. National emergency that creates a serious shortage of materials.
   3. Orders from duly constituted authorities relating to energy conservation.
   4. Restraining Orders or Injunctions obtained by third-party citizen action resulting from national or local environmental protection laws or where the issuance of such order or injunction is primarily caused by acts or omissions of persons or agencies other than the CONTRACTOR.

C. When the DEPARTMENT orders termination of a contract effective on a certain date, all completed items of work as of that date will be paid for at the contract bid price.
   1. Payment for partially completed work will be made either at agreed prices or by force account methods.
   2. Items that are eliminated in their entirety will be paid for as provided in Subsection 01282, paragraph: Eliminated Items.

D. Materials obtained by the CONTRACTOR that have not been incorporated into the project may be:
   1. Purchased from the CONTRACTOR at the option of the DEPARTMENT at actual cost delivered to a prescribed location
   2. Disposed of as mutually agreed.

E. CONTRACTOR may submit a claim for additional costs not covered in the Contract after receipt of Notice of Termination from the DEPARTMENT.
   1. Submit within 60 calendar days of the effective termination date.

2. Include such cost items as reasonable idle equipment time, mobilization efforts, bidding and project investigative costs, overhead expenses attributable to the project terminated, reasonable profit on work completed, subcontractor costs not otherwise paid for, actual idle labor cost if work is stopped in advance of termination date, guaranteed payments for private land usage as part of original Contract, and any other direct cost the CONTRACTOR has incurred.
3. The negotiated settlement figure reached with the CONTRACTOR will not include loss of anticipated profits.

F. Make cost records available to the DEPARTMENT for determining the validity and amount of each item claimed, and for providing a basis for negotiating an equitable settlement.

G. Termination of a Contract or portion thereof does not relieve the CONTRACTOR of contractual responsibilities for the work completed, nor does it relieve the Surety of its obligation for and concerning any just claim arising out of the work performed.

1.20 SAFETY REQUIREMENTS

A. Meet the General Safety Orders Covering Utah Industries and Federal Mine Safety Health Administration, issued by the Industrial Commission of Utah, Occupational Safety and Health Act of 1970 to protect the life and health of employees in the performance of this Contract. Obtain copies from the office of the ENGINEER.

B. Submit 1 signed and dated hard copy and 1 electronic copy of the Accident Prevention Plan in an approved format to the ENGINEER. Approved plan will be valid for a period of 3 years, and will be published in the Construction Section of the UDOT internet site.

C. Outline the safety program to be enforced.
1. An example may be furnished to help in preparing the Accident Prevention Plan.
2. Review the Plan with the ENGINEER to determine adequate coverage of the project work.
3. Address specialized situations in writing as requested.

D. Have the CONTRACTOR, ENGINEER and the Region /District Safety/Risk Manager sign and date the approved Accident Prevention Plan.

E. CONTRACTOR is responsible for implementing the Accident Prevention Plan before start of project work. Indemnify the DEPARTMENT from any liability related thereto.

F. Meet all safety, State Industrial Commission's requirements, and State and local laws and ordinances. No provision will provide relief from this responsibility.

G. Maintain an accurate record of and report to the ENGINEER and State Insurance Fund, on specified forms, all cases of death and accidents arising out of or in the course of employment on work under the Contract. Forms may be obtained from the ENGINEER.

H. Immediately correct any conditions that do not comply with the foregoing provisions.

I. A stop work order will be issued for failure or refusal to correct unsafe conditions.

1. A stop work order does not provide relief from completing the project within the specified contract completion time.
2. A start work order will be issued when satisfactory corrective action is taken.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 00570

DEFINITIONS

PART 1 GENERAL

1.1 ABBREVIATIONS

A. Wherever the following abbreviations are used in the Contract, they mean:

1. AAN American Association of Nurserymen
2. AAR Association of American Railroads
3. AASHTO American Association of State Highway and Transportation Officials
4. ACI American Concrete Institute
5. AGC Associated General Contractors
6. AI Asphalt Institute
7. AIA American Institute of Architects
8. AISC American Institute of Steel Construction
9. AISI American Iron and Steel Institute
10. AMRL AASHTO Materials Reference Laboratory
11. ANSI American National Standards Institute
12. ARA American Railway Association
13. AREA American Railway Engineering Association
14. ASCE American Society of Civil Engineers
15. ASLA American Society of Landscape Architects
16. ASTM American Society for Testing and Materials
17. AWPA American Wood Preservers' Association
18. AWWA American Water Works Association
19. AWS American Welding Society
20. CRF Code of Federal Regulations
21. EUSERC Electric Utility Service Equipment Requirements Committee
22. FHWA Federal Highway Administration
23. FSS Federal Specifications and Standards
24. GSA General Services Administration
25. IMSA International Municipal Signal Association
26. ITE Institute of Traffic Engineers
27. MIL Military Specifications
28. MUTCD Manual on Uniform Traffic Control Devices
29. NEMA National Electrical Manufacturers Association
30. NVLAP National Verification Laboratory Acceptance Program, (Bureau of Standards)
31. OSHA Occupational Safety and Health Administration
32. PCA Portland Cement Association
33. SAE Society of Automotive Engineers
34. SSPC Steel Structures Painting Council
35. U.L. Underwriter's Laboratory
36. UDOT Utah Department of Transportation

37. USASI United States of American Standard Institute
38. WWPA Western Wood Products Association

1.2 TERMS

A. Wherever the following terms are used in the Contract, they mean:

1. **A+B Bidding:** A Cost-Plus-Time bidding procedure.
2. **Acts of God:** Earthquake, tidal wave, tornado, hurricane, or any other cataclysmic phenomenon of nature beyond the CONTRACTOR's control that causes loss, damage, or injury to the work.
3. **Addendum:** Change in bid proposals during time of advertisement.
4. **Advertisement:** The public announcement inviting bids for work to be performed or materials to be furnished.
5. **Award:** The acceptance of a Proposal by the DEPARTMENT.
6. **Backfill:** Material used to replace, or the act of replacing material removed during construction.
7. **Bidder:** Any individual or legal entity submitting a Proposal.
8. **Bid Proposal:** The prescribed form on which the bidder's offer is submitted.
9. **Bridge:** A structure, including supports, erected over a depression or an obstruction such as water, highway, or railway, and having:
   a. A track or passageway for carrying traffic or other moving loads,
   b. A length measured along the center of roadway of more than 6.1 m between undercopings of abutments or extreme ends of openings for multiple boxes.
10. **Bridge Length:** The over-all length of a bridge measured along the line of survey stationing back to back of back-walls of abutments, if present, otherwise end to end of the bridge floor; but in no case less than the total clear opening of the structure.
    a. Bridge Roadway Width: The clear width measured at right angles to the longitudinal centerline of the bridge between the bottom of curbs or in the case of multiple height of curbs, between the bottoms of the lower risers or if curbs are not used, between inner faces of parapet or railing.
11. **Calendar Day:** Every day shown on the calendar, beginning and ending at midnight.
12. **Certificate of Compliance:** A document containing a certified statement from the manufacturer or supplier concerning the quality and quantity of material delivered.
13. **Change Order:** A written order to the CONTRACTOR, covering contingencies, extra work, increases or decreases in contract quantities, revised work schedule, and additions or alterations of the Contract, that establishes the basis of payment and time adjustments for the work affected by the changes.
14. **Commercial Plants:** A plant selling material to the general public before the DEPARTMENT's advertisement of the Contract, and possesses, in the State in which it resides, the required retail sales tax license and business license.
15. **Commission:** The Utah Transportation Commission.
16. **Completion:** Completion of the Contract occurs when:
    a. The work has been satisfactorily completed in all respects under the Contract.
    b. The project is ready for use by the DEPARTMENT as required by the Contract.

c. The CONTRACTOR has satisfactorily executed and delivered to the ENGINEER all documents, certificates and proofs of compliance required by the Contract.

d. The satisfactory execution and delivery of these documents, certificates and proofs of compliance to the ENGINEER is a material requirement of the Contract.

17. **Concrete - Small Structure:** 8 cubic meters or less of concrete.

18. **Conformity:** Compliance with reasonable and customary manufacturing and construction tolerances where working tolerances are not specified. Where working tolerances are specified, conformity means compliance with such tolerances.

19. **Contract:** The written agreement between the DEPARTMENT and the CONTRACTOR, establishing the obligations of the parties for the performance of the work prescribed. The Contract includes the following, all of which constitute one instrument:

    a. Invitation for Bids
    b. Proposal
    c. Contract Bond
    d. Specifications
    e. Supplemental Specifications
    f. Special Provisions
    g. General and detailed plans
    h. Notice of award
    i. Notice to proceed
    j. Authorized contract time extensions.
    k. Any change orders and agreements that are required to complete the construction of the work in an acceptable manner

20. **Contract Bid Item (Pay Item):** A specific unit of work for which a price is provided in the Contract.

21. **Contract Bond:** The approved form of security, executed by the CONTRACTOR and the CONTRACTOR's Surety or Sureties, guaranteeing complete execution of the Contract and all change orders pertaining thereto and the payment of all legal debts pertaining to the construction of the project.

22. **Contract Payment Bond:** The security executed by the CONTRACTOR and furnished to the DEPARTMENT to guarantee payment of all legal debts of the CONTRACTOR pertaining to the construction of the Contract.

23. **Contract Performance Bond:** The security executed by the CONTRACTOR and furnished to the DEPARTMENT to guarantee completion of the work under the Contract.

24. **Contract Time:** The number of working days or calendar days allowed for completion of the Contract including authorized time extensions. When a calendar date of completion is specified, the Contract is to be completed on or before that date. Specified completion date and calendar day contracts are to be completed on or before the day indicated even when that date is a Saturday, Sunday or holiday.

25. **CONTRACTOR:** The individual or legal entity contracting with the DEPARTMENT for performance of prescribed work.

26. **CONTRACTOR Affiliate:** Any person associated therewith in the capacity of owner, partner, director, officer, principal investigator, project director, manager, or auditor, or other like position.

27. **County:** The county where the contracted work is located.
28. **Culvert:** Any structure that provides an opening under the roadway not meeting the classification of a bridge as defined in paragraph 1.2 A: Bridge.
29. **Debarment:** Action taken by the DEPARTMENT or Federal Government pursuant to regulation that prohibits a person or company from performing work on a public project.
30. **DEPARTMENT:** The Utah Department of Transportation.
31. **Electronic Communication:** A communication transmitted through facsimile (fax), e-mail, or other electronic means where a hard copy can be produced.
32. **ENGINEER:** The UDOT Deputy Director of the DEPARTMENT, acting directly or through a duly authorized representative (usually the Project Engineer or Consultant Engineer), who is responsible for engineering supervision of construction covered by the Contract. A Consultant Engineer who is hired by the DEPARTMENT for Construction Project Management is considered an extension of the DEPARTMENT and has the same responsibility and authority as a Project Engineer.
33. **Equipment:** All machinery, tools, apparatus, and supplies necessary for the upkeep, maintenance, construction, and completion of the Contract.
34. **Extra Work:** Work not provided for in the Contract, but found by the ENGINEER to be essential for the satisfactory completion of the Contract within its intended scope.
35. **Force Account Work:** Work performed as directed by the ENGINEER and paid for on the basis of actual costs and appropriate additives.
36. **Geotextile:** Any permeable textile material used with foundation, soil, rock, earth, or any other geotechnical engineering related material, as an integral part of a man-made project, structure, or system. Geotextile generally refers to knitted, woven, and nonwoven fabrics.
37. **Highway, Street, or Road:** A general term denoting a public way for purposes of travel, including the entire area within the right-of-way.
38. **Holidays:** In the State of Utah, the following days are considered holidays for use in determination of working days:

New Year's Day	Labor Day
Human Rights Day	Columbus Day
Presidents Day	Veteran's Day
Memorial Day	Thanksgiving Day
Independence Day	Christmas Day
Pioneer Day	

When the Holiday falls on a Saturday, Friday will be the Holiday; when the Holiday falls on Sunday, Monday will be the Holiday.

39. **Incentive/Disincentive Provisions:** An adjustment to the contract price of a predetermined amount for each day the work is completed ahead of or behind the specified milestone, phase, or contract completion dates. The amount of the incentive/disincentive is determined based on estimated costs for engineering, traffic control, delays to the motorist, and other items involved in the Contract.
40. **Inspector:** The ENGINEER's authorized representative assigned to make detailed inspections of contract performance.
41. **Interpretations:** Unless otherwise stated in the Contract, all direction, approvals, permissions or acceptance will be by the ENGINEER.

42. **Invitation for Bids:** The Advertisement for Proposals for all work or materials on which bids are requested. Such advertisement will indicate with reasonable accuracy the quantity and location of the work to be performed or the character and quantity of the material to be furnished and the time and place of the opening of proposals.
43. **Laboratory:** The testing laboratory of the DEPARTMENT or any other testing laboratory designated by the ENGINEER.
44. **Lane Rental:** A method to assess the CONTRACTOR daily or hourly rental fees for each lane, shoulder, or combination of lanes and shoulders taken out-of-service.
45. **Limits of Construction:** An area with established boundaries, identified within the highway right-of-way or construction easements, where the CONTRACTOR's use for construction purposes is permitted. The limits of construction may also be referred to as the roadway.
46. **Liquidated Damages:** A predetermined sum to be assessed the CONTRACTOR. This sum is not considered as a penalty, but as liquidated damages due the DEPARTMENT by reason of inconvenience to the public, added cost of engineering and supervision, and other items for extra expenditures of public funds for the CONTRACTOR's failure as specified.
47. **Major and Minor Contract Items:** Any item having a contract value in excess of 5 percent of the original contract amount is a major item. All other original contract items are minor items.
48. **Materials:** Any substances specified for incorporation into the completed project.
49. **Notice to Proceed:** Written notice to the CONTRACTOR to begin the Contract; when applicable, the notice will include the starting date of contract time.
50. **Overburden:** Any material that overlays material designated for road or bridge construction.
51. **Pavement Structure:** The combination of subbase, base course, and surface course placed on a subgrade to support and distribute the traffic load to the roadbed.
    a. **Surface Course**: One or more layers of a pavement structure designed to accommodate the traffic load, the top layer of which resists skidding, traffic abrasion, and the disintegrating effects of climate. The top layer is sometimes called the "Wearing Course."
    b. **Base Course**: One or more layers of specified material and thickness placed on a subbase or a subgrade to support a surface course.
    c. **Subbase**: Layer(s) of specified material thickness placed on a subgrade to support a base course.
    d. **Subgrade**: The top surface of a roadbed upon which the pavement structure, shoulders, and curbs are constructed.
    e. **Subgrade Treatment**: Modification of roadbed material by stabilization.
52. **Plans:** Approved contract drawings showing the location, type, dimensions and details of the Contract to be performed.
    a. **Standard Plans**: Detailed drawings approved for repetitive use.
    b. **Working Drawings:** Supplemental design sheets or similar data that the CONTRACTOR is required to submit to the ENGINEER such as shop drawings, erection plans, falsework plans, framework plans, cofferdam plans, and bending diagrams for reinforcing steel.
53. **Prequalification Statement:** The specific forms on which required information is furnished as to the CONTRACTOR's ability to perform and finance the work.

54. **Profile Grade:** The trace of a vertical plane intersecting the top surface of the proposed wearing surface, usually along the longitudinal centerline of the roadbed. Profile grade means either elevation or gradient of such trace according to the context.
55. **Project:** The specific section of the highway or other specific property on which construction is to be performed under the Contract.
56. **Proposal:** A bidder's written offer on DEPARTMENT furnished forms, to perform stated work at the quoted prices.
57. **Proposal Form:** The prescribed form on which the bidder's offer is submitted.
58. **Proposal Guaranty:** The security furnished with a proposal to assure that the bidder will enter into the Contract if the Proposal is accepted.
59. **Responsible Bidder:** A bidder determined by the DEPARTMENT to possess the ability to perform the Contract work.
60. **Responsive Bid:** A bid that meets all requirements of the invitation for bids.
61. **Right-of-Way:** A general term denoting land, property, or interest acquired for or devoted to transportation purposes.
62. **Roadbed:** The graded portion of highway within top and side slopes, prepared as a foundation for the pavement structure and shoulders.
63. **Roadbed Material:** Material in cuts, embankments, and in embankment foundations from the subgrade down that supports the pavement structure.
64. **Roadside:** The areas between the outside edges of the shoulders and the right-of-way boundaries. Unpaved median areas between inside shoulders of divided highways and areas within interchanges are included.
65. **Roadside Development:** Those items necessary for the preservation or replacement of landscape materials and features that may include suitable plantings and other improvements or ground cover to preserve and enhance the appearance and stability of the highway right-of-way or acquired easements for scenic improvements.
66. **Roadway:** The portion of a highway within limits of construction.
67. **Shoulder:** The portion of the roadway adjacent to the traveled way for accommodation of stopped vehicles for emergency use, and for lateral support of base and surface courses.
68. **Sidewalk:** That portion of the roadway constructed for pedestrian use.
69. **Specialty Item:** Items limited to work requiring highly specialized knowledge, abilities, or equipment not ordinarily available in the type of contracting organization qualified and expected to bid on the Contract as a whole. Generally limited to minor components of the overall Contract.
70. **Specifications:** The compilation of provisions and requirements for the performance of prescribed work.
    a. **Special Provisions**: Additions and revisions to the standard and supplemental specifications applicable to an individual contract.
    b. **Supplemental Specifications**: Approved additions and revisions to the Standard Specifications.
    c. **Standard Specifications**: This book of specifications approved for general application and repetitive use.
71. **Specified Completion Date:** The date on which the Contract work is specified to be complete.
72. **Stabilization:** Modification of soils or aggregates by incorporating materials that increases load-bearing capacity, firmness, and resistance to weathering or displacement.

73. **State:** The State of Utah acting through its authorized representative.

74. **Structures:** Bridges, culverts, catch basins, drop inlets, retaining walls, cribbing, manholes, endwalls, buildings, sewers, service pipes, underdrains, foundation drains and other such features that may be encountered in the work.

75. **Subcontractor:** An individual or legal entity that performs part of the CONTRACTOR's required work through a contract agreement with the CONTRACTOR.

76. **Substantial Completion:** The point in time when the performance of all work under the Contract (except landscaping items, final cleanup, and repair of work) is performed but not yet accepted by the ENGINEER, provided the ENGINEER has determined in writing that:
    a. The project is safe and convenient for use by the public, fully signed and striped, and with all safety appurtenances installed.
    b. Failure to complete the work and repairs excepted above will not result in the deterioration of other completed work.
    c. Substantial completion shall not apply in Calendar Completion Date Contracts as specified in Section 00555, paragraph: Failure to Complete on Time.

77. **Substructure:** All of the structure below the bearings of simple and continuous spans, skewbacks of arches and tops of footings or rigid frames; including backwalls, wingwalls and wing protection railings.

78. **Superintendent:** The CONTRACTOR's authorized representative in responsible charge of the work.

79. **Superstructure:** All that part of a structure except the substructure as defined in paragraph 1.2 A: Substructure.

80. **Surety:** The legal entity or individual other than the CONTRACTOR, executing a bond furnished by the CONTRACTOR.

81. **Titles (Or Headings):** The titles or headings of the Divisions, Sections, and paragraphs herein are intended for convenience of reference and so not have any bearing on their interpretation.

82. **Town, City or District:** A subdivision of the county used to designate or identify the location of the Contract.

83. **Traveled Way:** The portion of the roadway designated for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

84. **Unbalanced Bid:**
    a. **Materially Unbalanced**: A bid that generates a reasonable doubt that award to the bidder submitting a mathematically unbalanced bid will result in the lowest ultimate cost to the DEPARTMENT.
    b. **Mathematically Unbalanced**: A bid containing lump sum or unit bid items that do not reflect reasonable actual costs plus a reasonable proportionate share of the bidder's anticipated profit, overhead costs, and other indirect costs.

85. **Unrestricted Continuous Traffic**: No lane closures for any operations necessary to complete the project, and the traffic following in the final lane arrangement as proposed for the finished surface of the roadway with line striping, delineation, and permanent safety features complete. ENGINEER will determine unrestricted continuous traffic.

86. **Utility:** All privately, publicly or cooperatively owned lines, facilities and systems for producing, transmitting or distributing communications, power, heat, gas, oil, water, waste, storm water not connected with the highway drainage, signal systems and other products that directly or indirectly serve the public; the utility company.

87. **Work:** The furnishing of all labor, materials, equipment, and other incidentals necessary to complete the Contract. This includes all alterations, amendments or extensions hereto made by change order or other written orders of the ENGINEER.

88. **Working Day:** Any calendar day, except:
    a. Saturdays, Sundays and Holidays
    b. Days between December 1 and February 29, inclusive
    c. Days when the CONTRACTOR is specifically required by the Contract or letter from the ENGINEER to suspend operations through no fault of the CONTRACTOR
    d. Days when the ENGINEER determines that inclement weather or adverse conditions interfere with the progress of the work.
        - When the ENGINEER determines that inclement weather prevents the CONTRACTOR from working with at least 75 percent of the normal labor and equipment force engaged in the work for at least 75 percent of the normal working day.
        - When inclement weather stops the CONTRACTOR from beginning work at the normal starting hour, and the crew is released as a result, it is not considered a working day even though conditions may improve and the major portion of the day could be considered suitable for operations.

89. **Working Drawings:** See "**Plans**."

90. **Written Permission of the ENGINEER**: A letter signed by the ENGINEER granting specific permission and outlining limitations of the permission.

PART 2 **PRODUCTS** Not used.

PART 3 **EXECUTION** Not used.

END OF SECTION

SECTION 00725

SCOPE OF WORK - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 00570: Definitions.

C. Section 01282 Payment.

D. Section 01355: Environmental Protection.

E. Section 01741: Final Cleanup

1.2 INTENT OF CONTRACT

A. Complete all work and furnish all resources and other incidentals required to complete the specified work.

1.3 VOLUNTARY PARTNERING

A. "Voluntary partnering" does not change the legal relationship of the parties to the Contract, and does not relieve either party from any of the terms of the Contract.

B. The DEPARTMENT encourages the formation of a strong partnership among the DEPARTMENT, the CONTRACTOR, and the CONTRACTOR's principal subcontractors. This partnership will be structured to draw on the strengths of each organization to identify and achieve mutual goals.

C. To implement the partner initiative, the CONTRACTOR should contact the DEPARTMENT's ENGINEER within 30 days of Notice of Award and before the preconstruction conference. The ENGINEER will facilitate a planning meeting to determine attendees, agenda, duration, and location of a partnering workshop.

D. Partnership will be multilateral, and participation will be totally voluntary. Any cost to accomplish the partnering will be agreed to by both parties and will be shared equally between the DEPARTMENT and the CONTRACTOR.

E. Persons who should attend the workshop:
   1. CONTRACTOR's corporate level manager.
   2. CONTRACTOR and key project supervisory personnel.
   3. Principal subcontractors.

4. DEPARTMENT's Deputy Construction Engineer.
5. DEPARTMENT's Region Construction Engineer.
6. The ENGINEER and key project personnel.
7. The Project Design Engineer.
8. The Project Manager.
9. Local government personnel.
10. Major utilities.

F. Follow-up workshops may be held periodically as agreed by the CONTRACTOR and the DEPARTMENT.

1.4 DIFFERING SITE CONDITIONS

A. During the progress of the work, if subsurface or latent physical conditions are encountered at the site, promptly notify the ENGINEER in writing of the specific differing conditions before the site is disturbed and before the affected work is performed. Conditions to report include:
   1. Conditions differing materially from those indicated in the Contract.
   2. Unknown physical conditions of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent to the work provided for in the Contract.

B. Upon written notification, the ENGINEER will
   1. Investigate the conditions.
   2. Determine if the conditions materially differ and cause an increase or decrease in the cost or time required for the performance of any work under the Contract.
   3. Notify the CONTRACTOR whether or not an adjustment of the Contract is warranted. If warranted, make an adjustment, excluding anticipated profits as follows:
      a. Adjustments in contract time will be made in accordance with Section 00555, paragraph: Determining Contract Time, and paragraph: Extending Contract Time.
      b. Payment will be made under the provisions of Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work, and paragraphs concerning Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, and Statements).
   4. Modify the Contract in writing accordingly.

C. DEPARTMENT will not allow adjustments to the Contract that benefit the CONTRACTOR unless the CONTRACTOR has provided the required written notice as specified in this Section, paragraph: Notification of Differing Site Conditions, Changes and Extra Work.

1.5 SIGNIFICANT CHANGES IN THE CHARACTER OF WORK

A. The ENGINEER reserves the right at any time during the work to make written changes in quantities and alterations in the work that are necessary to satisfactorily complete the project.

B. Such changes in quantities and alterations do not invalidate the Contract or release the surety, and the CONTRACTOR agrees to perform the work as altered.

C. DEPARTMENT will adjust the Contract, excluding anticipated profits, if the alterations or changes in quantities significantly change the character of the work under the Contract.

1. Such alterations or changes can be in themselves significant changes to the character of the work, or by their effect, can cause other work to become significantly different in character.
2. The basis for the adjustment shall be agreed upon before the performance of the work.
3. If a basis cannot be agreed upon, then an adjustment will be made either for or against the CONTRACTOR in such amount as the ENGINEER may determine to be fair and equitable.
4. DEPARTMENT will pay for the alterations in the work or changed quantities as provided in Section 01282, paragraphs:
   a. Altered Quantities
   b. Differing Site Conditions, Changes, Extra Work
   c. Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).
5. If the directed changes require additional time to complete the Contract, DEPARTMENT will adjust the contract time in accordance with Section 00555, paragraph: Determining Contract Time, and paragraph: Extending Contract Time.

D. If the alterations or changes in quantities do not significantly change the character of the work to be performed under the Contract, DEPARTMENT will pay for the altered work as provided elsewhere in the Contract.

E. The term "significant change" applies only to the following circumstances:

1. When the character of the altered work differs materially in kind or nature from that involved or included in the original proposed construction, or
2. When a major item of work, as defined elsewhere in the Contract, is increased in excess of 125 percent or decreased below 75 percent of the original contract quantity.
   a. Any allowance for an increase in quantity applies only to that portion in excess of 125 percent of the original contract quantity.
   b. Any allowance for a decrease below 75 percent applies only to the actual amount of work performed.
3. When a minor item of work, as defined elsewhere in the Contract, is increased in excess of 150 percent or decreased below 50 percent of the original contract quantity.
   a. Any allowance for an increase in quantity applies only to that portion in excess of 150 percent of the original contract quantity.
   b. Any allowance for a decrease below 50 percent applies only to the actual amount of work performed.

1.6 SUSPENSIONS OF WORK ORDERED BY THE ENGINEER

A. If the performance of all or any portion of the work is suspended or delayed by the ENGINEER in writing for an unreasonable period of time (not originally anticipated, customary, or inherent to the construction industry), and the CONTRACTOR believes that additional compensation or contract time or both are due as a result of such suspension or delay, submit to the ENGINEER a written request for adjustment within 7 calendar days of receipt of the notice to resume work. Explain in the request the reasons and support for such adjustment.

B. Upon receipt of request, the ENGINEER will:

1. Evaluate the request.
2. Adjust (excluding profit) and modify the Contract in writing accordingly, if the ENGINEER agrees that:
   a. The suspension increased the cost and/or time required for the performance of the Contract.
   b. The suspension was caused by conditions beyond the control of and not the fault of the CONTRACTOR, its suppliers, or subcontractors at any approved tier.
   c. The suspension was not caused by weather.
3. The ENGINEER will notify the CONTRACTOR of whether or not an adjustment of the Contract is warranted.
   a. DEPARTMENT will pay under the provisions of Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work, and paragraphs concerning Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).
   b. DEPARTMENT will adjust contract time in accordance with Section 00555, paragraph: Determining Contract Time, and paragraph: Extending Contract Time.

C. DEPARTMENT will not allow adjustment to the Contract unless the CONTRACTOR has submitted the request for adjustment within the time prescribed as specified in this Section, paragraph: Notification of Differing Site Conditions, Changes and Extra Work.

D. DEPARTMENT will not allow adjustments to the Contract under this clause to the extent that performance would have been suspended or delayed by any other cause, or for which an adjustment is provided for or excluded under any other term or condition of this Contract.

1.7 NOTIFICATION OF DIFFERING SITE CONDITIONS, CHANGES AND EXTRA WORK

A. Promptly notify the ENGINEER of alleged changes to the Contract due to differing site conditions, extra work, altered work beyond the scope of the Contract, or actions taken by the DEPARTMENT that changed the Contract terms and conditions.

B. Do not perform further work or incur further contract item expense relating to the claimed change after the date the change allegedly occurred, unless directed otherwise in writing by the ENGINEER.

C. Immediately notify the ENGINEER verbally of the alleged change or extra work occasioned by differing site conditions or actions by the DEPARTMENT. Provide the following applicable information to the ENGINEER in writing within 5 calendar days of the date the change or action was noted:

1. The date of occurrence and the nature and circumstances of the occurrence that constitute a change.
2. Name, title, and activity of each DEPARTMENT representative knowledgeable of the claimed change.
3. Identity of any documents and the substance of any oral communication involved in the claimed change.

4. Basis for a claim of accelerated schedule performance, if applicable.
5. Basis for a claim that the work is not required by the Contract, if applicable.

D. Particular elements of contract performance for which additional compensation may be sought under this paragraph include:
1. Pay item(s) that has (have) been or may be affected by the claimed change.
2. Labor or materials, or both, that will be added, deleted or wasted by the claimed change and what equipment will be idled or required.
3. Delay and disruption in the manner and sequence of performance that has been or will be caused.
4. Adjustments to contract prices, delivery schedules, staging, and contract time estimated due to the claimed change.
5. Estimate of the time within which the DEPARTMENT must respond to the notice to minimize cost, delay, or disruption of performance.

E. The failure to provide required notice under this paragraph constitutes a waiver of any and all claims that may arise as a result of the alleged change.

F. After notifying the ENGINEER, and in the absence of directions received to the contrary from an authorized representative of the DEPARTMENT, continue diligent prosecution of the work under the Contract to the maximum extent possible under the contract provisions.

G. Within 10 calendar days after receipt of notice, the ENGINEER will respond in writing to the CONTRACTOR to:
1. Confirm that a change occurred and, when necessary, direct the method and manner of further performance, or
2. Deny that a change occurred and, when necessary, direct the method and manner of further performance, or
3. Advise the CONTRACTOR that information necessary for deciding to confirm or deny the change has not been submitted, and indicate what information is needed for further review and date by which the CONTRACTOR should submit it to the ENGINEER. The ENGINEER will respond to such additional information within 10 calendar days of receipt from the CONTRACTOR.

H. Any adjustments made to the Contract will not include increased costs or time extensions for delay resulting from the CONTRACTOR's failure to provide requested additional information under requirements of this paragraph.

1.8 MAINTAINING TRAFFIC - GENERAL

A. Keep road(s) open to traffic during the work or provide and maintain detour roads as specified or directed.
1. Keep publicly and privately used roadways in a condition that safely and adequately accommodates traffic 24 hours a day and 7 days a week.
2. Provide traffic control in compliance with the current edition of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Traffic Control provisions of the Specifications, and the Traffic Control Plans.
3. Maintain the sections of road undergoing improvement.

B. Do not park equipment and vehicles, or store materials in the median on divided roadways or within 9 m from the outside edge of the driving lane.

C. Install guardrail so that uncompleted guardrail ends are not exposed to oncoming traffic. Diligently install or modify guardrails until complete.

D. Failure to comply with “Maintaining Traffic” will be cause for the DEPARTMENT to take action to meet the safety requirements of this specification. DEPARTMENT will deduct its costs incurred in such action from money due.

E. Snow removal will not be required during periods of winter shutdown or when construction operations are suspended by the DEPARTMENT. No additional compensation for maintenance will be made except for specific work directed by the ENGINEER. See this Section, paragraphs: Maintaining Traffic - Special Detours, and Maintaining Traffic - During Suspension of Work, and Maintaining Traffic - As Directed by the ENGINEER.

1.9 MAINTAINING TRAFFIC - SPECIAL DETOURS

A. When the Contract includes "Maintenance of Detours" or "Removing Existing Structures and Maintaining Traffic," the payment covers all costs to construct, maintain, water for dust control, and to obliterate the detours, including the construction and removal of temporary bridges and accessory features.

B. The DEPARTMENT will furnish specified right-of-way for temporary highways or bridges.

1.10 MAINTAINING TRAFFIC - DURING SUSPENSION OF WORK

A. Keep sections of the project and temporary roadways passable and open to traffic during work suspensions.

B. Suspensions ordered by the ENGINEER: The DEPARTMENT will maintain temporary roadways and portions of the project during work suspensions.
   1. Resume maintenance for the entire project once work proceeds.
   2. Replace or restore any work or materials lost or damaged because of temporary use of the project.
   3. Remove work or materials used for temporary maintenance, and complete the project as though the work had been continuous and without interference.
   4. Maintenance required for events beyond the CONTRACTOR's control during work suspensions are paid for at contract prices or as extra work.

C. Other Suspensions of Work: Maintain the roadway at no additional cost to DEPARTMENT to accommodate traffic during suspensions resulting from:
   1. Seasonal or climatic conditions.
   2. Failure to correct conditions unsafe for the workers or the general public.
   3. Failure to carry out orders of the ENGINEER.
   4. Any other reasons caused by the CONTRACTOR.

1.11 MAINTAINING TRAFFIC - AS DIRECTED BY THE ENGINEER

A. DEPARTMENT will pay for special maintenance directed by the ENGINEER that is not included in the Contract for the benefit of the traveling public, per unit prices or under Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work, and paragraphs concerning Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).

B. The ENGINEER will determine the work to be classified as special maintenance.

1.12 RIGHTS IN AND USE OF MATERIAL FOUND ON THE WORK

A. Obtain approval before using excavated materials found on the work site that are suitable for completing other bid items of work. The quantity of excavated materials will be paid at the Contract unit price for roadway excavation and under the pay item for which the material is used.

B. Replace excavated material used for completing other bid items of work with acceptable material at no additional cost to the DEPARTMENT.
   1. No charge for the materials used will be made.
   2. Obtain approval before excavating material outside grading limits but within the highway right-of-way.
   3. Compact replacement material to the density requirements specified for roadway embankment construction.

C. Structure materials designated for removal may be used temporarily in the work.

1.13 FINAL CLEANUP

A. Clean the highway, the project, borrow, and local material sources and all areas occupied in connection with the work of all rubbish, excess materials, temporary structures, and equipment, etc. before final inspection and acceptance.

B. Final cleanup cost is incidental to other items. Refer to Section 01741.

1.14 RESTORATION OF SURFACES OPENED BY PERMIT

A. Allow individuals, firm or corporation with authorized permits to enter the project to construct or reconstruct any utility service.

B. Repair damage caused by the permit holder when directed. Repair work is paid as extra work, or as provided in the Contract.

1.15 RAILWAY - HIGHWAY PROVISIONS

A. The DEPARTMENT will arrange with the railway for new crossings or for existing crossings used during the work.

B. Obtain approval from the railway and pay for the use of crossings not specified in the Contract.

C. Avoid accidents, damage, unnecessary delay, or any interference with the movement of trains, traffic of the railway company, or other property.

D. DEPARTMENT will not reimburse for railroad flagging and inspection.

1.16 CONSTRUCTION OVER OR ADJACENT TO NAVIGABLE WATERS

A. Do not interfere with the navigation of waterways when conducting work over, on, or adjacent to navigable waters.

B. Comply with all conditions of the permit from the U.S. Coast Guard or the U.S. Army Corps of Engineers.

1.17 CONTRACTOR'S RESPONSIBILITY FOR WORK

A. Protect the work against injury or damage from all causes whether or not related to performing the work until written acceptance of the project is given, except as provided in this Section, paragraph: Suspensions of Work Ordered by the ENGINEER.

B. Pay to rebuild, repair, restore, and make good all losses, injuries, or damages to any portion of the work from any cause before receiving final acceptance.
   1. Exclude from payment any loss, injury, or damage to the work from events beyond the CONTRACTOR's direct control including acts of God or other cataclysmic phenomena of nature, acts of the public enemy, or acts of governmental authorities.

C. When work is suspended for any cause:
   1. Protect the project from damage.
   2. Provide for normal drainage.
   3. Erect any necessary temporary structures, signs, or other facilities.
   4. Maintain all newly established plantings, seedings, and soddings and protect new tree growth and other designated vegetative growth in acceptable condition.
   5. For reimbursement for costs incurred in periods of suspension, refer to this Section, paragraph: Maintaining Traffic - During Suspension of Work.

1.18 ENVIRONMENTAL PROTECTION

A. Refer to Section 01355.

1.19 VALUE ENGINEERING - CONTRACTOR PROPOSALS

A. Savings resulting from a Value Engineering Change Proposal (VECP) offered by the CONTRACTOR and approved by the DEPARTMENT will be shared equally.

B. Base contract bid prices on specified work rather than on VECPs that are subject to DEPARTMENT approval. If a VECP is rejected, complete the Contract as bid.

C. The DEPARTMENT will consider proposals that may potentially result in savings without damaging essential functions and characteristics of the facility, including but not limited to service life, economy of operation, ease of maintenance, desired ability, safety, and approximate estimated savings.

1.20 VALUE ENGINEERING - SUBMITTING PROPOSALS

A. Submit the following materials and information with each proposal:
   1. A statement that the submission is a VECP.
   2. A description of the existing work and the proposed changes for performing the work. Include a discussion of the comparative advantages and disadvantages of each.
   3. A complete set of plans and specifications showing proposed revisions to the original Contract.
   4. A detailed cost estimate for performing the work under the existing Contract and under the proposed change.
   5. A time frame within which the DEPARTMENT must make a decision.
   6. A statement of the probable effect the proposal would have on the contract completion time.
   7. A description of any previous use or tests of the proposal, the conditions, and the result and the dates, project numbers, and the DEPARTMENT's action on the proposal if previously submitted.

B. The DEPARTMENT will notify the CONTRACTOR within 5 working days if it determines that there is insufficient review time for a response submitted under this Section, paragraph: Value Engineering - Submitting Proposals.

C. The DEPARTMENT will evaluate the need for a noncompensable delay adjustment to the Contract based on additional review time necessary and its effect on the CONTRACTOR's schedule.

D. The CONTRACTOR has no claim against the DEPARTMENT for compensable or noncompensable delay resulting from the failure to respond within the time indicated in this Section, paragraph: Value Engineering - Submitting Proposals, when additional information is necessary to complete the review.

1.21 VALUE ENGINEERING - CONDITIONS FOR PROPOSALS

A. The DEPARTMENT will only consider VECPs that meet the following conditions:
   1. Value Engineering proposals, regardless of their approval by the DEPARTMENT, apply only to the current proposal and become property of the DEPARTMENT.
      a. Submit proposals without restrictions on use or disclosure.
      b. The DEPARTMENT may duplicate or disclose any data necessary to use the proposal.
      c. The DEPARTMENT can apply a proposal for general use on other Contracts it administers.
      d. The purpose of this provision is to ensure legal right with respect to patented materials or processes.

B. Use only proven features that have been employed under similar conditions or projects acceptable to the DEPARTMENT.

C. The DEPARTMENT decides whether or not to accept a proposal. Basis for proposal rejection will include requirements for excessive review, evaluation, and/or investigation, or inconsistency with project design policies or criteria.

D. The DEPARTMENT **will** reject proposals that:
   1. Provide equivalent options to those already in the Contract.
   2. Change only pavement structure thickness or type.

E. The DEPARTMENT **may** reject proposals that:
   1. Contain revisions the DEPARTMENT is already considering or has approved for the Contract.
   2. Do not generate sufficient savings.
   3. Do not provide additional information as requested by the DEPARTMENT including requests for field investigation results and surveys, design computations, and field change sheet for proposed design changes.

F. The CONTRACTOR has no claim to additional costs or delays, including development costs, loss of anticipated profits, or increased material or labor costs, if the proposal is rejected.

G. The ENGINEER can reject all unsatisfactory work resulting from an approved proposal.
   1. Remove rejected work and reconstruct under the original contract provisions at no additional cost to DEPARTMENT.
   2. Reimbursement for modifications to the proposal to adjust field or other conditions is limited to the total amount of the contract bid prices.
   3. Rejection or limitation of reimbursement is not basis for any claim against the DEPARTMENT.

H. The saving generated by contingency items, such as Traffic Control, will not be considered when it is reduced as part of a VECP, unless it can be tied to a reduction in contract time.

1.22 VALUE ENGINEERING - PAYMENT

A. Proposals accepted in whole or in part will be by change order. DEPARTMENT will pay as follows:
   1. The Contract will incorporate changes in quantities of unit bid items, and/or new agreed price items, as appropriate.
   2. Cost of the revised work will be paid directly. The DEPARTMENT will pay the CONTRACTOR 50 percent of the savings reflected by the difference between cost of revised work and the original bid price.
   3. DEPARTMENT will not reimburse costs to develop, design, and implement the proposal.
   4. Only a CONTRACTOR may submit proposals and be reimbursed for savings. The CONTRACTOR can submit proposals for an approved subcontractor.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 00727

CONTROL OF WORK - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 00725: Scope of Work.

C. Section 01282: Payment.

1.2 AUTHORITY AND DUTIES OF THE ENGINEER

A. The ENGINEER will decide all questions regarding the quality and acceptability of materials furnished, work performed, rate of work progress, interpretation of the Contract Documents, and the acceptable fulfillment of the Contract.

B. The ENGINEER has the authority by written order to suspend the work without liability to the DEPARTMENT wholly or in part if the CONTRACTOR fails to:
   1. Correct conditions unsafe for the project personnel or the public, or
   2. Complete contract provisions, or
   3. Comply with the ENGINEER’s orders.

C. The ENGINEER can suspend work wholly or partially for:
   1. Periods of unsuitable weather, or
   2. Conditions unsuitable for the prosecution of the work, or
   3. Any other condition or reason determined to be in the DEPARTMENT's interest.

1.3 PLANS AND WORKING DRAWINGS

A. Keep one full set of plans (provided by the DEPARTMENT) on the project site at all times.

B. Furnish to the DEPARTMENT structure plans with working drawings that detail required work not included in the Contract Plans.

C. Include the cost of furnishing all working drawings in the related Contract Bid Items.

1.4 CONFORMITY WITH PLANS AND SPECIFICATIONS

A. Perform work and furnish materials to meet contract requirements.

B. If there are contract provisions to accept a contract item not complying fully with the minimum requirements, the specified pay adjustment factors will be used for payment.

C. When a contract item fails to meet contract requirements but is adequate to serve the design purpose, the ENGINEER will decide the extent to which the work will be accepted and remain in place. The ENGINEER will document the basis of acceptance by change order and adjust the contract unit price.

D. Remove, replace, or correct work at no cost to the DEPARTMENT when a contract item does not meet specified requirements and results in work inadequate to serve the design purpose.

1.5 COORDINATING PLANS, SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS, AND SPECIAL PROVISIONS

A. All supplementary documents are essential parts of the Contract and a requirement occurring in one is binding as though occurring in all. They are complementary and provide and describe the complete Contract.

B. If there is a discrepancy, the governing ranking is:

Dimensions		**Information**	
1.	Plan	1.	Special Provisions
2.	Calculated	2.	Plans
3.	Scaled	3.	Supplemental Specifications
		4.	Standard Specifications
		5.	Standard Plans
		6.	Information received at mandatory prebid meetings

C. Do not take advantage of any apparent error or omission in the Contract.

D. Notify the ENGINEER promptly of any omissions or errors in the Contract so that necessary corrections and interpretations can be made.

1.6 CONTRACTOR COOPERATION

A. Facilitate progress of the work, and cooperate with DEPARTMENT inspectors and other contractors.

B. Employ a competent superintendent experienced with the work being performed, and capable of reading and understanding the Contract Documents.

C. The superintendent must be:
1. Present at the project site at all times.
2. Available to execute instructions and directions from the ENGINEER or authorized representatives.
3. Authorized to act as agent for the CONTRACTOR on the work.

D. Supply all necessary resources to complete the Contract, regardless of the amount of work sublet.

1.7 COOPERATION WITH UTILITIES

A. Relocate or adjust utilities when specified.
   1. Use work procedures that consider the potential of inaccurate or inexact utility locations provided by utility owners, especially for underground installations.
   2. Cooperate with the utility owners to remove and rearrange underground or overhead utilities to avoid service interruption or duplicate work by the utility owner.

B. Cooperate with the utility owners to adjust utility fixtures and appurtenances shown in the Contract plans.

C. Use work procedures that protect utilities or appurtenances that remain in place during construction.

D. The DEPARTMENT has notified utility companies, pipeline owners, or other utility agencies affected by the work to ensure that all utility adjustments, within or adjacent to the construction limits, are made as soon as possible. Coordinate with utility companies.

E. Notify the appropriate utility authorities of any service interruption resulting from breakage within the construction limits.
   1. Cooperate with authorities until service is restored.
   2. Work around fire hydrants only after obtaining approval by the local fire authority and only after making provisions for continued service.

F. Repair damage to utilities that results from carelessness or omission. Restore damaged facilities to the preexisting condition at no additional cost to the DEPARTMENT.

G. When directed by ENGINEER, adjust or relocate utility facilities or appurtenances found but not noted in Contract Documents.
   1. ENGINEER will coordinate with the utility owner.
   2. DEPARTMENT will use Section 00725 or Section 00555 for compensable or non-compensable adjustments to the Contract because of revised or added work.

1.8 COOPERATION BETWEEN CONTRACTORS

A. The DEPARTMENT reserves the right to contract for and perform other or additional work on or near the work covered by the Contract.

B. Cooperate with other contractors working within the project limits. Conduct work without interrupting or inhibiting the progress or completion of work by other contractors.

C. Each contractor involved accepts all liability, financial or otherwise, in connection with the Contract.

D. Each contractor protects and saves harmless the DEPARTMENT from any damages or claims caused by inconvenience, delay, or loss from the presence and work of other contractors working within the same project limits.

E. Coordinate and sequence the work with other contractors. Arrange, place, and dispose of materials without interfering with the operations of other contractors on the same project.

1.9 DEPARTMENT-PROVIDED CONSTRUCTION STAKES, LINES, AND GRADES

A. The ENGINEER will provide and set construction stakes, lines, and grades unless otherwise specified.

B. Notify the ENGINEER at least 7 calendar days before beginning work on an item, and 24 hours before requiring stakes needed for the construction work shown on the schedule required by Section 00555, paragraph: Progress Schedules.

C. Determine the meaning of all stakes, indicated measurements, and marks before beginning work.

D. Use stakes, indicated measurements, and marks set by the ENGINEER as the field control to perform work.

E. Preserve all stakes and marks. The cost of replacing disturbed stakes and marks will be deducted from contract payment.

1.10 CONTRACTOR-PROVIDED CONSTRUCTION STAKES, LINES, AND GRADES

A. Perform the construction engineering, necessary calculations, and staking work. Include:
   1. Reestablish survey points and centerlines.
   2. Reference control points, when necessary.
   3. Run a level circuit to check or reestablish plan benchmarks.
   4. Set stakes for construction limits, right-or-way, drainage items, slopes, pavement structure, embankment and subgrade controls, bridge control points for vertical and horizontal alignment of all components, and any other stakes necessary to control lines and grades.

B. Furnish all stakes, templates, straightedges, and other devices necessary to check, mark, and maintain points, lines, and grades.

C. Conform to standard procedures used by DEPARTMENT engineering personnel.

D. Run level circuits to verify benchmarks the full length of road construction projects. On bridge construction projects, establish four benchmarks, two on each side of each structure unless physical conditions prohibit placement.

E. Maintain orderly and clear field notes in standard field notebooks consistent with standard engineering practices and meeting the DEPARTMENT'S Manual of Instruction for Construction.
   1. Use standard field books furnished by the DEPARTMENT.
   2. Allow DEPARTMENT personnel to inspect these field books at any time.
   3. The books become DEPARTMENT property once work is completed.

F. Supervise construction engineering personnel and correct any errors at no additional cost to the DEPARTMENT.

G. The ENGINEER will make all measurements and surveys that involve determining final pay quantities.

H. Assume responsibility for the final accuracy of construction.

1.11 DUTIES OF INSPECTOR

A. DEPARTMENT Inspectors are authorized to inspect all work and materials furnished.
   1. Inspection may extend to the preparation, fabrication, or manufacture of the materials to be used.
   2. The Inspector is not authorized to alter or waive the contract provisions, to issue instructions contrary to the Contract, or to act as foreman for the CONTRACTOR.
   3. The Inspector is authorized to reject work or materials until any issue in question can be referred to and decided by the ENGINEER.

1.12 INSPECTION OF WORK

A. Provide safe access to all parts of the work and provide information and assistance to the ENGINEER to ensure a complete and detailed inspection.

B. Remove and replace work performed or materials used without supervision or inspection by an authorized DEPARTMENT representative at CONTRACTOR expense, if ordered. **Exception:** If the DEPARTMENT representative fails to inspect the work after receiving written notice 24 hours in advance of beginning work.

C. Remove and uncover portions of finished work, as directed. Once inspected, restore work to contract requirements.
   1. If the uncovered work is found acceptable, the additional cost to uncover, remove, and replace or make good the parts removed will be paid as extra work.
   2. If the work is found unacceptable, additional costs to uncover, remove, and replace the covering, or make good the parts removed will not be paid.

D. When a government agency, utility or railroad company is to accept or pay a portion of the contract cost, that organization's representatives may inspect the work. The right to inspect does not make that entity a party to the Contract and does not interfere with the rights of parties to the Contract.

1.13 REMOVAL OF UNACCEPTABLE AND UNAUTHORIZED WORK

A. Remove and replace any unacceptable work before final acceptance.
   1. Work will be considered unacceptable if it fails to meet the contract requirements, unless accepted under this Section, paragraph: Conformity with Plans and Specifications.

B. Work performed contrary to ENGINEER's instructions, work beyond plan limits, or extra work performed without the ENGINEER's permission:
   1. Is excluded from pay consideration.
   2. May be ordered removed, restored, or replaced by others at the CONTRACTOR's expense.

1.14 LOAD RESTRICTIONS

A. Observe legal load restrictions when hauling equipment or materials on public roads beyond project limits.
   1. A special permit does not decrease CONTRACTOR liability for damage.
   2. Refer to the "Utah Regulations for Legal & Permitted Vehicles."

B. Obtain the ENGINEER's written permission to exceed legal load limits.
   1. Do not allow operating equipment or hauling loads that may damage structures, roadway, or any construction.
   2. Obtain approval from ENGINEER before hauling materials over any completed work within the project limits.
   3. Do not permit traffic and hauling over portland cement concrete construction before the minimum curing time has passed or the specified strength is obtained.
   4. Do not exceed legal gross weight limits on any component of the pavement or structure excluding granular borrow.
   5. Suspend construction operations when load restriction violations are observed until acceptable corrective measures are approved by the ENGINEER.

C. When public roads are used to haul any type of excavated, borrow, backfill, base, or surfacing material, the ENGINEER will not issue weight tickets for those loads that exceed the legal gross weight limit and will contact the appropriate law enforcement agency, if necessary.

D. For materials imported to the job site (i.e. Asphalt, Cement, Concrete, Steel, etc.), the quantity of material exceeding the legal gross load limit may be placed on the project, but DEPARTMENT will reduce payment for the item or for the item that incorporates the material by 4 cents per kilogram for that portion of the material that exceeds the legal gross load limit.
   1. Provide the ENGINEER with invoices showing the gross load weights or showing information by which the gross load weights may be determined.
   2. DEPARTMENT will withhold payment for material used in the project if invoices are not provided.
   3. The ENGINEER will notify the appropriate enforcement agency if the hauler continues to exceed legal gross load limits.

1.15 MAINTAINING THE WORK DURING CONSTRUCTION

A. Maintain the work during construction in a satisfactory condition until the project is accepted.
   1. Maintain traffic detour routes and project travel ways in accordance with the accepted traffic control plan.

B. The ENGINEER will immediately notify the CONTRACTOR of failure to meet these provisions.
   1. The ENGINEER will maintain the project if unsatisfactory maintenance is not remedied within 24 hours after receiving notice.
   2. The entire cost for the ENGINEER to maintain the work will be deducted from the monies due or to become due the CONTRACTOR.

C. Include in the bid unit prices the cost of maintaining work during construction until final acceptance.

1.16 OPENING SECTIONS OF PROJECT TO TRAFFIC

A. The ENGINEER may order certain sections of work opened to traffic before completion or acceptance of the work.

B. Opening sections of work does not constitute acceptance of the work or a waiver of any contract provisions.

C. Maintain any section of roadway opened to traffic by order of the ENGINEER.
   1. When the ordered opening to traffic is not the result of CONTRACTOR fault or inactivity, compensation to CONTRACTOR will be as provided in Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work, and paragraphs: Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, and Statements).
   2. A change order will be prepared when the opening is not provided for in the Contract. DEPARTMENT will give no compensation if the order to open is the result of CONTRACTOR fault or inactivity.

D. ENGINEER will give written notice establishing a time period for completing features of the work for which the CONTRACTOR is late.
   1. ENGINEER may order all or a portion of the project opened to traffic if the CONTRACTOR fails to complete or make a reasonable effort to complete the late work.
   2. Assume liability and responsibility for maintaining the work and conduct the remaining construction operation with minimum interference to traffic without additional compensation.

E. Repair damage to the project that is not attributable to traffic (except landslides) at no additional cost to DEPARTMENT. Establish the basis for removal with the ENGINEER before removing landslides.

1.17 FURNISHING RIGHT-OF-WAY

A. The DEPARTMENT will secure all necessary rights-of-way in advance of construction, except as provided in the Contract.

1.18 PROJECT ACCEPTANCE - PARTIAL

A. CONTRACTOR may request a final inspection when a unit or portion of the project is substantially complete, and the unit or portion is considered or determined necessary for the convenience of traffic, such as a structure, an interchange, section of road, intersection, substation, or portion of a lighting or signal project.

B. The ENGINEER may make written acceptance of such unit if it meets the contract requirements with the exceptions of Lighting and Signal Warranties and Guarantees, and Plant Establishment Periods, as follows:

C. **Lighting And Signal Warranties And Guaranties**:

1. DEPARTMENT will not give notice of acceptance for lighting and signal work until six months after the date of inspection and acceptance.
2. During this six-month period, all manufacturer's warranties and guarantees on CONTRACTOR- furnished electrical and mechanical equipment will be enforced.
3. At the end of the six-month period, and after all electrical and mechanical defects within the scope of warranties and guarantees are corrected, the ENGINEER will make written acceptance of the work completed and provide relief of further responsibility for that portion of the project.
4. Partial acceptance will not void or alter any terms of the Contract.

D. **Plant Establishment Periods**:

1. The DEPARTMENT will not give the notice of acceptance for plants until the establishment period as specified in the Contract is completed.
2. The establishment period on plants will begin after the ENGINEER'S inspection and acceptance, and will continue as specified in the Contract.
3. At the end of the establishment period, and after all unacceptable plants have been replaced, the ENGINEER will make written acceptance of the plants and provide relief of further responsibility for that portion of the project.

E. The six-month warranty period for lighting and signal work and the establishment period for plants will not affect the processing of a semi-final estimate when the Contract is 95 percent or more complete or after completion of work on the project.

1. DEPARTMENT will pay (including retention) for all final quantities. The DEPARTMENT will hold 1 1/2 percent of the total of the lighting and signal items pending completion of the six-month warranty period and/or 15 percent of the total of the plant items pending completion of the establishment period.
2. A supplemental final estimate will be forwarded for approval and release of retained monies under Section 01282, paragraph: Acceptance and Final Payment, upon completion of the six-month warranty period and/or establishment period.

1.19 PROJECT ACCEPTANCE - FINAL

A. Provide written notice of project completion to the ENGINEER. Where all work is completed, ENGINEER will conduct the final inspection and accept the completed work in writing.

B. The ENGINEER will issue instructions for necessary corrections to work that is found unsatisfactory.
   1. Comply immediately with the instructions.
   2. When the deficiencies are corrected, ENGINEER will conduct another final inspection, and will notify the CONTRACTOR in writing of work acceptance.

1.20 PROCEDURES FOR RESOLUTION OF DISPUTES

A. Notify DEPARTMENT orally and in writing of the dispute under Section 00725, paragraph: Notification of Differing Site Conditions, Changes and Extra Work, before beginning or continuing the affected work, if additional compensation is considered due for work or material not covered in the Contract.

B. The ENGINEER will respond as described under Section 00725, paragraph: Notification of Differing Site Conditions, Changes and Extra Work, following notification and indicate whether or not a change has occurred and provide further information concerning the method and manner of further performance of the work.

C. Provide cooperation and information to the ENGINEER during the period of notification review and evaluation.

D. DEPARTMENT will not grant additional compensation if oral and or written notification is not given, or the ENGINEER is not given proper facilities for keeping strict account of actual costs.

   1. DEPARTMENT will not construe notice by the CONTRACTOR, and the ENGINEER's accounting of costs as substantiating the validity of the claim.
   2. DEPARTMENT will equitably adjust the Contract if the dispute is found to have merit.

1.21 PROCEDURES FOR RESOLUTION OF CLAIMS

A. Disputes that are not resolved are escalated to the claims procedure.
   1. Provide written notification of the intent to make a claim under Section 00725, paragraph: Notification of Differing Site Conditions, Changes and Extra Work.
   2. Submit the formal claim in writing and with sufficient detail to enable the ENGINEER to ascertain the basis and amount of the claim.

B. As a minimum, include the following information with each claim submitted:
   1. A detailed factual statement of the claim for additional compensation and time, providing all necessary dates, locations, and items of work affected by the claim.
   2. The date actions resulting in the claim occurred or conditions resulting in the claim became evident.
   3. The name, title, and activity of each DEPARTMENT employee knowledgeable about facts that gave rise to the claim.
   4. The name, title, and activity of each CONTRACTOR employee knowledgeable about facts that gave rise to the claim.
   5. The specific provisions of the Contract that support the claim and a statement of the reasons why such provisions support the claim.

6. All detailed facts which support position related to a decision that the Contract leaves to the ENGINEER's discretion or provides that the ENGINEER's decision is final.
7. Identity of pertinent documents, and the substance of any material oral communications relating to the claim.
8. A statement whether the additional compensation or extension of time is based on alleged breach of Contract.
9. Copies of any identified documents, other than DEPARTMENT documents and documents previously furnished to the DEPARTMENT that support the claim (manuals that are standard to the industry may be included by reference).
10. For an extension of time include:
    a. The specific days for which a time extension is requested.
    b. The specific reasons a time extension should be granted.
    c. The specific provisions under which a time extension is requested.

11. The exact amount of compensation requested and a breakdown of the cost into the following categories:
    a. Direct labor.
    b. Direct materials.
    c. Direct equipment. The rates claimed for each piece of equipment shall not exceed actual cost. In the absence of actual equipment cost, the rates for the equipment, when in use, shall not exceed the rates established by Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work, and paragraphs: Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, and Compensation). The equipment cost shall be broken down in accordance with Section 01282, paragraph: Force Account work - CONTRACTOR-Owned Equipment, and paragraph: Force Account Work - Rented or Leased Equipment.
    d. Job overhead.
    e. Overhead (general and administrative).
    f. Subcontractor's claims (in the same level of detail as specified herein is required for any subcontractor's claims).

12. **Certification:** Submit a statement to the ENGINEER containing the following language:

Under the penalty of law for perjury or falsification, the undersigned,

_____	_____	_____
Name	Title	Company

hereby certifies that the claim for extra compensation and time, if any, made herein for work on this Contract is a true statement of the actual costs incurred and time sought, and is fully documented and supported under the Contract between the parties.

Dated _____/s/_____
Subscribed and sworn before me this _____day of _____
Notary Public _____
My Commission Expires _____

C. Failure to submit information and details as described in this Section for any claim shall operate as a waiver of the claims.

1.22 RECORD KEEPING FOR RESOLUTION OF CLAIMS

A. Maintain full and complete records of all costs and additional time incurred for any alleged claim.

B. Permit the ENGINEER access to those records and any other records as required to determine the facts or contentions involved in the claim.

C. Retain all records for a period of not less than 3 years after final acceptance.

1.23 AUDITING OF CLAIMS

A. All claims filed against the DEPARTMENT will be subject to audit at any time following the filing of the claim.

B. The audit may be performed by employees of the DEPARTMENT or by an auditor under contract with the DEPARTMENT. The audit may begin at any time during the life of the Contract, or 20 calendar days after notice is provided to the CONTRACTOR, their subcontractors, or their agents if more than 60 calendar days after the final acceptance date of the Contract have elapsed.

C. Provide adequate facilities, acceptable to the ENGINEER, for the audit during normal business hours. Cooperate with the auditors.

D. Failure of the CONTRACTOR, subcontractors, or agents to maintain and retain sufficient records to allow the auditors to verify all or a portion of the claim or to permit the auditor access to the books and records of the CONTRACTOR, subcontractors, or agents will constitute a waiver of the claim and will bar any recovery thereunder.

E. As a minimum, make the following documents available to auditors:
1. Daily time sheets and supervisor's daily reports.
2. Union agreements.
3. Insurance, welfare, and benefits records.
4. Payroll registers.
5. Earnings records.
6. Payroll tax forms.
7. Material invoices and requisitions.
8. Material cost distribution work sheet.
9. Equipment records (list of company equipment, rates, etc.).
10. Vendors', rental agencies', subcontractors', and agents' invoices.
11. Subcontractors' and agents' payment certificates.
12. Canceled checks (payroll and vendors).
13. Job cost report.
14. Job payroll ledger.
15. General ledger.

16. Cash disbursements journal.
17. All documents that relate to each and every claim together with all documents that support the amount of damages as to each claim.
18. Work sheets used to prepare the claim establishing the cost components for items of the claim including but not limited to labor, benefits and insurance, materials, equipment, subcontractors, all documents that establish the time periods, individuals involved, the hours for the individuals, and the rates for the individuals.

F. Full compliance with the provisions of this paragraph is a contractual condition precedent to the right to seek judicial relief.

1.24 HIGHER LEVEL REVIEW FOR RESOLUTION OF CLAIMS

A. Submit all claims for higher level review to the ENGINEER in writing within 10 calendar days of the ENGINEER's denial of a claim.

B. Failure to submit a request within this 10-day time frame will be considered acceptance of the ENGINEER’s denial action.

1.25 CLAIMS BOARD OF REVIEW

A. Pursue administrative resolution of any claim with the ENGINEER or the designee of the ENGINEER.

B. If no agreement is reached, at the CONTRACTOR's written request to the ENGINEER, the Engineer for Construction and Materials will schedule a hearing before a DEPARTMENT "Claims Board of Review" when deemed to be in the best interest of both the CONTRACTOR and the DEPARTMENT.

C. The Board will make their recommendations and outline their reasoning to the UDOT Deputy Director within 30 calendar days after the claim hearing.

D. The UDOT Deputy Director will make offer of settlement within 45 calendar days after the claim hearing.

E. The decision of the UDOT Deputy Director is administratively final.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

Section added by Supplemental Specification

SECTION 00820

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00725: Scope of Work.

B. Section 01355: Environmental Protection.

1.2 GENERAL LEGAL COMPLIANCE

A. Observe and comply with:
1. Federal and State Laws
2. Local laws and ordinances
3. Regulations, orders and decrees of bodies or tribunals having jurisdiction or authority.

B. Protect and indemnify the DEPARTMENT and its representatives against claim or liability arising from the violation of any of the above listed items, whether violated by the following companies or their employees:
1. The CONTRACTOR
2. Subcontractor(s) at any tier
3. Suppliers of materials or services
4. Any others engaged by the CONTRACTOR

1.3 SANITARY, HEALTH AND SAFETY

A. Observe the rules and regulations of Federal, State, and local health officials.

B. Do not require employees of the CONTRACTOR or subcontractor(s) to work in surroundings, or under conditions that are unsanitary, hazardous or dangerous to health or safety.

C. Admit any inspector of the OSHA or other legally responsible agency involved in safety and health administration without delay and without presentation of an inspection warrant to all areas of the work and project site upon presentation of proper credentials.

1.4 EXPLOSIVES

A. Comply with all laws and ordinances as well as Title 29, Title 30, and Code of Federal Regulations, Part 1926 - Safety and Health Regulations for Construction (OSHA), whichever is the most restrictive, in the use, handling, loading, transportation, and storage of explosives and blasting agents.

B. Do not endanger life, property, or new work with the use of explosives.

C. Accept liability for property damage, injury, or death resulting from the use of explosives.

D. Notify property owners and public utility companies in the vicinity of the proposed detonation before using any explosives.

1.5 CIVIL RIGHTS

A. Comply with Federal, State and local laws, rules and regulations that enumerate unlawful employment practices including discrimination because of race, religion, color, sex, age, disability, or national origin, and that define actions required for Affirmative Action and Minority/Disadvantaged Business programs.

1.6 FORESTS

A. Perform work within or adjacent to State or National Forest under regulations of the State Fire Marshal, Conservation Commission, Forestry Department, or other authority having jurisdiction governing the protection of forests.

B. Immediately notify the ENGINEER in writing upon discovering any discrepancy or inconsistency between the Contract and any law, ordinance, regulation, or order, except as noted in this Section, paragraph: Federal Aid Participation.

C. Keep the project site orderly and clean.

D. Obtain all required permits.

E. Prevent and assist with the suppression of forest fires.

F. Cooperate with responsible forestry officials.

1.7 PERMITS, LICENSES AND TAXES

A. Acquire all permits and licenses; pay applicable charges, fees, and taxes; and give all notices necessary to perform the work.

B. Include these costs in the appropriate unit prices bid for the Contract items.

1.8 PATENTED DEVICES, MATERIALS, AND PROCESSES

A. Provide proof of legal agreement with the patentee or owner, if necessary, for use of any of the following:
   1. Design(s)
   2. Devised(s)
   3. Material(s)
   4. Process(es)
   5. Trademark(s)

6. Copyright(s)

B. Indemnify and hold harmless the DEPARTMENT and any affected third party or political subdivision from claims of infringement that result from use of any patented or copyright item listed above.

C. Indemnify the DEPARTMENT for costs, expenses, and damages obligated for payment resulting from infringement during the conduct of the work or after the project is completed.

1.9 FEDERAL AID PARTICIPATION

A. Federal requirements of a Federally assisted Contract supersede conflicting provisions of laws, rules, or regulations.

B. The DEPARTMENT supervises all work, but appropriate Federal officials will inspect and approve the work when there is Federal participation in the Contract. The U.S. Government, however, is not a party to the Contract and will not interfere with the rights of Contract parties.

1.10 PUBLIC CONVENIENCE AND SAFETY - TRAFFIC AND PEDESTRIANS

A. Perform construction with minimal obstruction to traffic.

B. Follow the safety provisions of all applicable laws, rules, codes, and regulations to ensure the safety and convenience of the public and property as provided under Section 00725, paragraphs: Maintaining Traffic (General, Special Detours, During Suspension of Work, and As Directed by the ENGINEER.)

C. Provide, erect, and maintain all traffic control devices such as barriers, barricades and warning signs to protect the work and the public safety.
   1. Use barriers and barricades to delineate highway sections closed to traffic.
   2. Illuminate obstructions during darkness and provide warning signs to control and direct traffic.

D. Erect warning signs before work that may interfere with traffic or where work crosses or coincides with an existing road.
   1. Place and maintain warning signs according to the project traffic control plan.
   2. Obtain approval before dismantling or removing traffic control devices.

E. For Pedestrians:
   1. Place and maintain warning signs under project traffic control plan.
   2. Provide pedestrian access in area where construction interferes with existing sidewalk.

1.11 PROTECTION AND RESTORATION - PROPERTY AND LANDSCAPE

A. Preserve public and private property during the work.

B. ENGINEER will verify reference to the location of monuments and property line markers before they are moved, disturbed, or damaged.

C. Accept liability for any damage to public or private property resulting from defective work or materials, or nonexecution of the Contract.

D. Maintain liability until the project is accepted.

E. Restore damaged property to a condition similar or equal to that existing before the damage at no additional cost to the Contract.

F. Temporarily discontinue work if remains of prehistoric dwelling sites or artifacts of historical or archeological significance are encountered.

G. Follow procedures outlined in Section 01355, paragraph: Discovery of Historical, Archeological or Paleontological Objects.

1.12 PERSONAL LIABILITY OF DEPARTMENT EMPLOYEES

A. The DEPARTMENT's authorized representatives are acting solely as agents and representatives of the DEPARTMENT when carrying out the provisions of or exercising the power or authority granted to them under the Contract.

B. They will not be liable either personally or as employees of the DEPARTMENT for actions in their ordinary course of employment.

1.13 NO WAIVER OF LEGAL RIGHTS UPON COMPLETION

A. Upon completion of the Contract, the DEPARTMENT will make final inspection and notify the CONTRACTOR of acceptance.
   1. Final acceptance will not prevent the DEPARTMENT from correcting any measurement, estimate, or certificate made before or after completion of the work.
   2. The DEPARTMENT will not be prevented from recovering from the CONTRACTOR or SURETY or both, overpayment sustained for failure of the CONTRACTOR to fulfill the obligations under the Contract.
   3. A waiver from the DEPARTMENT of any breach of any part of the Contract shall not be held to be a waiver of any other or subsequent breach.

B. Assume liability to the DEPARTMENT for latent defects, fraud, or such gross mistakes as may amount to fraud, or as regards to the DEPARTMENT's rights under any warranty or guaranty without prejudice to the terms of the Contract.

1.14 RESPONSIBILITY FOR DAMAGE CLAIMS

A. Protect, indemnify and save harmless the State of Utah, its agents and employees, from and against all claims, demands, damages, and causes of action of every kind or character on account of bodily injuries, death, or damage to property arising because of, for, out of, or in any way connected with the performance of the Contract.
   1. **Exceptions**: where such injury, death, or damage has resulted from the sole negligence of the State of Utah, without negligence or willful act on the part of the CONTRACTOR, its agents, employees, or subcontractors.

2. **Intent of this provision:** Indemnify the State of Utah, its agents and employees regardless of whether or not such injury, death, or damage is caused in part by the State of Utah, its agents and employees.

B. Defend all suits brought upon such claims and pay all costs and expenses incidental thereto. The State of Utah will have the right, at its option, to participate in the defense of any such suit without relieving the CONTRACTOR of any obligation hereunder.

C. Protect against liability, loss, or expense arising from damage to property or injury or death of any person or persons incurred in anyway out of, in connection with or resulting from the work provided hereunder by purchasing insurance:
   1. From reliable insurance companies authorized to do business in the state where the work is to be done.
   2. Rated "A" or better, and with a financial size category of Class VII or larger by A.M. Best Company at the time the Contract is executed.

1.15 INSURANCE REQUIREMENTS

A. Provide insurance at the time the contract is executed and maintain the policy in force during the entire period of this Contract as described.
   1. Provide Workers' Compensation Insurance and Employers' Liability Insurance, with statutory benefits.
      a. The Best's rating requirements are waived for coverage provided by the Workers' Compensation Fund of Utah.
      b. Require all subcontractors at any tier to take and maintain similar policies of Workers' Compensation Insurance.
   2. Provide Comprehensive General Liability Insurance or Commercial General Liability Insurance or both.
      a. Include coverage for premises and operations, explosion, collapse and underground hazards, products and completed operations and hazards, contractual (including this contract, and personal injury including employees).
      b. With limits of not less than $1,000,000 combined single limit per occurrence, and not less than $2,000,000 aggregate.
      c. If this insurance coverage is written on a "claims-made" basis, the certificate of insurance required below shall indicate and the policy shall provide an extended reporting period provision or similar "tail" provision such that claims reported up to 3 years beyond the date of substantial completion of this Contract are covered for insurance coverage.
   3. Provide Comprehensive Automobile Liability Insurance, including owned, hired, and non-owned automobiles with limits not less than $1,000,000 combined single limit per accident.

B. Maintain Aircraft Liability Insurance, with a combined single limit of not less than $1,000,000 per occurrence when using CONTRACTOR-owned aircraft, or employing aircraft in connection with the work performed under this Contract.

C. All required liability insurance policies required will provide that:

1. The State of Utah and all institutions, agencies, departments, authorities and instrumentalities, and while acting within the scope of their duties, all of its elected or appointed officers, agents, employees, and authorized volunteers as well as members of governing bodies, boards, commissions and advisory committees, will be named as insureds, but only in respect to the work to be performed under this Contract.
2. Coverage for the above insureds is primary and not contributing.

D. Any policy required by this paragraph may be arranged under a single policy for the full limit required, or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability Policy.

E. Irrespective of the requirements as to insurance to be carried by CONTRACTOR as provided herein; insolvency, bankruptcy or failure of any insurance company to pay all claims accruing, shall not be held to relieve CONTRACTOR of any obligations hereunder.

F. Before beginning the work, furnish to the DEPARTMENT certificates evidencing coverage as specified above are in effect.

1. Such insurance certificates shall contain provisions that no cancellation, material change therein or non-renewal shall become effective except upon 30 calendar days prior written notice to the DEPARTMENT as evidenced by return receipt, certified mail sent to DEPARTMENT.

1.16 THIRD PARTY BENEFICIARY CLAUSE

A. It is specifically agreed between the parties executing this Contract that it is not intended by the contract provisions:

1. To create in the public or any member thereof a third party beneficiary hereunder.
2. To authorize anyone not a party to the Contract to maintain a suit for personal injuries or property damage pursuant to the Contract.

1.17 SITE OF WORK

A. As defined in Section 5.2(1) of 29 U.S. Code of Federal Regulations Part 5:

1. The physical place or places where the construction called for in the Contract will remain when the work is completed.
2. The adjacent nearby property used by the CONTRACTOR or subcontractor in such construction.
3. Fabrication plants, mobile factories, batch plants, borrow pits, job headquarters, tool yards, etc., provided they are dedicated exclusively (or nearly so) to the performance of the Contract and are so located in proximity to the actual construction location that it would be reasonable to include them, except as noted in the following exclusions.
4. Exclusions:
   a. The **permanent** home offices, branch plants, fabrication plants, and tool yards of a CONTRACTOR or subcontractor whose location and continuance in operation are determined wholly without regard to a particular Federal or Federally assisted contract.

b. Fabrication plants, borrow pits, job headquarters, etc., of a commercial supplier or materialman that are established by the supplier of the materials for the project before opening of bids and not on the project site.

1.18 TRUCK HAULING - GENERAL

A. This provision outlines the requirements that must be met by the CONTRACTOR and by any subcontractor who is employed on a Federal-Aid project for the purpose of providing truck hauling services.

B. This provision is necessary to ensure that the interests of the public, the DEPARTMENT, the CONTRACTOR, other governmental agencies, and those employed as operators of hauling vehicles are protected.

C. Hauling by truck may be done by the prime CONTRACTOR, a subcontractor where the hauling is incidental to the performance of the subcontract work item(s), or by a transportation subcontractor having valid Public Service Commission (P.S.C.) Certificate of Authority.

1. Transportation subcontractor: A subcontractor who performs a transportation service only and does not manufacture nor incorporate materials into the roadway. The transportation subcontractor is defined by the Utah Code Annotated 54-6-3(5) as a "common motor carrier."
2. Common Motor Carrier: Any person with a certificate from the Public Service Commission and who is holding itself out to the general public as engaging in commercial transportation of passengers or property by motor vehicle in Utah for compensation.

D. Since the CONTRACTOR has the ultimate responsibility for the performance of the Contract, both the transportation subcontractor and the CONTRACTOR will be jointly and severally responsible for the provisions of all the applicable regulations including, but not limited to, Federal Wage and Hour Regulations, PSC Regulations, Public Safety Regulations, and all applicable Utah Tax Regulations.

1.19 METHODS OF TRUCK HAULING ON SITE OF WORK

A. Use any combination of the following methods to accomplish hauling by truck on the site of work:

B. Owned/Leased Vehicles: Operate their own or leased equipment utilizing their own employees.

1. Motor vehicles used for on-site work in the performance of the Contract that are not owned and operated by the CONTRACTOR must be leased or subcontracted directly to the CONTRACTOR or leased or subcontracted to a transportation subcontractor who holds a valid PSC Certificate of Authority.
2. Vehicles leased and operated by a transportation subcontractor shall comply with the regulations of the Public Service Commission.
3. Leased vehicles shall be considered the property of the lessee.
4. The lessee shall be responsible to see that leased vehicles are in compliance with all applicable motor carrier and public safety regulations.

C. Independent owner-operators: An "Owner-operator" must satisfy the following requirements:
   1. Economic Realities Test:
      a. Ability to bear responsibility for costs associated with operating equipment, license fees, their taxes, insurance, maintenance, operating, supplies.
      b. Ability to influence profits, length of job commitment, form of payment, and directions on schedules and on performance work.
   2. Current PSC Certificate of Authority, issued in the name of the owner-operator, to haul the commodity being transported.
   3. Owner-operator status will be allowed only for the person whose name is registered with the Utah Motor Vehicle Division as the owner of the vehicle. Corporations and partnerships are not allowed owner-operator status.
   4. Evidence of current, valid and sufficient liability and other appropriate insurance coverage for the owner-operator shall be on file with the CONTRACTOR at all times during the performance of the hauling operations.
   5. Special Fuel Permit issued in the name of the owner-operator (if diesel).
   6. Approved subcontract agreement between each individual owner operator and the CONTRACTOR.

1.20 PAYROLL REQUIREMENTS

A. Copies of documents showing proof of requirements above in this Section, paragraph: Methods of Truck Hauling on Site of Work, item C, 2 through 6, must be in the project office before or with the first payroll listing the owner-operator.

B. Provided that all of the provisions are met, the DEPARTMENT will consider that owner-operator status has been established in accordance with contract wage and hour requirements.

C. Having met these provisions, list on the certified payrolls:
   1. The owner-operator with the notation "owner-operator" after each name.
   2. Neither hours worked nor wages paid need be shown.
   3. Include the name, address and social security number of each driver and indicate the vehicle identification number or the license plate number of the vehicle being driven by the driver.

D. If an owner of a truck or a driver of any truck used by the CONTRACTOR does not meet the criteria of an "owner-operator" as provided in this Section, paragraph: Methods of Truck Hauling on Site of Work, item C, and is not owned by the CONTRACTOR:
   1. Execute an equipment lease agreement as required by the PSC Regulations.
   2. Consider the driver of such a vehicle the employee of the CONTRACTOR.
   3. Pay appropriate wages and benefits as required by Federal Wage and Hour Regulations (Davis-Bacon Act, etc.) and submit certified payrolls showing hours worked and wages in accordance with the Regulations.

1.21 U.S. DEPARTMENT OF LABOR GUIDELINES ON OWNER OPERATORS

A. The Department of Labor has provided the following written guidance regarding "Independent Contractors" and considers that owner-operators must qualify as "Independent Contractors" in order to be exempt from the pre-determined wage rates (Davis-Bacon and related Acts).

B. Test of the Employment Relation:

1. The Supreme Court has said that there is "no definition that solves all problems as to the limitations of the employer-employee relationship" under the Act. It has also said that determining the relation cannot be based on "isolated factors" or upon a single characteristic or "technical concepts," but depends upon the circumstances of the whole activity" including the underlying "economic reality."
2. An employee, as generally distinguished from an independent Contractor who is engaged in a business of his/her own, is one who "follows the usual path of an employee" and is dependent on the business that the employee serves. The factors that the Supreme Court has considered significant, although no single one is regarded as controlling, are:
   a. The extent to which the services in question are an integral part of the employer's business.
   b. The permanency of the relationship.
   c. The amount of alleged CONTRACTOR's investment in facilities and equipment.
   d. The nature and degree of control by the principal.
   e. The alleged CONTRACTOR's opportunities for profit and loss.
   f. The amount of initiative, judgement, or foresight in open market competition with others required for the success of the claimed independent enterprise.

C. **Prospective bidders are advised** that the U. S. Department of Labor may challenge the status of personnel performing work on the project who are designated on payrolls as an "owner-operator."

1. CONTRACTOR is responsible in such instances to defend such challenges at their expense and to make supplementary payments to such individuals who are determined to be employees rather than owner-operators by the Department of Labor.
2. The DEPARTMENT will not accept responsibility for same.

1.22 TRANSPORTATION: NON SITE OF WORK, TO AND FROM

A. For "non-site of work" to "site of work," payment of Davis-Bacon wages is not required. (ie., hauling from a commercial source to "site of work")

B. For "site of work" to "non-site of work," payment of Davis-Bacon wages is not required when hauling materials from the project site to a "non-site of work" facility.

1.23 PURCHASE TRANSPORTATION

A. Purchase transportation is a relationship that exists between two certified motor carriers where one carrier is purchasing the services of another.

B. Under such an arrangement a second tier motor carrier with PSC Certificate of Authority may be used by the primary transportation subcontractor.

1. In this event the purchase transportation subcontractor shall be totally responsible for the purchase transportation vehicle(s) including but not limited to: placarding, insurance, safety, operational controls, and payrolls.
2. Each carrier shall display its own placards.

3. PSC Regulations do not require a lease agreement between the two certificated motor carriers.

C. The DEPARTMENT's regulations require that a second tier subcontract be submitted and approved by the ENGINEER before any work is performed by the purchase transportation subcontractor. The purchase transportation subcontractor will be subject to the same provisions that govern the prime CONTRACTOR, subcontractor, and transportation subcontractor.

1.24 AIR QUALITY PROTECTION

A. Refer to Section 01355: Environmental Protection.

B. Complete and submit the CONTRACTOR's *Air Quality Impact Statement* form included in the Contract documents to the Utah Bureau of Air Quality if operations involve asphalt, aggregate, concrete, open burning, sandblasting, or other operations impacting air quality or otherwise impacting air quality.

C. The CONTRACTOR will not be allowed to proceed with work affecting air quality without an Air Quality Approval Order or Notice of Intent to Approve letter or a Temporary Approval Order for the project, process, or equipment to be used.

D. Comply with Quality regulations and submit the form for *Contractors Air Quality Impact Statement* including Sections 3.1 through 3.1.9 of the form, which follows.
   1. Forms are included here for the CONTRACTOR's information.
   2. Submit the form early to the Department of Health since long delays are often encountered in obtaining the Bureau's concurrence to begin work.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

Contractors Air Quality Impact Statement follows this Section.

Contractors Air Quality Impact Statement
(This form to be submitted to the Utah Bureau of Air Quality)

Any Contractor or Subcontractor that plans to construct, install, modify, operate or relocate any air pollution source or air pollution control device of any air contaminate is required to comply with the Utah Air Conservation Regulations.

The answers to the following questions are REQUIRED of each person to determine compliance with contract bid requirements and Utah Air Conservation Regulations (UACR).

Please complete the statement as thoroughly as possible (use additional paper if needed) and submit to the Utah Bureau of Air Quality at

1950 West North Temple
P.O. Box 16990
Salt Lake City, Utah 84116-0690

1. Briefly describe the proposed project for which you are bidding (i.e., Type of Project(s); asphalt mixing, batching, recycling, concrete processing, aggregate processing (crushing, washing, screening), material hauling, open burning, sandblasting, etc.; Location of Project(s); and Project Date(s). Any subcontractor to whom you may award a contract is required to complete a Contractors' Air Quality Impact Statement and have an approval order.

_____

_____

2. As a Contractor or Subcontractor, do you currently possess an Air Quality Approval Order Notice of Intent to Approve letter for new or modified equipment, or Temporary Relocation Approval issued by the Executive Secretary of the Utah Air Conservation Committee - Bureau of Air Quality for the project, process, or equipment to be used? Yes____ No____ (If yes, complete A through E.)

Note: An Air Quality Approval Order for initial approval and operation of equipment requires over ninety (90) days for review and issuance (see Section 3.1, UACR, enclosure I). CONTRACTOR should be aware that review by the Department of Health may extend this time. The CONTRACTOR is on notice that the approval process can be very time consuming. The process must be started early, preferably as soon as a Contractor decides to operate in Utah.

Note: After an initial approval has been issued, a Temporary Relocation Approval may require a detailed environmental impact analysis (to include a computer dispersion modeling) to be performed by the CONTRACTOR or the Bureau of Air Quality or both prior to project start. Therefore, the approval may require over thirty days (30) for issuance (see Section 3.1.9, UACR, enclosure I).

A. Name of Company or person to whom the Approval Order is/was issued?

_____

_____

B. Date Approval Order issued?

_____

C. Equipment included in Approval Order?

_____
_____
_____
_____
_____

(See description as stated in #4.)

D. Exact location where project, process, or equipment Approval Order is/was applicable? _____
_____
_____

E. If you are a Subcontractor, to what company are you contracted?

_____
_____

3. Are there any recycle conditions stated in the Approval Order? If so, please itemize. (Omit this question if Answer to #2 is "NO.")

_____
_____
_____
_____

4. If your answer to #2 is "NO," describe the process equipment to be used on the project. Include equipment quantity, make, model, serial number, manufacture date, date used in Utah for first time, process capacity or capability of equipment, and any air pollution control devices and their exact location on process equipment.

_____
_____
_____
_____

5. This statement completed:

A. For (Company Name) _____
1. Address: _____
_____
2. Phone: _____

B. By Whom (Name) _____
1. Title: _____
2. Address: _____
_____

3. Phone: _____

6. List any additional information that may be pertinent.

_____
_____
_____
_____
_____

Should you have any questions concerning the completion of this statement or any Air Quality Approval Order or Air Quality Impact concerns, please contact:

Utah Bureau of Air Quality
1950 West North Temple
P.O. Box 16690
Salt Lake City, Utah 84116-0690
(801)536-4000

UTAH STATE DEPARTMENT OF HEALTH

AIR CONSERVATION REGULATIONS

PART III

CONTROL OF INSTALLATIONS
(Obtaining and Approval Order)

3.1 **Notice of Intent and Approval Order**. Except for the exemptions listed herein, any person planning to construct a new installation which will or might reasonably be expected to become a source or an indirect source of air pollution or to make modifications or relocate an existing installation which will reasonably be expected to increase the amount or change the effect of, or the character of, air contaminants discharged, so that such installation may be expected to become a source or indirect source of air pollution, or any person planning to install an air cleaning device or other equipment intended to control emission of air contaminants from a stationary source, shall **submit to the Executive Secretary a notice of intent** and receive an approval order prior to initiation of construction, modification or relocation. The notice of intent shall include plans, specifications and other information as necessary to determine whether the proposed construction, installation, modification, relocation or establishment will be in accord with applicable requirements of these regulations as he deems necessary to review the Bid Proposal. Within 30 days after receipt of a notice of intent, or any additional information necessary to the review, the Executive Secretary shall advise the applicant of any deficiency in the notice or the information submitted. The Executive Secretary shall transmit to the Administrator, EPA, a copy of each notice of intent for each major source or major modification and provide notice to the Administrator, EPA, of every action related to the consideration of such permit.

3.1.1 Within 90 days of receipt of all plans, specifications and other information, the Executive Secretary shall issue an order prohibiting the proposed construction, installation, modification, relocation or establishment if he deems any part of it inadequate to meet the applicable requirements of these regulations. If more time is needed to review the Bid Proposal it shall not exceed three 30-day extensions.

3.1.2 Prior to issuing an approval or disapproval order, the Executive Secretary shall advertise the intent to approve or disapprove in a newspaper of general circulation in the locality of the proposed construction, installation, modification, relocation or establishment. A copy of the notice of intent to approve or disapprove will be sent to the applicant.

3.1.3 Whenever the Executive Secretary determines that the plans, specifications and other information submitted, with such revisions as required, are in accord with applicable requirements, an order will be issued permitting the proposed construction, installation, modification, relocation or establishment, with the further stipulation that all required facilities be adequately and properly maintained. Issuing of an approval order does not relieve any owner or operator of the responsibility to comply with the provisions of these regulations or the State Implementation Plan or other local, state and/or Federal requirements.

3.1.4 Approval orders issued by the Executive Secretary in accordance with the provisions of these regulations shall be reviewed 18 months after the date of issuance to determine the status of construction, installation, modification, relocation or establishment. If a continuous program of

construction, installation, modification, relocation or establishment is not proceeding, the Executive Secretary may revoke the approval order.

3.1.5 The following information, where applicable, should be submitted with the Notice of Intent (NOI) (Please note that the following is a detailed description of the actual regulation):

A. A description of the proposed process including any of the following information necessary to convey to the review engineer enough knowledge of the process to be able to confirm the information required in items B through H:

1. A process flow diagram

2. List of type and quantity of raw materials, products, by-products and waste produced

3. List of the chemical reactions involved.

B. A list of the potential emission points and air contaminants which could be emitted to the atmosphere from each potential emission point. This list should include air contaminants which could be emitted as a result of upset conditions in the process or failure of pollution control equipment.

C. A detailed description of the pollution control equipment and or pollution control procedures proposed.

D. An estimation of the emission rates of the air contaminants projected for each emission point listed in B above, including:

1. The maximum annual and hourly emission rates which would result from operation of the process assuming:

a. The pollution control equipment or procedures function properly

b. The process would operate with no pollution control equipment or procedures.

2. The annual and hourly quantities of air contaminants which may be released as a result of typical failures of the process or pollution control devices or procedures during a typical year.

3. For all air contaminants emitted from a stack or vent, the flow rate of exhaust from that stack and the concentration of the air contaminant in ppmdv for gasses and gr/dscf for particulate.

E. Calculations justifying the emission estimates of item D above with documentation of the source of predictive equations, emission factors and an explanation of all assumptions made in the calculations.

F. An explanation as to why the owner of the source believes the equipment or procedures described in the NOI are consistent with the definition of BACT (Section 1.25, UACR). If the proposed emission controls give the lowest emission rate of any possible sister no further explanation is needed. If a system which does not give the lowest emission rate is proposed and economic reasons are given as the justification for this system being considered BACT, the comparison of the cost of the system vs. the systems which can achieve a low emission rate must be included. The comparison should be made on a $/t of pollutant removed for each system. See the attached cost comparison sheet for details.

G. Location (street address) of the planned process.

H. Identification and mailing address of the owner of the process.

I. If the emission rates of the proposal exceed the following values;

1. PM-10, S02 and NOx

   a. In nonattainment areas and PSD areas where baseline has been triggered ... 9 t/a, 45 kg/d, 9 kg/h.

   b. In attainment areas where PSD baseline has not been triggered ... 23 t/a, 113 kg/d, 23 kg/h.

   or

2. Carbon Monoxide

   a. In nonattainment areas 45 t/a, 227 kg/d, 45 kg/h.

   b. In attainment areas 91 t/a, 450 kg/d, 91 kg/h.

   or

3. Volatile Organic Hydrocarbons (Ozone)

   a. In nonattainment areas 23 t/a.

   b. In attainment areas 45 t/a.

The results of computer dispersion modeling must be submitted with the NOI. If modeling is required, David Prey should be contacted at (801) 538-6108 for information on which model to use and details of proper inputs for the model.

J. If the proposal of the NOI will emit more than the following quantities of air contaminants in megagrams (Mg) per year:

1.	TSP (Total Suspended Particulate)	23
2.	PM-10	14
3.	S02, NOx, VOC	36
4.	CO	91
5.	lead	0.5
6.	asbestos	0.006
7.	beryllium	0.0003
8.	mercury	0.09
9.	vinyl chloride	0.9
10.	fluorides	2.7
11.	sulfuric acid mist	6.4
12.	total reduced sulfur	9

that are defined as significant in Section 1.132, UACR, the NOI should include a description of all other sources owned by the same person or persons under common contract which are located on the same or continuous or adjacent land to the proposed source and the allowable and actual emission rates as defined in the UACR of those sources.

K. If the source or modification is subject to the definition of major source (Section 1.91) or major modification (Section 1.89) and is located in an area classified as PSD I, II or III, the NOI should include information required in Section 3.6.5 B (1) (a), UACR (PSD major source review).

L. If the source or modification is subject to definition of major source (Section 1.90) or major modification (Section 1.89) and the source is located in or would impact an area classified as nonattainment the NOI should include:

1. An explanation as to why the owner of the source believes the proposed emission control equipment and or procedures are consistent with the definition of LAER (section 1.85).

2. Certification that all other sources owned by the same persons under common contract are in compliance with the UACR and SIP, or are on an approved compliance schedule.

3. A list of other sources of the same **air contaminant** which shall reduce emissions to offset the increase from the proposed source or change.

4. If the source or modification is subject to the definition of major for VOC or CO, an analysis of alternative sites, sizes, production processes, emission control equipment, and/or procedures, which demonstrates that the benefits of the proposed source significantly outweigh the environment and social costs imposed as a result of the construction of the source.

ANNUALIZED COST CALCULATION FOR CONTROL EQUIPMENT
(For Cost Comparison)

A. Annualized Cost = B + C/D $/t of pollutant removed.

B. Annualized equipment cost = $[i/(1 - (1 + i)^n)] \times PV$ $/a

Where:

i = Interest rate at which the company can borrow money. 10% should be entered into the equation as 0.10.

n = Number of years of the life of the equipment.

PV = Present day value of the equipment or the cost of the equipment today.

C. Annual operating cost is the sum of the cost for spare parts, power, labor, maintenance, etc. less the value for the amount of reclaimed product or by product recovered and used or sold.

D. Amount of emission reduction due to the installation and operation of the pollution control equipment in megagrams per year.

3.1.6 Not Applicable.

3.1.7 Not Applicable.

3.1.8 The owner or operator of a source previously approved under this paragraph who intends to temporarily relocate or extend the source (not to exceed 180 consecutive days) shall submit a notice of intent to relocate but is not required to submit additional plans and specifications nor is the Executive Secretary required to submit the proposal for public comment prior to approval or disapproval.

SECTION 01280

MEASUREMENT

PART 1 GENERAL

1.1 DEFINITIONS

A. Station: 100 meters.

B. Megagram: 1,000,000 grams: 1,000 kilograms: 1 Metric Ton.

1.2 GENERAL MEASUREMENT OF QUANTITIES

A. All work completed under the Contract will be measured in SI metric system.

B. The method of measurement and computations for determining quantities of material furnished and of work performed under the Contract will be those methods generally recognized as conforming to good engineering practice.

C. When the estimated quantities for a specific portion of the work are designated to be the pay quantities for the Contract:
   1. They shall be the final quantities for which payment for such specific portion of the work will be made, unless the plan dimensions are revised by the ENGINEER.
   2. If revised dimensions result in an increase or decrease in the quantities of work, the final quantities for payment will be revised in the amount represented by the authorized changes in the dimensions.

D. Measurements for area computations:
   1. Longitudinal measurements: made horizontally.
   2. Transverse measurements: the neat dimensions shown on the plans.

E. Computing volumes of excavation: Average end area method, or computer generated DTM method, unless the ENGINEER and CONTRACTOR agree in writing to an alternate method.

F. Measure complete structure or structural unit, signal or lighting system, ("lump sum" work) unit to include all necessary fittings and accessories.

G. Structures: Neat lines shown on the plans or as altered to fit field conditions.

H. Standard manufactured items (fence, wire, plates, rolled shapes, pipe conduit, etc.), are identified by gauge, unit, weight, section dimensions, etc.,
   1. Identification will be nominal weights or dimensions.
   2. Use industry manufacturing tolerances, unless more stringently controlled by specifications.

I. Items measured by the meter, (pipe culverts, guardrail, underdrains, etc.): parallel with the base or foundations upon which structures are placed.

J. The thickness of plates and galvanized sheet used in the manufacture of corrugated metal pipe, metal plate pipe culverts and arches, and metal cribbing: measured in millimeters.

K. Materials to be measured by volume will be hauled in approved vehicles, and measured at the point of delivery. Vehicles for this purpose may be of any size or type, provided the body is shaped so the actual volume may be readily and accurately determined.

L. Materials specified to be measured by the cubic meter may be weighed and converted to cubic meter for payment purposes, when requested by the CONTRACTOR and approved by the ENGINEER in writing. Factors for conversion from weight measurement to volume measurement will be determined by the ENGINEER and agreed to by the CONTRACTOR before this method of measurement of pay quantities is used.

M. Rental of equipment: hours of actual working time and necessary traveling time of the equipment within the limits of the project.
   1. If special equipment has been ordered by the ENGINEER in connection with force account work, travel time and transportation to the project will be measured.
   2. If equipment is ordered held on the project on a standby basis by the ENGINEER, the agreed rental rate minus the operating cost will be paid.

1.3 MEASUREMENT OF QUANTITIES - MATERIALS

A. Asphalt materials: liter (l) or megagram (Mg).
   1. Volumes will be measured at 16 degrees C or will be corrected to the volume at 16 degrees C using ASTM D 1250 for asphalts or ASTM D 633 for tars.
   2. Net certified scale weights or weights based on certified volumes in the case of rail shipments will be used as a basis of measurement, subject to correction when asphalt material has been lost from the car or the distributor, wasted, or otherwise not incorporated in the work.
   3. When asphalt materials are shipped by truck or transport, net certified weights or volume subject to correction for loss or foaming may be used for computing quantities.

B. Cement: megagram (Mg).

1.4 WEIGHING REQUIREMENTS AND PROCEDURES

A. All materials that are measured or proportioned by weight, or contract items measured by the megagram, such as aggregates and asphalt materials, must be weighed on scales that have been approved, certified, and which meet specification requirements.

B. If material is shipped by rail, the car weight may be accepted provided only the actual weight of material will be paid for.
   1. Car weights will not be acceptable for material processed through mixing plants.
   2. Weigh trucks used to haul material empty daily at times as directed by the ENGINEER, and place on each truck a legible identification mark.

C. An inspector will observe materials delivered to the project or designated site
   1. Submit the printed or written haul ticket to Inspector.
   2. At this time, the materials can be accepted and the ticket initialed and retained by the Inspector.
   3. DEPARTMENT may return to be reweighed any loads of material that appear to be deficient or questionable.

1.5 SCALES

A. Have the Utah State Department of Agriculture, Division of Weights and Measures inspect and seal all scales inspected and sealed at least once a year, and before use each time the scale is moved or adjusted.

B. Scale accuracy: to within 0.5 percent of the maximum load required.

C. Scales for weighing highway and bridge construction materials that are required to be proportioned or measured and paid for by weight:
   1. Furnish, erect, have certified, and maintain, or use permanently installed and certified commercial scales.
   2. Must be accurate within the limits set by the laws of the State of Utah, meeting requirements of the U.S. Bureau of Standards.
   3. Must bear a current seal of acceptance from the State of Utah Department of Agriculture, Division of Weights and Measures.

D. Physically arrange electronic, beam, dials, platform, and other scale equipment for convenient and safe viewing.

E. Cease using scales that overweigh (indicate more than true weight). Reduce all materials received subsequent to the last previous correct weighing accuracy test by the percentage of error in excess of one half of 1 percent.

F. Adjust scales that underweigh (indicating less then true weight). DEPARTMENT will allow no additional payment to the CONTRACTOR for materials previously weighed and recorded.

G. Include in the unit contract prices for the various pay items of the Contract, costs for furnishing, installing, certifying or testing, and maintaining scales, furnishing scale house, materials for proportioning or payment, and all other items specified in this section for the weighing of highway and bridge construction materials

1.6 PLATFORM SCALES

A. Install and maintain with the platform level and rigid bulkheads at each end.

B. Must be of adequate size and capacity so the entire power unit and hauling unit can be weighed at the same time.
   1. The CONTRACTOR may use a platform scale that will accommodate the power unit and the first hauling unit and all remaining hauling units in two weighing operations.

2. When two weighing operations are used, provide a level approach at both ends of the scale at least 23 m in length composed of a base course and a minimum of 75 mm of asphalt surface course or 75 mm of concrete cement pavement.
3. Repair or replace approach grades, or any portion that varies by more than one-tenth of one percent, or revert to weighing the entire power unit and hauling units at the same time.

C. CONTRACTOR is responsible for costs for construction and maintenance of the approaches.

1.7 ELECTRONIC HOPPER SCALE REQUIREMENTS

A. The CONTRACTOR has the option of furnishing an electronic hopper scale system. When this type of weighing system is used, the following applies:
1. Use hopper or load cells.
2. Weights must be accurate to 1.0 percent of true weights.
3. Provide an automatic printer that will provide the following information:
   a. Project number and name
   b. Date
   c. Time
   d. Ticket number
   e. Haul unit number
   f. Gross weight (if possible)
   g. Tare weight
   h. Net kilograms or megagrams loaded
   i. A minimum of two copies of each ticket
   j. Description of item

B. Maintain electronic and hopper scales and conduct necessary testing to assure continued scale accuracy within specification limits after certification by the Department of Agriculture and required by specification.

C. Comparison Test. The accuracy of the hopper scale may be checked by comparing the weight of the material from the hopper and the weight of the material after it is weighed on another certified scale. The comparisons shall be within 0.5 percent tolerance or within the combined tolerance of the two scales.

D. If no platform scales are readily available, use known weights to occasionally recalibrate the scales by hanging weights from the weigh hopper.

E. Furnish weights equal to 12.5 percent of capacity and of known accuracy. Use a buildup procedure in combination with the weights by batching or placing a measured amount of material in the hopper and adding known weights to verify.

F. Request written approval to use alternate weighing devices.

1.8 DEPARTMENT INSPECTION AND VALIDATION OF WEIGHTS

A. Validating weights by Continuously Observed Weighing Method:
   1. The DEPARTMENT will provide a scale person who must either weigh, or observe, or weigh and observe the weighing of equipment or trucks both loaded and empty to determine the payload of materials to be hauled.
   2. The scale person will issue a weigh ticket at the scale site when truck scales without automatic printers are provided by the CONTRACTOR.

B. Validating weights by Random Scale Weighing Check Method:
   1. Used when a DEPARTMENT scale person does not weigh materials, or when an electronic scale with an automatic printer is used for weighing equipment, trucks, or materials.
   2. The ENGINEER will validate the equipment, truck, and material weight by random reweighing or by other methods as indicated.

C. ENGINEER or Inspector will randomly check the weight of the equipment, trucks, and the material indicated on the electronically produced weigh ticket or manually prepared ticket, by reweighing the loaded truck on another certified scale, if available.
   1. If no other platform scales are available, ENGINEER may check by operating the scale in the manual mode.
   2. When manual verification is used, ENGINEER will reweigh the truck by running it back over the platform scale to manually check weights.

D. Conduct frequent checks at the beginning of the operations to verify proper scale function and accuracy.
   1. Frequency may be reduced after initial verification to a minimum of once per week when a substantial amount of material is being weighted.
   2. Scale Tests: Maintain scales and conduct necessary testing to verify scale accuracy within the specifications.
      a. When the scale does not meet specified tolerance, discontinue using the scale until it is operating within specifications.
      b. Comparison scale checks must be within a 0.5 percent tolerance of the net load or within the combined tolerance of the two scales or two weights.

1.9 PROJECTS WITH SMALL QUANTITIES

A. ENGINEER may accept and receive small quantities of materials paid by weight when the following conditions are met.
   1. The vendor, producer, or supplier issues a signed weight ticket to the truck driver, weighted on certified scales.
   2. The certified weigh ticket is received at the site by a DEPARTMENT employee or inspector. Visual acceptance must be noted on the ticket for the quantity and other required information.
   3. The amount of material received on the project for any one day does not exceed:
      a. Hot Mix Asphalt or Plant Mix Seal Coat - 100 Mg
      b. Untreated Base Course - 200 Mg
      c. Borrow or Granular Borrow - 300 Mg

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01282

PAYMENT - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 00725: Scope of Work.

C. Section 00727: Control of Work.

D. Section 01280: Measurement.

1.2 SCOPE OF PAYMENT

A. DEPARTMENT will fully compensate CONTRACTOR as provided in the Contract for:
   1. Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of the work.
   2. All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the DEPARTMENT, subject to the provisions of Section 00725, paragraph: CONTRACTOR's Responsibility for Work.
   3. All costs arising from any infringement of a patent, trademark, or copyright.

B. Lump sum: Complete payment for the work described in the Contract when used as an item of payment.

C. CONTRACTOR will not be paid for:
   1. Work that is in excess of that contained in the Contract.
   2. Removal and replacement of defective work.
   3. Loss of anticipated profits.

D. Neither partial payment nor release of retainage will relieve the CONTRACTOR of the obligation to correct all defective work or materials.

1.3 ALTERED QUANTITIES

A. When the accepted quantities of work vary from the estimated quantities in the Contract, the DEPARTMENT will pay the original contract unit prices for the accepted quantities of work done.
   1. DEPARTMENT will not allow for any increased expenses, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the CONTRACTOR resulting either directly from such alterations or indirectly from

unbalanced allocation among the contract items of overhead expense and subsequent loss of expected reimbursement or from any other cause.

2. Exceptions: as provided in
   a. Section 00555, paragraph: Termination of Contract for Convenience of the Department.
   b. Section 00725, paragraph: Differing Site Conditions.
   c. Section 00725, paragraph: Significant Changes in the Character of the Work.
   d. Section 00725, paragraph: Suspensions of Work Ordered by the Engineer.

1.4 DIFFERING SITE CONDITIONS, CHANGES, EXTRA WORK

A. DEPARTMENT will pay for differing site conditions, changes, and extra work performed under Section 00725 at unit price or lump sum as stipulated in the order authorizing the work.

1.5 FORCE ACCOUNT WORK - GENERAL

A. Instead of a unit price or lump sum basis specified above, the DEPARTMENT may require the CONTRACTOR to do such work on a force account basis.

B. DEPARTMENT will not make additional allowance for:
   1. Timekeepers, bookkeepers, or other general office help.
   2. General superintendent except for the time spent in direct supervision of the force account work.
   3. The use of small tools (tools costing $400 or less) or other costs for which no specific allowance is herein provided.

C. DEPARTMENT will not pay for pickup trucks used solely for transportation.

D. DEPARTMENT will pay straight time for all hours worked. Overtime must have the prior written approval of the ENGINEER.

1.6 FORCE ACCOUNT WORK - LABOR

A. Compensation for labor: DEPARTMENT will pay for all labor, including direct supervision, used in the actual and direct performance of the work, at the rate of wage (or scale) agreed upon in writing before beginning work.

B. DEPARTMENT will reimburse for actual costs paid to, or in behalf of workmen, including subsistence and travel allowances, and health and welfare required by collective bargaining agreements or other employment contract generally applicable to the classes of labor employed on the work.
   1. An amount equal to 60 percent of the sum of the above items will be paid to the CONTRACTOR to cover the costs of bonds, insurance, taxes, etc.
   2. CONTRACTOR`s wage, payroll, and cost records pertaining to work paid for on a force account basis shall be open to inspection or audit.

1.7 FORCE ACCOUNT WORK - MATERIALS

A. DEPARTMENT will pay for all materials accepted by the ENGINEER and incorporated in the project at actual cost:
   1. Including sales taxes and transportation charges plus 15 percent.
   2. Excluding machinery rentals as hereinafter set forth.

B. Include invoices with statements for all materials used. Certify by affidavit the cost of material furnished from CONTRACTOR's stocks when no invoice is available.

1.8 FORCE ACCOUNT WORK - CONTRACTOR OWNED EQUIPMENT

A. Machinery or special equipment (excluding small tools) authorized by the ENGINEER will be paid at an hourly rate obtained from the "RENTAL RATE BLUE BOOK FOR CONSTRUCTION EQUIPMENT," (Blue Book). These hourly rental rates shall be determined by the monthly rental rate taken from the above mentioned publication divided by 176. Updated supplements will be authorized for use Statewide on specified dates. This publication can be obtained through:

   Primedia Information Inc.
   1735 Technology Drive, Suite 410
   San Jose, CA 95110-1313
   Phone: (800) 669-3282
   Fax: (408) 467-6795

B. The total hourly rates derived from the above have been computed from equipment costs currently in effect. The rates derived do not include costs for operating personnel.

C. The rates require adjustment by a Regional Factor and a Depreciation Factor found in the front of each Chapter in the Rental Rate Blue Book.

D. Equipment Rental rates can fall in the following two categories:
   1. Operating Rate - For those hours the equipment is actually in use. Includes ownership and operating costs. Adjusted for depreciation using Rate Adjustment Table and region using the Regional Adjustment Maps.
   2. Standby Rate - Compensation for equipment required to be at the work site but not operating. Includes ownership costs only. This rate will be 50 percent of the adjusted ownership costs computed in the previous paragraph. The duration of allowable standby time is to be approved in writing by the ENGINEER with a maximum of 8 hours per day or 40 hours in a normal week.

E. When the "Manufacturer's Rated Capacity" falls between those shown in this manual, the closest will be used. Do not interpolate for rates in between.

F. Agree upon all rates in writing before work is begun and measured as provided in Section 01280.

G. Equipment rental rates not provided by the aforementioned manual must be approved by the Office of Construction and Materials before the start of any "force account work".

H. DEPARTMENT will allow "move-in" and "move-out" transportation cost for a piece of equipment not available on the job, if the particular piece of equipment is not moved onto the job under its own power.

1. DEPARTMENT will allow hourly operating rate for equipment moved to the site under its own power.
2. DEPARTMENT will pay these charges only once for any particular piece of equipment except in unusual circumstances that must be justified in writing and agreed to by the ENGINEER.

1.9 FORCE ACCOUNT WORK - RENTED OR LEASED EQUIPMENT

A. When the equipment to be used is specialized in nature and is not available in the CONTRACTOR's inventory and is rented or leased from an outside source, DEPARTMENT will add a 10 percent allowance on the first $5,000 plus five percent of the balance in excess of $5,000 for overhead for all rented or leased equipment paid for by invoices.

1. Where the rental rate charged exceeds the rate determined by the Blue Book, submit the rental or lease agreement to the Engineer for Construction and Materials for approval.
2. DEPARTMENT will pay equipment operating costs at the rate from the Blue Book for rented or leased equipment for each hour the equipment was actually used.

B. When the required equipment is in the CONTRACTOR's available inventory but not on the project site, the equipment may be rented from a local source. The ENGINEER may approve rental rates for equipment obtained from local sources when such rates are within 10 percent of the Blue Book. When the equipment is to be used less than a week, "move-in" and "move-out" costs for CONTRACTOR owned equipment may be considered when comparing rental costs of equipment obtained from local sources.

1. This option will only be allowed when the cost of locally rented equipment would be less than using CONTRACTOR owned equipment including "move-in" and "move-out" charges.
2. Such rentals must be supported by a cost analysis indicating the method used was the least expensive.
3. If the CONTRACTOR elects to rent equipment of a type that is in the CONTRACTOR's inventory and the rental costs exceed that allowed by this paragraph, the DEPARTMENT will reimburse for such equipment based on the Blue Book.

1.10 FORCE ACCOUNT WORK - SUBCONTRACTS

A. For all force account work performed under an approved subcontract, DEPARTMENT will pay an additional allowance equal to ten percent of the first $5,000 plus 5 percent of the balance in excess of $5,000 for overhead for the subcontract.

B. The ENGINEER will review each situation to determine that performing the work by subcontract is justified.

1.11 FORCE ACCOUNT WORK - STATEMENTS

A. The CONTRACTOR's representative and the ENGINEER will compare records of the cost of work done as ordered on a force account basis.

B. At the ENGINEER's request, provide an itemized statement of the cost of the force account work detailed as follows:
   1. Name, classification, date, daily hours designating straight time and overtime, total hours, rate, and extension for each laborer and supervisor. (Payrolls may be used for part of this information.)
   2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
   3. Quantities of materials, prices, and extensions.
   4. Transportation of materials and equipment.
   5. Cost of fringe benefits and subsistence.
   6. Subcontractors.

1.12 ELIMINATED ITEMS

A. If any items contained in the Contract are determined to be unnecessary, the ENGINEER will eliminate the items from the Contract with a Change Order to the CONTRACTOR. This action will not invalidate the Contract.

B. When a CONTRACTOR is notified of eliminated items, DEPARTMENT will reimburse for actual work done under the provisions of Section 01282, paragraph: Differing Site Conditions, Changes, Extra Work; and paragraphs concerning Force Account Work (General, Labor, Materials, CONTRACTOR-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).

1.13 PROGRESS PAYMENTS

A. DEPARTMENT will make progress payments at least once each month when the work is progressing.

B. More frequent payments may be made during any period when the DEPARTMENT determines that the value of work performed during the period is of sufficient amount to warrant a payment.

C. Payments will be based on estimates prepared by the ENGINEER of the value of the work performed and materials in place under the Contract and for materials delivered under this Section, paragraph: Payment for Material on Hand.

D. DEPARTMENT will make no progress payment when the total value of the work done since the last estimate is less than $1,000.

E. From the total of the payable amounts, the DEPARTMENT will deduct and retain 5 percent until after the entire Contract has been completed in an acceptable manner. When no less than 95 percent of the work has been completed, and with the consent of the Surety, the ENGINEER may prepare a semi-final estimate from which the DEPARTMENT will retain 1-1/2 percent of the original contract amount. The DEPARTMENT will certify the remainder for payment, less all previous payments.

F. The CONTRACTOR may enter into an addendum agreement providing for the payment of retained monies into an escrow account, or the DEPARTMENT will do so automatically.

1. These monies are to be applied toward the purchase of approved securities that are to be held by an escrow agent until satisfactory completion of the construction Contract.
2. The value of the securities placed in escrow will have a minimum value equal to or greater than the amount that would otherwise be retained.
3. The addendum agreement must be executed concurrently with the execution of the construction Contract. Agreement forms are available in the office of the DEPARTMENT's Engineer for Construction and Materials.

1.14 PAYMENT FOR MATERIAL ON HAND

A. When the CONTRACTOR presents delivery copies of invoices, the DEPARTMENT may include in the partial payment invoice, advance payments for acceptable nonperishable materials purchased expressly to be incorporated into the work when delivered in the vicinity of the project, or stored in approved storage place.

1. The ENGINEER will determine the amount to be included in the estimate, but in no case will the amount exceed the value of the materials as shown on the delivery invoice, or 75 percent of the in-place price, whichever is less.
2. When the approved storage location is other than the project site, furnish evidence that the stockpiled materials are irrevocably obligated to the project.
3. Payment will not be made when the invoice value of such materials, as determined by the ENGINEER, amounts to less than $2,000 or if materials are to be stored less than 30 calendar days.
4. Within 60 calendar days following the date of the estimate invoice on which the stockpile material is to be paid by the DEPARTMENT, furnish to the ENGINEER certified paid invoices or a certified statement with a copy of the check showing payment.
5. The material will be removed from the next partial estimate as stockpiled materials if proper invoices showing payment to the supplier is not received.

B. DEPARTMENT will make no partial payment on living or perishable materials until incorporated as specified in the Contract.

C. DEPARTMENT will make no payment for materials brought onto the site at the CONTRACTOR's election that may be incorporated into the project such as fuels, supplies, metal decking forms, ties, or supplies used to improve efficiency of operations.

D. Approval of partial payment for stockpiled materials will not constitute final acceptance of such materials for use in completing items of work.

E. DEPARTMENT will purchase at actual cost and without any percentage allowance for profit, materials delivered to the project in compliance with the Contract or left unused due to changes in plans or variation in quantities, if the materials are not practicably returnable for credit.
   1. Purchased materials will become the property of the DEPARTMENT.
   2. Actual costs will be based on invoice price plus transportation costs to the work.

F. Payment will be limited to contract quantities unless ordered by the ENGINEER. Assume responsibility for excess materials delivered to the project, or aggregate produced beyond the contract amount without authority from the ENGINEER.

G. At the option of the DEPARTMENT, surplus aggregates up to the contract quantities may be purchased provided:
   1. The material is stockpiled where directed, and
   2. The material meets specification requirements when stockpiled.

H. DEPARTMENT will pay for material accepted on an agreed price basis, which price will normally be CONTRACTOR's production cost. In addition, the DEPARTMENT will pay the cost to haul the materials to the stockpile site and place in pile at the rate of 9 cents per megagram kilometer or 20 cents per cubic meter kilometer.

1.15 ACCEPTANCE AND FINAL PAYMENT

A. When the project has been accepted as provided in Section 00727, paragraph: Project Acceptance - Partial, and paragraph: Project Acceptance - Final, the ENGINEER will prepare the final estimate of work performed.
   1. If the CONTRACTOR approves the final estimate or does not object to the quantities within 30 calendar days of receiving the final estimate, the DEPARTMENT will process the estimate for final payment.
   2. After approval of the final estimate by the CONTRACTOR, DEPARTMENT will pay for the entire sum due after deducting all previous payments and all amounts to be retained or deducted under the provisions of the Contract.

B. If additional payment is due from the DEPARTMENT, file with the DEPARTMENT a full, complete, and itemized written statement justifying the adjustment within 30 calendar days after the final estimate is submitted for approval.
   1. All disputes not itemized in said statement are waived by the CONTRACTOR.
   2. Submission of disputes by the CONTRACTOR will not be reason for withholding full payment of the total value of work shown on the ENGINEER's final estimate.
   3. The DEPARTMENT will evaluate the dispute. If it is determined that additional payment is due, the final estimate will be revised accordingly, under the terms of the Contract. If not, the estimate as submitted will be final.

C. All prior partial estimates and payments will be subject to correction in the final estimate and payment.

D. The DEPARTMENT will have the final estimate complete and to the CONTRACTOR within six months of when the CONTRACTOR meets substantial completion of the project and has supplied the ENGINEER with all project certifications.

1.16 ADJUSTMENTS FOR FUEL COST

A. This price adjustment provision is intended to minimize risk to the CONTRACTOR due to potential volatile price fluctuations for fuel that might occur throughout the duration of the Contract.

1. The CONTRACTOR may invoke this provision at any time during the Contract by written notification to the ENGINEER.
2. Adjustments will then be made on all prior and future partial estimates. When this provision becomes effective, it shall remain in effect for the duration of the Contract.

B. This provision is not designed to estimate actual quantities of fuel used in construction operations, but to provide a reasonable basis for calculating a fuel price adjustment based on average conditions.

C. DEPARTMENT will determine compensation adjustments under the provisions of this Section, and will presume that the CONTRACTOR has relied on these provisions for compensation adjustments when determining unit bid prices.

D. Terms for calculating adjustments for fuel costs:

1. Fuel Partial Estimate Base Price (EP): - The average of all base prices determined during the partial estimate period.
   a. The DEPARTMENT will determine the base price per barrel for crude on the first working day of each week, using postings from the commodities and futures section of the Wall Street Journal for West Texas Intermediate (WTI) crude using the spot price for that date as a basis.
   b. A conversion factor of 159 L per barrel will be used.

2. Fuel Contract Base Price (CP): The base price determined for the week during which the bid opening is held. The source of the price will be the same as that used for the (EP).

3. Fuel Usage Factors (FU): A combined diesel and gasoline factor. Table 1 contains the items for which adjustments may be made, and the fuel usage factors upon which the adjustment will be based.

E. Determining Adjustments (AF): The ENGINEER will compute the adjustments separately for each partial estimate period. The adjustment will be determined on appropriate items in Table 1 using the formula with the following constraints.

1. The Partial Estimate Base Price must change plus or minus 15 percent from the Contract Base Price before an adjustment will be made; then add or deduct 5 percent per the formula.
2. ENGINEER will adjust only major contract items as defined by Section 00570, paragraph 1.2.A: Major and Minor Contract Items, or items that have an individual value of $100,000 or more based on original contract quantities.
3. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.

F. Work Beyond Contract Time: DEPARTMENT will not adjust for any partial estimate falling wholly after the expiration of contract time plus approved time extensions.

G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the DEPARTMENT will determine whether it is feasible for the remainder of the project to proceed, and will notify the CONTRACTOR in writing if the project is to be terminated.

H. Adjustment Formula:

EP greater than CP:

$$AF = \frac{[(EP - CP) - 0.05\ CP]\ Q\ (FU)}{159}$$

EP less than CP:

$$AF = \frac{[(EP - CP) + 0.05\ CP]\ Q\ (FU)}{159}$$

Where:

EP	=	Partial Estimate Base Price per barrel (dollars)
CP	=	Contract Base Price per barrel (dollars)
Q	=	Quantity of Acceptable Work Performed on Item
FU	=	Fuel Usage Factor for that Item
AF	=	Adjustment for Fuel Costs in Dollars
159	=	Liters per Barrel of Crude

Table 1
Adjustable Items and Fuel Usage Factors

Item of Work	Quantity of Work Q	Combined Diesel & Gasoline Usage Factor FU*
Roadway Excavation, Borrow, Embankment, Granular Borrow, Top Soil	Cubic Meter Megagram	2.23 1.04
Loose Riprap	Cubic Meter	2.82
Underdrain Granular Backfill	Cubic Meter	5.74
Untreated Base Course	Megagram	3.51
Hot Mix Asphalt Mix	Megagram	37.43
Hot Mix Asphalt	Megagram	15.02
Plant Mix Seal Coat	Cubic Meter Megagram	35.65 15.02
Cover Material: Produced and Placed on Roadway Produced and Stockpiled	 Megagram Megagram	 2.67 1.50
Portland Cement Concrete Pavement Lean Concrete Base Course	25 mm Thick Sq Meter	0.214

Structures (includes: Concrete, Piles, Reinforcing Steel, Structural Steel) Pipe Culvert Special Pipe Culvert (includes excavation for structures) Underdrains Right-of-Way Fence & Gates Seeding Concrete Small Structures Portland Cement Concrete Highway Traffic Paint Precast Concrete Barrier Guardrail	$	0.144 L

* Fuel Usage (FU) factor is based on liters

1.17 ADJUSTMENT FOR ASPHALT MATERIALS

A. This price adjustment provision is intended to minimize risk to the CONTRACTOR due to potential volatile price fluctuations for asphalt materials that might occur throughout the duration of the Contract.

1. The CONTRACTOR may invoke this provision at any time during the Contract by written notice to the ENGINEER.
2. DEPARTMENT will then adjust all prior and future partial estimates. When this provision becomes effective it will remain in effect for the duration of the Contract.

B. DEPARTMENT will adjust the price of asphalt materials for work done on bid items that contain asphalt materials, including asphalt cement, liquid asphalt, and emulsified asphalt.

C. DEPARTMENT will determine compensation adjustments under the provisions of this Section, and will presume that the CONTRACTOR has relied on these provisions for compensation adjustments when determining unit bid prices.

D. Terms for calculating adjustments for asphalt materials are as follows:

1. Asphalt Partial Estimate Base Price (EP): The average of all the base prices determined during the partial estimate period.
   a. On the first working day of each week, the DEPARTMENT will determine the base price per barrel for crude oil using postings from the commodities and futures section of the Wall Street Journal for West Texas Sour (WTS).
   b. A conversion factor of 6.2 barrels per megagram will be used.

2. Asphalt Contract Base Price (CP) - The base price determined for the week during which the bid opening is held will be the Contract Base Price. The source of the price will be the same as that used for the (EP).

E. Determining Adjustments (AF): The ENGINEER will compute the adjustments separately for each partial estimate period. The adjustment on each item will be determined using the formula with the following constraints.

1. The Partial Estimate Base Price of asphalt materials must change plus or minus 15 percent from the Contract Base Price before an adjustment will be made; then add or deduct 5 percent per the formula.
2. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.

F. Work Beyond Contract Time: DEPARTMENT will not adjust for any partial estimate falling wholly after the expiration of contract time plus approved time extensions.

G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the DEPARTMENT will determine whether it is feasible for the remainder of the project to proceed and will notify the CONTRACTOR in writing if the project is to be terminated.

H. Adjustment Formula

EP greater than CP:

$$AF = [(EP - CP) - 0.05\ CP]\ (6.2)\ Q$$

EP less than CP:

$$AF = [(EP - CP) + 0.05\ CP]\ (6.2)\ Q$$

Where:

EP	=	Partial Estimate Base Price per barrel (dollars)
CP	=	Contract Base Price per barrel (dollars)
Q	=	Quantity in megagram of Asphalt Materials used
AF	=	Adjustment for Asphalt Costs in dollars
6.2	=	Barrels per megagram of Asphalt

The ENGINEER will calculate the megagrams of asphalt product that will be Q in the above equation for the following:

Hot Mix Asphalt
Plant Mix Seal Coat
Emulsified Asphalts
Cutback Asphalts

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01285

MOBILIZATION - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Payment for preparatory work and operations necessary for moving personnel, equipment, supplies, and incidentals to the project site before beginning work.

B. Refer to Section 01285 of Methods of Measurement and Basis of Payment in the Supplement Specifications (Bid Book).

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01315

PUBLIC INFORMATION SERVICES - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Responsibilities of Public Information Manager (PIM) for the duration of a project.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

B. Section 02891: Traffic Signs.

1.3 PUBLIC INFORMATION MANAGER (PIM) RESPONSIBILITIES

A. PIM to be designated at the preconstruction conference for the project.

B. Available on every working day, on call at all times, and available upon the ENGINEER's request at other than normal working hours.

C. Maintain communications with the ENGINEER and affected businesses.

D. Provide information on a regular basis to private individuals, local news media, local organizations interested in the project, local city offices (fire, police, and public works departments), the Utah Highway Patrol, and the Utah Department of Transportation (ENGINEER and Community Relations Office).

E. Establish a local public information office equipped with a telephone and an answering machine.
   1. May be located within the CONTRACTOR's regular office provided that the telephone line is a local call line.
   2. May provide a cellular phone line.
   3. Provide on the answering machine.
      a. Updated message each week concerning the forthcoming activities on the project.
      b. Public information office hours.
      c. Allow the recording of a message from the caller.
      d. Check the answering machine at least twice a day.

F. Respond to questions concerning project activities and schedules, participate in and document meetings held with affected individuals, and maintain ongoing communication with businesses directly impacted by construction.

G. Prepare and distribute a flier to the residents and businesses directly adjacent to the project limits prior to beginning construction and once each month thereafter.
   1. Print on orange paper.
   2. Discuss the project's ongoing work, the anticipated completion date and the schedule for the forthcoming month.
   3. Provide the name of the CONTRACTOR's contact person and the telephone number and office hours of the public information office.
   4. Provide fliers and media releases to the ENGINEER, UDOT's Public Information Office, and to the people listed under Public Infomration Manager (PIM) Responsibilities.

H. Maintain a logbook of citizen and business contacts, including names, addresses, phone numbers and subsequent action taken during construction
   1. Provide the ENGINEER a copy each week.
   2. Follow up all inquiries and complaints with either a return phone call, or a meeting, as warranted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Sections 01554 and 02891.

B. Follow Standard Drawing 745-52.

PART 3 EXECUTION

3.1 CONSTRUCTION TRAFFIC SIGNS

A. Erect signs with the CONTRACTOR's public information office phone number at each major approach to the project.

B. Conform to Sections 01554 and 02891.

END OF SECTION

SECTION 01355

ENVIRONMENTAL PROTECTION

PART 1 GENERAL

1.1 GENERAL PROVISIONS

A. Comply with all Federal, State, local laws and regulations, and the provisions of this Section controlling environmental pollution.

B. Prevent pollution of streams, lakes, ponds, and reservoirs with fuels, oils, bitumens, chemicals, or other harmful materials and pollution of the atmosphere from particulate and gaseous matter.

1.2 HAZARDOUS MATERIAL - DISCOVERED DURING CONSTRUCTION

A. Immediately suspend work in the area and notify the ENGINEER if abnormal conditions are encountered or exposed during construction that indicates the presence of a hazardous material, toxic or hazardous waste.
   1. The conditions shall be treated with extreme caution.
   2. Abnormal conditions shall include, but not be limited to, the following: presence of barrels; buried storage tanks; above ground tanks; obnoxious odors; excessively hot earth; stained and discolored soils; smoke; unidentifiable powders, sludges, pellets; or any other condition that could be a possible indicator of hazardous material, toxic or hazardous waste.

B. Resume operation in this area when directed by the ENGINEER. Continue working in other areas of the project, unless otherwise directed by the ENGINEER.

C. Dispose of the hazardous material, toxic or hazardous waste under the requirements and regulations of the Utah State Department of Environmental Quality and United State Environmental Protection Agency.
   1. Perform by change order necessary work required to dispose of these materials.
   2. Disposition of waste materials requiring special procedures by certified personnel will be arranged by the DEPARTMENT with qualified persons to dispose of the material.

1.3 HAZARDOUS MATERIAL - CONTRACTOR CAUSED

A. Notify the ENGINEER and the Department of Environmental Quality of spills of petroleum based products or hazardous waste if the release would meet the definition of a hazardous waste as defined in 40 U.S. Code of Federal Regulations 261.
   1. Notify within 24 hours after the discovery of the spill.
   2. Notify in writing within 5 calendar days of the discovery.
   3. Notify the Department of Environmental Quality in accordance with R315.9 of Utah Administrative Code.

B. Dispose of spilled material according to the requirements and regulations of the Utah State Department of Environmental Quality.

C. Pay for the required clean-up operations.

1.4 LIVE STREAMS

A. Ford or work in live streams or any live body of water (live water) only with approval from the Utah Division of Water Quality and Utah Division of Water Rights. Do not operate mechanized equipment in live water unless provided for in the Contract. Minimize stream siltation.

B. Use a dike or barrier to separate work areas or pits located in or adjacent to streams from the main stream. Prevent sediment from entering adjacent streams.

C. Treat water used to wash aggregate or water from other operations that produce sediment by filtration, settling basins, or other methods that reduce sediment concentrations to the level of the stream or lake into which it is discharged.

1.5 OPEN BURNING

A. Not permitted along highway rights-of-way without approval orders from the Executive Secretary of the Utah Bureau of Air Quality.

1.6 ABRASIVE BLASTING - VISIBLE EMISSION STANDARDS

A. **Visible Emission Standards:**

1. Abrasive blasting outside of Weber, Davis, Salt Lake and Utah Counties: Do not discharge into the atmosphere an opacity darker than 40 percent for a period or periods aggregating more than 3 minutes in any 1 hour.
2. Abrasive blasting inside Weber, Davis, Salt Lake or Utah Counties where the performance standards in this paragraph item C are used: Do not discharge into the atmosphere an opacity darker than 20 percent for a period or periods aggregating more than 3 minutes in any 1 hour.
3. Abrasive blasting inside Weber, Davis, Salt Lake or Utah Counties where the performance standards in this paragraph item C are not used: Do not discharge into the atmosphere an opacity darker than 40 percent for a period or periods aggregating more than 3 minutes in any 1 hour.

B. **Visible Emission Evaluation Techniques:**

1. Rad emissions from unconfined blasting at the densest point of the emission after a major portion of the spent abrasive has fallen out. Densest point will be between 2 m and 8 m from the impact surface of the abrasive blasting nozzle.
2. Judge emissions from unconfined blasting employing multiple nozzles as a single source unless each nozzle meets the emission and performance standards.
3. Read emissions from confined blasting at the densest point after the air contaminant leaves the enclosure.

C. **Performance Standards:** Any one of the following may be used as a performance standard.

1. Confined blasting
2. Wet abrasive blasting
3. Hydroblasting
4. Unconfined blasting using abrasives defined below:
   a. Before blasting, the abrasive will not contain more than 1 percent by weight material passing a 212 µm standard sieve.
   b. After blasting, the abrasive will not contain more than 1.8 percent by weight material 5 µm or smaller.
   c. Abrasives reused for dry unconfined blasting are exempt from the requirements of "after blasting", but must conform with the requirements of "before blasting" above.

D. **Abrasive Certification:** Sources using the performance standard for unconfined blasting must demonstrate they have obtained abrasives from persons who have certified (submitted test results) to the Utah Air Quality Executive Secretary at least annually that such abrasives meet the requirements outlined above for abrasives.

1.7 NOISE AND VIBRATION CONTROL

A. Identify haul routes and percussive noise sources that annoy sensitive receptors and prevent these sources from becoming a problem.

B. Definitions and Standards - Terminology used will meet applicable American National Standards Institute (ANSI) publications and commonly accepted practices of acoustical measurements.

1. Receptor - An occupied residential dwelling, church, hospital, school, outdoor stage, or structure confining other noise sensitive activities.
2. Noise Sensitive Zone - The land enclosed within a 500 m radius circle of any receptor.
3. Sound Level - The total sound pressure level from all concurrent construction activities related to the subject project, as measured with a sound level meter using the A-weighting network (ANSI S1.4). The standard notation is dB(A) or dBA.
4. Percussive Noise - Short burst(s) of banging or clattering noise including but not limited to blasting, pile driving, and jack-hammering.

C. Prohibitions - Suspend construction work under the following conditions:

1. Construction activity in a noise sensitive zone causes the sound level within 3 m of the nearest receptor to exceed: 95 dBA in daytime (7 a.m. - 9 p.m.), or 55 dBA in nighttime (9 p.m. - 7 a.m.)
2. A noise sensitive zone on Sundays and State Holidays.
3. Project related construction noise or vibration does not meet specifications. The portion of construction work responsible for the problem shall be suspended until reduced to the required noise standards.

D. Compliance:

1. Follow all local noise ordinances, except where a variance in accordance with local regulations has been granted.

2. Local noise ordinance variance does not provide an exemption from complying with the requirements of this paragraph, item C.

E. Percussive Noise: Notify the ENGINEER at least 2 weeks in advance of any percussive noise activity that is expected to exceed the provisions of this paragraph item C. Coordinate with the ENGINEER to notify the public.

1.8 ENVIRONMENTAL CLEARANCE BY THE CONTRACTOR

A. Obtain and provide the following environmental clearances before commencing project activity when adding or selecting any ground- or resource-disturbing features such as material (gravel, borrow or waste) sites, equipment staging sites, office sites, water lines, holding ponds, etc., not provided in the Contract:

1. Cultural and Paleontological - Initiate consultation concerning proposed additional feature(s) with a DEPARTMENT staff archeologist. (Hiring of a private archeological subconsultant and subsequent coordination with the Utah State Historic Preservation Office may be required.) The DEPARTMENT staff archeologist will provide clearance to the CONTRACTOR via written notification. See this Section, paragraph: Discovery of Historic Archeological or Paleontological Objects.
2. Threatened and Endangered Species - Obtain written clearance from the U.S. Fish and Wildlife Service.
3. Wetlands - Obtain written clearance from the U.S. Army Corps of Engineers.
4. Floodplains - Initiate consultation concerning the proposed additional feature(s) with the Region Hydraulics Section. ((Subsequent coordination with the Federal Emergency Management Agency (FEMA) may be required.)) Verification of non-interference by the CONTRACTOR with a floodplain, or compliance with FEMA guidelines will be provided to the CONTRACTOR by the Region Hydraulic Engineer.
5. Prime, Unique and Important Farmland - Initiate consultation concerning the proposed additional feature(s)with the farmland specialist with the Region's Environmental Engineer. (Subsequent coordination by the CONTRACTOR with the U.S. Natural Resources Conservation Service may be required.) The Region will provide clearance to the CONTRACTOR in writing.
6. UTAH POLLUTANT DISCHARGE ELIMINATION SYSTEM (UPDES) -Obtain UPDES permit for storm water discharge from Utah Division of Water Quality (DWQ). Comply with the requirements of the permit including submittal of Notice of Intent (NOI) form to DWQ and development and approval of the storm water pollution prevention plan by the DWQ when required.
7. Air Quality: Obtain construction approval from the Utah Division of Air Quality, if construction project or area of disturbance outside of the project is in an area of air quality non-attainment for any pollutant.

B. CONTRACTOR is responsible for all costs of pursuing and obtaining all the above clearances, and is not entitled to time extension for delays encountered in obtaining these clearances.

1.9 DISCOVERY OF HISTORICAL, ARCHEOLOGICAL OR PALEONTOLOGICAL OBJECTS

A. Immediately suspend construction operations in the vicinity of the discovery if a suspected historic, archeological or paleontological item, feature, prehistoric dwelling sites or artifacts of historic or archeological significance are encountered.

B. Notify the ENGINEER verbally of the nature and exact location of the findings.

C. The ENGINEER will contact the State archeological authorities who will determine their disposition.

D. Protect the discovered objects and provide written confirmation of the discovery to the ENGINEER within 2 calendar days.

E. The ENGINEER will keep the CONTRACTOR informed concerning the status of the restriction.

1. The time necessary for the DEPARTMENT to handle the discovered item, feature, or site is variable and dependent on the nature and condition of the discovered item.
2. Expect a two (2) week or more delay in the vicinity of the discovery.
3. Written confirmation will be given by the ENGINEER when the restriction is terminated.

F. If a changed condition is approved, it will be controlled in accordance with Section 00725, paragraph: Differing Site Conditions.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 01452

PROFILOGRAPH

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for 7.6 m wheel base California type profilograph with electronic data recording, storing, data reduction, and printing capabilities.

1.2 ACCEPTANCE

A. Test as work progresses and accept in lots equal to the number of square meters placed each day.

B. Thin Lifts:
1. Evaluate and accept the finished surface in 0.5 km sections.
2. Begin the initial section at the start of the project. Lay out subsequent sections consecutively to the end of the project.
3. If the final section is less than 0.3 km, add the section to the previous full 0.5 km section. Otherwise evaluate the section individually.

PART 2 PRODUCTS

2.1 FRAME

A. Construction:
1. All welded of light-weight square aluminum tubing in three separate units of the same dimensions in width and within 150 mm in length of each other.
2. Design: reinforced truss.

B. Length:
1. Effective wheel base of the frame assembly: 7.6 m.
2. Overall length with multiple wheel assemblies attached: not to exceed 10.7 m.

C. Frame Connections:
1. Indexed with steel location pins or dowels to prevent misalignment of frame assembly.
2. Secured with quick acting clamps rated at a minimum of 3500 N each.

D. Parts: Each of the three frame units shall be manufactured to allow interchangeable replacement of individual units.

2.2 WHEEL SUPPORT ASSEMBLIES

A. Tubing: All welded, light-weight square aluminum.

B. Connections: All connection points between wheel assemblies and frame sections secured with quick-acting clamps.

C. Support wheels: Cast aluminum hubs with ball bearing supported steel axles and cushion rubber tires. Caster wheel assemblies must be ball bearing supported.

D. Front Wheels: Steerable from the center of the machine.

E. Rear Wheels: Quick setting manual adjustment to allow for short radius turning, moving laterally, and for trimming to avoid crabbing on superelevations.

2.3 RECORDING WHEEL

A. Light weight, 600 mm to 650 mm nominal diameter, and heavy duty spokes.
   1. Tire: pneumatic tube type with non-aggressive tread design.
   2. Frame: all welded of light-weight square aluminum tubing. Frame pivot points and rotating shafts shall be supported by sealed ball bearings.

2.4 GENERAL MECHANICAL

A. All exposed steel components anodized, nickel plated, or zinc plated for corrosion protection.

B. Constructed to allow for interchangeability of parts.

C. Capable of being broken down in segments that can fit into the back of a standard pickup truck or van for ease of transport.

D. Constructed to allow complete assembly in less than 15 minutes without tools.

2.5 AC POWER GENERATING UNIT

A. Self-contained, capable of delivering 120 VAC at 60Hz.

B. Mount on the frame with appropriate vibration and shock control hardware.

2.6 MICROCOMPUTER

A. Control the system by a dedicated on-board microcomputer.

B. The microcomputer components must be replaceable and interchangeable with like items from the manufacturer's stock to facilitate controller repairs, and provide the minimum operation characteristics as follows:

1. Processor:
   a. Minimal 16 bit microprocessor capable of running at a nominal 8 MHz processing speed.
   b. On-board memory shall be sufficient to store Profile Index (PI) and bump Discrimination software.
   c. RAM memory must be sufficient to input control parameters and process project documentation variables at the test site.
2. Displacement Transducer Interface:
   a. Must contain an analog to digital converter that is compatible with the operating characteristics of the microprocessor.
   b. Signal conditioning for analog filtering and scaling must be included.
   c. Overall resolution for displacement transducer must be less than or equal to 0.1 mm.
3. Odometer Transducer Interface: Must provide digital logic to encode positive or negative signals to microprocessor.
4. Clock:
   a. Must provide time and calendar functions to microprocessor unit automatically.
   b. Independent battery power required to avoid documentation errors and input data losses caused by on-board power shut downs.

2.7 TRANSDUCERS

A. Rated to withstand shock, vibration, dust, and extremes of humidity. Operational from -30 degrees C to 100 degrees C.

1. Vertical Displacement Transducer: Resolution of 0.25 mm.
2. Odometer: horizontal resolution of 9.75 mm and operational in either an incrementing or decrementing mode.
3. Temperature transducer: Accurate to ± 1 degree C.

2.8 PRINTER/PLOTTER

A. Compatible with and provide suitable interfaces with the microprocessor.

B. The data acceptance (baud rate) and buffer storage capacity: adequate to fully register, plot, and accept data from a 6 km/h operational run without excessive wait states.

C. If dot matrix mechanism (if applicable): print bar resolution of 4 dots per millimeter with a row resolution of 8 rows per millimeter.

2.9 OPERATOR CONTROL PANEL

A. Located within easy access of the operator and in a location on the profilograph that does not hinder other operational functions or line of sight to testing path.

B. Control panel must have a digital display, data input key board, observable indicators, (video or screen) and operator actuated control switches.

C. Parameters that will be entered, displayed, and printed are as follows (all numeric):
   1. Time
   2. Date
   3. Region, route and pavement
   4. Pass number
   5. Beginning Station
   6. Ending Station
   7. Odometer
   8. Blanking band width
   9. Bump height
   10. Bump width
   11. Event marker

2.10 REPORTING REQUIREMENTS

A. Determine Profile Index, documentation, reports, outputs, etc., as specified. UDOT Materials Manual, 8-995.

B. Set preprogrammed or operator entered scaling or sensitivity factors at a sensitivity level that will correlate with DEPARTMENT profilographs.

C. Include the following documentation supplied with the Profilograph system:
   1. Operator's Manual.
   2. Wiring Diagrams.
   3. Industry standard part number or name and model numbers for complete subsystems.

PART 3 EXECUTION

3.1 TESTING AND CORRECTING PAVEMENT - HOT MIX ASPHALT

A. Provide rotating amber lights or strobe light so the device and operator are highly visible from front or rear.

B. Operators must be appropriately certified. ENGINEER will verify certification.

C. The ENGINEER or representative must witness all profile testing for acceptance.

D. Run a Profile Index within two working days, starting 30 m before the beginning of the day's placement and ending 15 m before the end of the day's placement.
   1. A day's production for categories 1, 2, and 3 is defined as a minimum of 3300 m^2 of pavement placed in a single day.
   2. A day's production for categories 4 and 5 is the length between intersections.
   3. Group quantities smaller than 3300 m^2 with the subsequent day's production.
   4. Profile Index is defined as the average of the two profiles taken as described.

E. Take two profiles for each traffic lane 1 m from each edge of the traffic lane.
   1. Evaluate in 0.2 km consecutive sections.
   2. Use a blanking band of 5 mm.
   3. Stationing shall match pavement stations.

F. Do not include side street intersections and returns in the Profile Index.

G. Do not include bridges in the Profile Index. Start and end the profile index 5 m from each bridge approach or existing pavement that abuts new pavement, running in the same direction as the pavement.

H. Comply with the provision in Table 1.

Table 1

Pavement Smoothness Category	**Surface Smoothness Criteria - Hot Mix Asphalt**			
	Class I and II Mainline Surface		**Class III Mainline Surface**	
	Section PI	**Deviation in 7.6 m**	**Section PI**	**Deviation in 7.6 m**
Category	mm/km	mm	mm/km	mm
1 2	110 160	7.5 7.5	140 180	7.5 10
Category 1 Category 2	National Highway System and Truck Haul Routes: Table 4, Section 02741. All other routes.			
Class I and II Class III	Mainline surfaces consist of all through traffic and climbing lanes including bridges and bridge approach slabs with final riding surfaces of asphalt pavement. Excluded are (1) the portions on horizontal curves having a centerline radius of curvature less than 300 m. and (2) areas within the superelevation transition to such curves. Mainline surfaces consist of all acceleration and deceleration lane ramps, tapers, shoulders wider than 1.8 m without rumble strips, and surfaces excluded from Class I and II due to horizontal curves.			

I. Correct all deviations in pavement which exceed the limits specified in Table 1.
   1. Remove all high points with an approved grinding device or a device consisting of multiple blades.
   2. Re-profile the areas requiring corrective action for correction verification.
   3. Skid resistance of final surface must be equal to or better than adjacent sections not requiring corrective work.
   4. Re-saw to proper depth, clean, and reseal all transverse joints in the ground area (concrete only).

5. Taper ground areas from the lane/shoulder line into the shoulder area t the rate of not greater than 20 mm/m.
6. Seal all ground areas with an asphaltic tack coat (0.15 L/m^2 - 0.25 L/m^2), and sand. (asphalt only).

J. Traffic control for grinding or sawing is at no additional cost to the DEPARTMENT.

K. Conduct a final profilograph run from start to end of the project including all structures, etc. for both directions of travel after all corrective work is completed. These profilographs will become the property of the DEPARTMENT, and will be used for informational purposes.

L. Provide the profiles to the ENGINEER or representative at the completion of each record testing run. Profiles become the property of the DEPARTMENT.

3.2 TESTING THIN LIFTS

A. Place temporary traffic control devices as approved by the ENGINEER prior to and during surface testing.

B. Run a profile trace in each projected approximate wheel path contained in the paving pass.
1. Each wheel path is defined as a continuous parallel line 0.75 m from the projected lane lines for the new surface.
2. Include all manholes, culverts, box-out, approach slabs, structures, etc., that are located within the wheel path.
3. Do not include intersections in the profile index. Intersection smoothness will be limited to bump removal.

C. Preliminary Surface Testing:
1. Calibrate the profilograph and make filter and setting adjustments as necessary to correlate with DEPARTMENT profilograph. CONTRACTOR's profilograph required to read within 10 percent of DEPARTMENT's profilograph on the same segment of roadway.
2. The initial Profile Index for each 0.5 km section is determined by taking the average of all profiles traces taken on the section.

D. Finished surface:
1. For traces on the beginning and ending segments of the project, extend the trace an additional 10 m into the adjacent pavement. The additional length is for locating grind sections only, not for determining the Profile Index for that section of pavement.
2. Run all Profile Traces within two working days after pavement has been placed including pavement for or around all manholes, culverts, box-outs, approach slabs, structures, etc.
3. All profile testing for acceptance must be witnessed by the ENGINEER.
4. Correct all individual profile deviations with an approved grinding device or a device consisting of multiple blades.
   a. Longitudinal smoothness requirements will be limited to a 7.5 mm bump in 7.5 m as identified by the Profilograph.

b. Transverse smoothness requirements will be limited to a 7.5 mm bump in 7.5 m as identified by string-lining or straight edge.

5. Seal all ground areas with an asphalt tack coat (0.15 - 0.25 L/m^2) and sand.
6. The Final Profile Index for each 0.5 km section is determined by taking the average of all profiles traces taken on the section.

3.3 TESTING PLANT MIX SEAL COAT

A. Surface Requirements: Correct all deviations, exceed the limits in Table 2 with approved grinding device, or device consisting of multiple blades. Take an additional profilograph run after grinding.

B. Transverse smoothness requirements is limited to 7 mm bump in 7 m.

Table 2

Pavement Smoothness Category	**Surface Smoothness Criteria - Plant Mix Seal Coat**			
	Class I and II Mainline Surface		**Class III Mainline Surface**	
	Section PI	**Deviation in 7.6 m**	**Section PI**	**Deviation in 7.6 m**
Category	mm/km	mm	mm/km	mm
1 2	110 160	7.5 7.5	140 180	7.5 7.5
Category 1 Category 2	National Highway System and Truck Haul Routes: Table 4, Section 02741. All other routes.			
Class I and II Class III	Mainline surfaces consist of all through traffic and climbing lanes including bridges and bridge approach slabs with final riding surfaces of asphalt pavement. Excluded are (1) the portions on horizontal curves having a centerline radius of curvature less than 300 m. and (2) areas within the superelevation transition to such curves. Mainline surfaces consist of all acceleration and deceleration lane ramps, tapers, shoulders wider than 1.8 m without rumble strips, and surfaces excluded from Class I and II due to horizontal curves.			

3.4 TESTING PORTLAND CEMENT CONCRETE PAVEMENT

A. Comply with the provisions in Table 3.

Table 3

Surface Smoothness Criteria - Portland Cement Concrete Pavement					
Pavement Smoothness Category	**Class 1 Mainline Surface**		**Class II Mainline Surface**		**Class III All Other Surfaces**
	Section PI	Deviation in 7.6 m	Section PI	Deviation in 7.6 m	Deviation in 3 m
	Millimeter/ Kilometer	Millimeter	Millimeter/ Kilometer	Millimeter	Millimeter
1	80	7.5	140	7.5	3
2	80	7.5	140	10	3
3	140	7.5	190	10	5
4	200	10	240	10	5
5	230	10	280	10	5
Category 1	Rural Interstate Highways				
Category 2	Urban Interstate Highways and Non-Interstate Freeways				
Category 3	All other Rural Highways				
Category 4	Urban Highways with Design Speed $ 65 km/h				
Category 5	Urban Highways with Design Speed < 65 km/h				
Class I	Mainline surfaces consist of all through traffic and climbing lanes including bridges and bridge approach slabs with final riding surfaces of concrete. Excluded are the portions of horizontal curves having a centerline radius of curvature less than 305 m and areas within the superelevation transition to such curves.				
Class II	Mainline surfaces consist of all acceleration and deceleration lane ramps, tapers, shoulders wider than 1.8 m without rumble strips, and surfaces excluded from Class I due to horizontal curves.				

END OF SECTION

SECTION 01455

MATERIALS QUALITY REQUIREMENTS - See Supplemental

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00727: Control of Work.

B. Section 01355: Environmental Protection.

1.2 SOURCE OF SUPPLY AND QUALITY REQUIREMENTS

A. Use only materials that meet contract requirements.

B. Notify the ENGINEER of the proposed source of materials to be used prior to their delivery.

C. Materials can be conditionally approved at the supply source.

D. If materials are conditionally approved but fail to meet contract requirements, correct to the satisfaction of the ENGINEER, or remove.

E. Unless otherwise specified, use new materials for the work.

1.3 LOCAL OPTIONAL MATERIAL SOURCES - DEPARTMENT FURNISHED SOURCES

A. Possible sources of local optional materials may be designated.
   1. Determine the amount of equipment and work required to produce a material meeting the Specifications using these sources.
   2. Expect variations in both quantity and quality.
   3. Procure material from designated portions of the deposit.
   4. Material may be rejected if it is unacceptable or fails to meet contract requirements.

B. Specific information about optional material sites and sources is usually available for inspection at the Region Materials Lab. Sources and sites are those either identified in Contract Documents or within the vicinity of the project, including aggregate quality test or quality control test results from previous projects where the sources or materials sites may have been used or investigated.
   1. This information will be made available to prospective bidders upon request for their inspection.
   2. By making this information available, the DEPARTMENT is not representing that a bidder should necessarily expect to produce materials corresponding with those previously produced by others, or that the CONTRACTOR may expect to produce based upon the CONTRACTOR's interpretation of test data.

C. The DEPARTMENT may acquire the right to take and make materials available from designated sources, including the right to use the property as specified, or for plant site, stockpiles, and haul roads. The Contract will define acquisition and rights provided for this procedure.

1.4 LOCAL OPTIONAL MATERIAL SOURCES - CONTRACTOR FURNISHED SOURCES

A. Acquire the rights to take materials from sources other than those designated in the Contract.

B. Pay all related costs including those for increased haul length and for exploring and developing sources.

C. Use material from other than DEPARTMENT furnished sources only after DEPARTMENT tests indicate that the material is of equal or better value than the DEPARTMENT furnished source, and after its conditional acceptance is received.
   1. Notify the ENGINEER in writing of the choice of aggregate source.
   2. The DEPARTMENT will obtain and process the additional samples to determine the suitability of the aggregate.
   3. Allow 30 calendar days for sampling and testing after the ENGINEER has been notified and the number of test pits has been determined.
   4. The ENGINEER may require additional samples for inspection and testing before authorizing use of the source.
   5. ENGINEER will determine the location and necessary number of test pits, with three test pits and samples per aggregate source as a minimum.

D. Pay 50 percent of the DEPARTMENT's sampling and testing cost if the material source is found to be unacceptable for use as a particular contract bid item.

E. DEPARTMENT will not extend time to the original contract time for the time required for DEPARTMENT testing of non-designated sources.

F. Obtain environmental clearances following Section 01355, paragraph: Environmental Clearance by the CONTRACTOR.

1.5 FINISHING LOCAL MATERIAL SOURCE SITES

A. Finish all (public or private) material source sites to leave a pleasing appearance.

B. Locate, where practicable, borrow pits, gravel pits, and quarry sites where they are not visible from the highway.

C. Grade to drain without causing excessive erosion and without altering the natural drainage courses.

D. Prepare pit site plans that show in detail the line and grades to which materials are to be removed.
   1. The ENGINEER will evaluate the pit site plans as to their physical, environmental, and ecological effect before materials are removed from that source.

2. If a property owner requests that the pit be finished other than stipulated, the change will be permitted only with written approval from the ENGINEER and the property owner.

E. Locate waste sites in areas that are least visible from public view. Spread waste material to obtain a natural appearance.

F. Obtain environmental clearances following Section 01355, paragraph: Environmental Clearance by the CONTRACTOR.

G. Strip and stockpile topsoil. Spread over the excavated area topsoil that is not used for the highway.

H. Remove trash. Remove, bury or distribute excess materials over the pit areas when pit excavation has been completed.

I. Grade to approved lines and grades, before topsoil is spread.
1. Avoid vertical cuts and sharp corners.
2. Grade side slopes to be 1:3 or flatter.
3. Abandon and obliterate haul roads.

J. Seed the pit, the denuded areas around the pit resulting from construction operations, and the obliterated haul roads with a grass or grasses adaptable to the area and approved by the ENGINEER and property owner. Conduct the seeding under the contract requirements for grass seeding, including mulching.

K. DEPARTMENT will not pay separately for pit finishing and seeding, including mulching, but will consider them incidental to other bid items of work.

1.6 SAMPLES, TESTS AND REFERENCED CITED SPECIFICATIONS

A. Incorporate into the work only material that the DEPARTMENT has inspected, tested, and accepted. Pay to remove unacceptable materials from the site.

B. DEPARTMENT test methods will be as provided in the most recent minimum sampling and testing requirements and standard test methods of the DEPARTMENT, AASHTO or ASTM tests in effect at the time the job is advertised.

C. The DEPARTMENT will perform testing at its expense, unless otherwise designated.

D. Test method precedence is as follows:
1. The DEPARTMENT's Minimum Sampling and Testing Requirements Manual.
2. AASHTO.
3. ASTM.

E. A DEPARTMENT representative will perform or observe sampling and sample splitting of materials.

F. The DEPARTMENT can retest and reject materials conditionally accepted at the source.
   1. Materials designated for use can be inspected, tested, or rejected before or during incorporation into the work.
   2. Copies of any or all test results are available upon request.

G. Pay for retesting of materials made necessary by the CONTRACTOR's activities.

1.7 CERTIFICATE OF COMPLIANCE

A. The Contract or the DEPARTMENT's current minimum sampling and testing requirements will designate manufactured materials and assemblies that can be incorporated in the work, if accompanied by Certificates of Compliance from the manufacturer.
   1. The Certificates of Compliance will state that the materials or assemblies provided fully meet the requirements of the Contract, and will be signed by a representative of the manufacturer who is in a position to legally bind the manufacturer.
   2. Each lot of certified materials or assemblies delivered to the work must be accompanied by a Certificate of Compliance clearly identifying the materials delivered and the specification requirement satisfied.

B. DEPARTMENT may sample and test materials or assemblies used on the basis of Certificates of Compliance and reject or accept if it is determined not to meet contract requirements under Section 00727, paragraph: Conformity with Plans and Specifications.

C. The form and distribution of the Certificates of Compliance will be as found in the Contract or the DEPARTMENT's Minimum Sampling and Testing Requirements Manual.

1.8 PLANT INSPECTION

A. DEPARTMENT may inspect materials at the acquisition or manufacturing source for compliance with specified manufacturing methods. Material samples will be obtained and tested for compliance with quality requirements.

B. Meet the following conditions if inspection is at the plant.
   1. Cooperate fully and assist the ENGINEER during the inspection.
   2. Ensure the ENGINEER full access to all parts of the plant used to manufacture or produce materials.
   3. If specified, provide a building, located at the plant, for use by the ENGINEER, as required under this Section, paragraph: Field Laboratory.
   4. Provide and maintain adequate safety measures.
   5. Equip crushing or screening facilities with automatic or semiautomatic mechanical sampling devices.

C. The DEPARTMENT can retest materials conditionally approved at the source prior to incorporation into the work.

D. The DEPARTMENT will reject material not meeting contract requirements.

1.9 FIELD LABORATORY

A. Provide the DEPARTMENT a field laboratory, consisting of a suitable building to house the equipment and perform the required tests.

B. The DEPARTMENT will specify by a Special Provision the type of building and other requirements, including payment.

1.10 STORAGE AND HANDLING OF MATERIALS

A. Store and handle materials to preserve their quality and fitness for the work.

B. Transport bulk materials in a manner to prevent loss or segregation after loading and measuring.

C. Store materials so they can be easily inspected and retested following this Section, paragraph: Samples, Tests and Referenced Cited Specifications.

D. Obtain approval to store materials and CONTRACTOR's plant and equipment within the right-of-way.

E. Additional storage space is at the CONTRACTOR's expense and option.
   1. Obtain owner's or lessee's written permission before storing material on private property.
   2. Furnish copies of the permission to the ENGINEER, if requested.

F. Pay to restore storage and plant sites to their original condition.

1.11 UNACCEPTABLE MATERIALS

A. ENGINEER will reject all materials not meeting the contract requirements.

B. Remove unacceptable materials immediately from the project site unless the defects are corrected and approved by the ENGINEER or accepted at a reduced price under Section 00727, paragraph: Conformity with Plans and Specifications.

1.12 DEPARTMENT FURNISHED MATERIALS

A. Deliver or make available DEPARTMENT-furnished materials at the locations specified in the Contract. Receive, inventory, store, protect, distribute and install DEPARTMENT-Furnished material.

B. Include the cost of handling and placing DEPARTMENT-Furnished materials in the contract price for the item for which the materials are used.

C. CONTRACTOR is responsible for all materials received.
   1. Deductions will be made from any monies due for any shortages, deficiencies, and damage that may occur to the material after delivery.

2. Demurrage charges resulting from failure to accept the material at the designated time and point of delivery will be deducted from monies due.

1.13 BUY AMERICA

A. Federal-aid projects are subject to Title 23, U. S. Code of Federal Regulations, Section 635.410, Buy America Requirements.
   1. Check the appropriate box on the bid proposal indicating the intent to use steel or iron or both of 100 percent domestic supply, or with some foreign supply.
   2. If neither box is checked, the DEPARTMENT will consider the bid a bid for furnishing domestic steel and iron, and only domestic steel and iron will be used in the Contract.
   3. The DEPARTMENT will award the Contract to the bidder who submits the lowest total contract bid based on furnishing domestic steel and iron unless the total contract bid exceeds the lowest total contract bid based on foreign steel and iron by more than 25 percent.

B. To be considered domestic, all steel and iron used and all products manufactured from steel and iron must be produced in the United States.
   1. All manufacturing processes, including application of a coating, for these materials must occur in the United States.
   2. Coating includes all processes that protect or enhance the value of the material to which the coating is applied. The material being applied as a coating is not covered under Buy America.

C. If 100 percent steel and iron is furnished, provide a written certification that all contract items using steel and iron are of domestic supply.

D. The above requirement does not preclude a minimal use of foreign material, provided the cost of material used does not exceed one-tenth of one percent (0.1 percent) of the total contract amount or $2,500 whichever is greater.

1.14 CONVICT PRODUCED MATERIALS

A. Federal-aid projects are subject to Title 23, U. S. Code of Federal Regulations, Section 635.417, Convict Produced Materials.

B. Materials produced after July 1, 1991, by convict labor may only be incorporated in a Federal-aid highway construction project if such materials have been:
   1. Produced by convicts who are on parole, supervised release, or probation from a prison, or
   2. Produced in a qualified prison facility and the cumulative annual production amount of such materials for use in Federal-aid highway construction does not exceed the amount of such materials produced in such facilities for use in Federal-aid highway construction during the 12-month period ending July 1, 1987.

PART 2 **PRODUCTS** Not used.

PART 3 **EXECUTION** Not used.

END OF SECTION

SECTION 01554

TRAFFIC CONTROL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Traffic Control Plan requirements, and materials and labor necessary for implementation.

B. Traffic Control Supervisor.

C. Advance warning arrow panels, work zone traffic control devices, flagging and pilot car.

1.2 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 01558: Temporary Traffic Striping.

C. Section 02842: Delineators.

D. Section 02891: Traffic Signs.

1.3 REFERENCES

A. Manual on Uniform Traffic Control Devices, Latest Edition (MUTCD).

B. Standard Drawings.

1.4 BIDDING REQUIREMENTS

A. The apparent low bidder:
   1. Submit three copies of the traffic control plans to the ENGINEER no later than the fourth Wednesday following bid opening.
   2. Attend a mandatory meeting no later than the fifth Wednesday following bid opening with:
      a. CONTRACTOR's Traffic Control Designer.
      b. CONTRACTOR's Certified Traffic Control Maintainer. (Certification done through the Associated General Contractors, 1135 South West Temple, Salt Lake City, UT. Telephone (801) 363-2753 for details.)
      c. ENGINEER, Region Traffic Engineer, or designated representative.

B. Attendees of the mandatory meeting will review the CONTRACTOR's submitted traffic control plans to ensure compliance with the criteria in the plans, specifications, and in this Section, paragraph: Traffic Control Plan Requirements. Modify plans where necessary.

C. Do not begin project work until the Traffic Control Plan is approved and in place.

D. The DEPARTMENT will not grant additional contract time for preparing or modifying the Traffic Control Plan.

1.5 TRAFFIC CONTROL PLAN REQUIREMENTS

A. Create traffic control plans using the following sources. Resolve discrepancies between the various standards for traffic control in descending order shown.
   1. Current UDOT Standard Drawings, i.e. 745-2 through 745-12 (included with the Contract plans).
   2. Manual on Uniform Traffic Control Devices (MUTCD), Latest Edition.

B. Include the following documents as part of the traffic control plans:
   1. Written description of phasing.
   2. Drawing showing phasing (if required for clarity).
   3. Drawings showing any traffic control including UDOT, MUTCD, and project specific drawings used. On project specific drawings, use the same level of detail as in the MUTCD and UDOT Standard Drawings.

C. Submit a plan for advanced and ongoing public notice with Traffic Control Plans.

D. Provide a riding surface at all times, consisting of material with a uniform gradation of 50 mm max.

E. Provide a minimum of one traffic lane in each direction of travel at all times. Do not exceed a maximum traffic delay of 15 minutes.

F. Provide temporary traffic striping and or removal as needed for traffic control.

G. Provide temporary traffic striping on newly constructed asphalt pavement and refresh as needed until the final surfacing is placed.

1.6 TRAFFIC CONTROL SUPERVISOR

A. Must be certified by the DEPARTMENT or by the American Traffic Safety Services Association.

B. Authority:
   1. Obtains and uses all labor, equipment, and materials necessary to maintain traffic control in routine situations.
   2. Changes traffic control operations within the limits of the traffic control plan.

C. Responsibilities and Duties:
   1. Oversees all traffic control operations.
   2. Implements the traffic control plan.
   3. Remains available 24 hours a day, seven days a week and can be on-site within 45 minutes of notification.
   4. Corrects deficiencies within specified time not to exceed 24 hours.

5. Inspects all traffic control devices at least four times each day
    a. Before beginning work.
    b. At mid-shift.
    c. Half-hour after evening shift ends.
    d. Once during the night.
6. Coordinates project traffic control with emergency services and local law enforcement agencies.
7. Prepares and submits revisions to the traffic control plan.
8. Completes a daily record of traffic control activities using a form acceptable to the ENGINEER.

PART 2 PRODUCTS

2.1 PILOT CAR

A. Equip with reflectorized sign:
    1. Refer to Section 02842.
    2. Minimum 200 mm letter size.
    3. Black legend on orange background reading “Pilot Car — Follow me.”

B. Minimum two systems of rotating or flashing lights, or a light bar:
    1. Minimum 100 mm diameter, and minimum 1.8 m mounting height.
    2. Yellow/amber color.

2.2 FLAGGER EQUIPMENT AND CLOTHING

A. Refer to the DEPARTMENT’s “Instruction of Flaggers Handbook.”

B. Equipment:
    1. 600 mm “Stop/Slow” sign.
    2. 150 mm - 200 mm red wand for night flagging.
    3. Light plant for night flagging.

C. Clothing:
    1. Fully clothed: full length pants and short/long sleeved shirt.
    2. Hard toed shoes.
    3. Flagger vest and hard hat: Orange, red-orange, or fluorescent version of these colors with:
        a. Minimum 20 000 mm^2 each on the front and back of strong yellow-green reflective tape, or
        b. Minimum of 20 000 mm^2 each on the front and back of yellow-green non-reflective tape and 10 000 mm^2 each on the front and back of white reflective tape.
        c. Orange or fluorescent orange hard hat with 6000 mm^2 of white reflective tape or strong yellow-green tape.

2.3 TRAFFIC CONTROL DEVICES

A. Signs: Refer to Section 02891.

B. Cones and Barrels: Plastic cones and drums.

C. Reflective Sheeting: Refer to Section 02842.

2.4 ADVANCE WARNING ARROW PANEL

A. Advance Warning Device:
   1. Sign panel:
      a. Hooded, amber-colored design with sealed beam units attached.
      b. Non-reflective black finish.
   2. Circuitry control unit:
      a. Solid state unit capable of displaying “pass either side,” “warning,” and at least one of the “pass right” or “pass left” modes.
      b. Light bulbs must be of the same intensity.
      c. Arrow panels equipped with a photoelectric cell activated by ambient light only and shielded from direct headlights. Must automatically dim the panel to 50 percent of rated voltage at night.
      d. Lamp flashing rate of 25 to 40 flashers per minute.
      e. Warning mode flash frequency of approximately 22 times/minute.
      f. Minimum “on-time” lamp duration of 50 percent for flashing arrow and 25 percent for sequential chevron.
   3. Mounting frame on a pneumatic-tire vehicle:
      a. 2.1 m clearance between the bottom edge of the sign panel and the roadway surface.
      b. Frame and sign panel able to withstand 129 km/h sustained winds and 167 km/h intermittent gusts from any direction.
      c. Panel capable of rotation on a horizontal axis.

PART 3 EXECUTION

3.1 FLAGGING

A. Flag as specified. Refer to the DEPARTMENT’s “Instructions to Flaggers Handbook.”

B. Flaggers must have a current DEPARTMENT flagging certificate.

C. Flag beyond project limits only at the materials site approach to a public highway.

3.2 TRAFFIC CONTROL DEVICES

A. Installing:
   1. Install before work activities begin.
   2. Maintain to ensure proper, continuous function.

3. Wash devices weekly unless conditions warrant more frequent cleaning.
4. Replace any device missing any part of the message or background.

B. Channelizing Devices: Use Type I barricades, Type II barricades, vertical panels, or barrels.

C. Furnish a daily record of the number and location of all traffic control devices in use.

D. Remove devices from the designated clear zone when no longer required.

3.3 ADVANCE WARNING ARROW PANEL

A. May substitute Type C units for Type B units. Refer to Standard Drawing 745-1.

B. Type B units may not be substituted for Type C units.

C. Place in view of oncoming traffic without obstructing traffic flow.

D. Remove from the designated clear zone when not in use.

END OF SECTION

SECTION 01558

TEMPORARY TRAFFIC STRIPING - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for temporary traffic striping.

1.2 RELATED SECTIONS

A. Section 02765: Pavement Marking Paint.

B. Section 02842: Delineators.

1.3 REFERENCES

A. Federal Test Methods #370.

B. Federal Specification L-S-300.

PART 2 PRODUCTS

2.1 PAINT AND GLASS BEADS

A. As specified in the plans. Refer to Section 02765.

B. Accepted upon approval of the weights and analysis stated on the containers.

2.2 PAVEMENT MARKING TAPE

A. Physical characteristics:
   1. White or yellow.
   2. 0.5 mm to 0.75 mm thick.
   3. Crack-free and with straight, unbroken edges.
   4. Does not shrink or release prematurely.
   5. With an easily removable liner.
   6. Weather- and traffic-resistant reflective film on conformable backing.
   7. Pre-coated with a pressure-sensitive adhesive that does not require an activation procedure.
   8. Easily removed without sandblasting, grinding, or solvents.
   9. On rolls ready for application.

B. Minimum reflective values:

1. Express reflective values as candela per lux per square meter measured on a 0.3 m x 0.6 m panel at 86 degrees incidence.
2. Conform to the values in Table 1 and measure as specified.
3. Follow Federal Test Method #370, and Federal Specification L-S-300.

Table 1

Pavement Marking Tape Reflective Values		
Divergence Angle	**White**	**Yellow**
0.2 E 0.5 E	0.20 0.18	0.18 0.16

2.3 TEMPORARY PAVEMENT MARKERS

A. Plastic raised markers with a reflective material width of 38 mm to 89 mm with a minimum reflective area of 245 mm^2 reflective face.

B. Rigid markers: specific intensity at a 0.2 degree observation angle.

1. White:
   a. 1.0 at 0 degrees horizontal entrance angle.
   b. 0.4 at 20 degrees horizontal entrance angle.
2. Yellow: 60 percent of values for white.

C. Flexible marker sheeting that complies with Section 02842.

PART 3 EXECUTION

3.1 GENERAL

A. Place temporary striping on any roadway surfaces, including gravel, that are opened to the traffic at the end of each workday. Apply to clean, dry surfaces.

B. Place permanent paint striping and pavement messages for winter shutdown. Refer to Section 02765.

3.2 APPLICATION

A. Apply striping according to requirements shown in Table 2.

Table 2

Temporary Traffic Striping Requirements			
	Highway Classification	**Center Lane and Lane Line Stripe Length on 12 m Centers**	**Shoulder Line**
Intermediate Lifts	Urban Interstate Rural Interstate All Other Locations	1.2 m 1.2 m 1.2 m	Required Not required Not Required
Final Lift	All Locations	3 m	Required
Urban Interstate	I-15 Between North Spanish Fork and Hot Springs Interchanges I-80 Between the mouth of Parleys Canyon and 7200 West I-215 Entire road		
Rural Interstate	All other locations not listed above.		
Short Term Pavement Markers - To be used no longer than two weeks.			
Note: Stripe all *NO PASSING* locations.			

3.3 APPLYING PAINT AND GLASS BEADS

A. Paint coverage rate.
   1. 100 mm solid line at 39 m to 41 m of roadway/L.
   2. 100 mm x 3 m skip-line at 155 m to 164 m of roadway/L.
   3. 100 mm x 1.2 m skip line at 387 m to 411 m of roadway/L.

B. Glass Beads: Apply at 707 g/L to 731 g/L of paint.

3.4 APPLYING PAVEMENT MARKING TAPE

A. Press tape into the pavement surface until it adheres.

B. Remove the tape immediately before paving.

3.5 APPLYING TEMPORARY PAVEMENT MARKERS

A. Do not use temporary pavement markers to mark the right shoulder lines.

B. Space markers as follows:
   1. Solid Line : on 1.5 m centers.

2. Skip Line (3 m): Four pavement markers on 1 m centers with a 9 m gap.
3. Skip Line (1.2 m): Three pavement markers on 0.6 m centers with an 11 m gap.

C. Immediately replace any markers that come loose.

D. Remove the markers immediately before paving.

3.6 APPLYING EMERGENCY PAVEMENT MARKING

A. Mark transversely any pavement elevation differences that exceed 25 mm and that are not delineated by other methods (such as channelizing devices).

B. Place a 100 mm x 460 mm (minimum size) piece of reflectorized pavement marking tape approximately every 7.6 m along the vertical edge.
1. Place the long axis of the tape perpendicular to and centered on the longitudinal axis of the vertical edge.
2. Remove the marking tape before placing tack coat for adjacent passes of asphalt material.

END OF SECTION

SECTION 01561

TEMPORARY ENVIRONMENTAL FENCE - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing and removing temporary environmental fencing.

1.2 RELATED SECTIONS

A. Section 02936: Vegetation Establishment Period.

1.3 REFERENCES

A. AASHTO M 281: Steel Fence Posts and Assemblies, Hot Wrought.

1.4 DELIVERY, STORAGE, AND HANDLING

A. The fence and all its components become property of the CONTRACTOR when construction is complete.

B. When a fence or its components is to remain in place in areas designated for the vegetation establishment period, and becomes the property of the DEPARTMENT. Refer to Section 02936.

1.5 SCHEDULING

A. Install the fence before construction begins.

B. Fence for vegetation establishment period will be installed at the beginning of the establishment period.

PART 2 PRODUCTS

2.1 FENCE FABRIC

A. Polyethylene, high-density, UV stabilized.

B. Width: 1.2 m minimum.

C. Tensile Strength: capable of maintaining an upright position through construction.

D. Fabric pattern: sufficient to create a durable visual barrier.

E. Color: orange.

2.2 POSTS

A. Meet AASHTO M 281.

B. Painted or galvanized metal “T” post, 1.5 m to 1.8 m long.

C. Anchor plates optional.

2.3 TWINE, WIRE, OR PLASTIC TIES

PART 3 EXECUTION

3.1 INSTALLATION

A. The ENGINEER will stake the fence location.

B. Install posts at a spacing (4 m maximum) so the fence does not sag more than 50 mm between posts.

C. Weave the fence over the support posts alternating every two loops and secure it to the posts with twine, wire, or plastic ties.

3.2 REPAIR AND REMOVAL

A. Maintain the fence during construction.

B. Remove the fence and posts upon completion of construction when required.

END OF SECTION

SECTION 01571

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Requirements for controlling surface environmental conditions at the construction site, and related areas under the CONTRACTORS's control.

B. Coordinating temporary erosion control measures.

1.2 RELATED SECTIONS

A. Section 01282: Payment.

B. Section 02061: Select Aggregate.

C. Section 02373: Riprap.

D. Section 02610: Pipe Culverts.

E. Section 02613: Culvert End Sections.

1.3 REFERENCES

A. AASHTO M 288: Geotextile Specifications for Highway Applications.

1.4 TYPES

A. Check Dam:
   1. Intercepts and ponds sediment-laden ditch flows.
   2. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out.
   3. Water exits the check dam by flowing over the top.
   4. Types:
      a. Straw or Hay Bale
      b. Stone

B. Silt Fence Slope Barrier:
   1. Intercepts and ponds sediment-laden sheet flow runoff from slopes.
   2. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out.
   3. Water exits by percolating through the silt fence.

C. Slope Drain:
   1. Collects and transports storm runoff down the face of a slope.
   2. Consists of a berm at the top of the slope, a pipe culvert with end sections and outlet protection.
   3. Used until permanent facilities are installed or until vegetation growth is adequate.

D. Drop-inlet Barrier:
   1. Intercepts and ponds sediment-laden runoff.
   2. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out.
   3. When pond height reaches the top of the barrier, water flows over the bales or stones and into the drop-inlet. If a silt-fence barrier is used, the ponded water percolates through the silt-fence fabric and into the drop-inlet.
   4. Types:
      a. Straw or Hay Bale Drop-inlet Barrier
      b. Stone Drop-inlet Barrier
      c. Silt-Fence Drop-Inlet Barrier

E. Sediment Trap:
   1. Intercepts and ponds sediment-laden concentrated flows.
   2. Ponding the water reduces the velocity of the incoming flow and allows most of the suspended sediment to settle out.

F. Temporary Berm:
   1. Diverts storm runoff from a recently constructed slope to a controlled release point.
   2. Ridge of compacted soil, with or without shallow ditch.

G. Curb Inlet Barrier:
   1. Intercepts Sediment-laden runoff.
   2. Minor ponding may occur.

PART 2 PRODUCTS

2.1 MATERIALS

A. Check dams:
   1. Straw or hay bale:
      a. Twine bound hay or straw bales free from weeds declared noxious by the UDA.
      b. Hardwood stakes: 50 mm square (nominal) by 1.2 m.
      c. Filter Fabric: AASHTO M 288.
   2. Stone: Well graded with a 13 mm to 38 mm.

B. Silt Fence:
   1. Hardwood Post: 50 mm square (nominal) by 1.2 m in length.
   2. Free Draining Granular Backfill Borrow: Refer to Section 02061.

3. Filter Fabric: Synthetic, pervious sheet of propylene, nylon, polyester, or ethylene yarn. AASHTO M 288.
   a. Allows a flow rate of 0.3 $l/m^2/min$
   b. Filter efficiency of 97 percent
   c. With ultraviolet ray inhibitors and stabilzers
   d. Provide a minimum of 6 months of expected usable construction life at a temperature range of -18 degrees C to 49 degrees C.
4. Fasteners: Staples, wire, zip ties, or nails.

C. Slope Drain:
1. Pipe Culverts: Refer to Section 02610.
2. End Section: Refer to Section 02613.
3. Riprap or Rock Lining: Refer to Section 02373. Fifty percent of the riprap to be between 150 mm and 300 mm with a maximum size of 300 mm and a minimum size of 100 mm.
4. Hay or straw bales and hardwood stakes: Refer to this Section, Part 2, paragraph: Check Dams.

D. Drop-Inlet Barriers:
1. Straw or Hay Bale: Refer to this Section, Part 2, paragraph: Check Dams.
2. Stone: Refer to this Section, Part 2, paragraph: Check Dams, Stone.
3. Silt-fence: Refer to this Section, Part 2, paragraph: Silt Fence.

E. Sediment Trap:
1. Free draining granular backfill borrow: Refer to Section 02061.
2. Riprap or Rock Lining: Refer to Section 02373, and this Section, this paragraph: Materials, Slope Drain.

F. Temporary Berm: Existing Soil.

G. Curb Inlet Barrier:
1. Concrete Building Blocks.
2. Stone: Refer to this Section, Part 2, paragraph: Check Dams, Stone.
3. Wire Mesh: 13 mm by 13 mm.

PART 3 EXECUTION

3.1 PREPARATION

A. Follow the Storm Water Pollution Prevention Plan (SWPPP) in the plan.
1. Address in the SWPPP all disturbed areas on a project including staging areas, haul roads, borrow sites, stockpiles, and disposal areas.
2. If SWPPP is not provided in the plans, create and submit a plan to the ENGINEER for approval.
3. Obtain written approval from the ENGINEER to change the SWPPP.

B. Designate a SWPPP coordinator who will:
   1. Work directly with the DEPARTMENT SWPPP coordinator designated by the ENGINEER.
   2. Be available as needed to coordinate the SWPPP, inspect and maintain sediment control devices, and resolve other issues.

C. Do not start earth disturbing work until SWPPP is approved, and appropriate temporary erosion and sediment control measures are in place.

D. Follow installation procedures outlined in the Standard Drawings and in the UDOT Temporary Erosion and Sediment Control Manual.

E. Use the most restrictive requirement if a conflict occurs between erosion and sediment control specifications and federal, state, or local agency's laws, rules, or regulations.

3.2 INSTALLATION

A. Provide or construct measures such as check dams, silt fence, slope drains, drop-in inlet barriers, sediment traps, and other erosion control devices or methods to prevent erosion and sedimentation during construction and/or shutdown periods.
   1. Control surface drainage from cut, fill, borrow, and waste disposal areas, to prevent erosion and sedimentation.
   2. Remove sediment when it reaches a depth that interferes with the operation of an erosion control structure.
   3. Maintain temporary sediment control devices until all disturbed areas draining to it are stabilized.

B. Inspect earthwork during construction to detect any evidence of the start of erosion. Pro-actively apply corrective measures in a timely manner as required.

C. Inspect all sediment retention structures after each storm, remove deposited silt, and make any necessary repairs.

END OF SECTION

SECTION 01572

DUST CONTROL AND WATERING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide and apply water for dust control, and prewetting, mixing, or compacting materials.

PART 2 PRODUCTS

2.1 WATER

A. Free of dirt, silt, or other detrimental matter, and in adequate quantities for dust control and watering requirements.

2.2 EQUIPMENT

A. Water distribution system: self-propelled, pressure distributor with a spray system, equipped with a positive shut-off control. Pressure pump must have the capacity to apply the whole load uniformly.

B. Pressure system must operate at least 75 percent of the time during 5 successive work days or be removed from the project. In case of pressure system failure, a gravity flow spray system may be used for the remainder of the shift.

C. Water truck: 4000 L minimum capacity, with the capacity clearly and permanently marked on the tank. ENGINEER may require CONTRACTOR to verify capacity.

D. Metered pipeline may be used when prewetting. Apply at a rate and nozzle size to obtain specified results.

PART 3 EXECUTION

3.1 APPLICATION

A. Apply water for dust control in quantities and locations as directed by ENGINEER. Do not waste water.

B. Dust control may be required at any time.

END OF SECTION

SECTION 01741

FINAL CLEANUP

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Finish and clean all areas disturbed by construction.

1.2 RELATED SECTIONS

A. Section 01455: Materials Quality Requirements.

1.3 REFERENCES

A. AASHTO Roadside Design Guide.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 CLEANING PROCEDURES

A. Do not drag, push or scrape along or across the final pavement surface.

B. Only use equipment with pneumatic tires on the final pavement surface.

C. Determine the Safety Zone using the current AASHTO Roadside Design Guide.
   1. No protrusions or depressions greater than 75 mm will be allowed within the clear zone (rocks, boulders, ridges, stumps, etc.).
   2. Remove trees and provide proper sight distance.

D. Within drainage ditches: clean all debris and obstructions and dispose of material removed.

E. On fill slopes: cover large rocks or boulders with fine material from roadway excavation or borrow. On slopes steeper than 1:3 beyond the clear zone, clean up of large rocks and boulders may not be required.

F. On cut slopes: do not undercut the slope. Remove all overhanging rocks. On slopes steeper than 1:4 beyond the clear zone, solid ledge rock or partially buried boulders 0.25 m^3 or more may be left in place.

G. Within borrow pits: Refer to Section 01455, paragraph: Finishing Local Material Source Sites.

H. Within right-of-way limits:

1. Remove all dead trees and shrubs.
2. Prune trees and shrubs as required.
3. Trim and shape trees to provide horizontal sight distance and 6 m vertical clearances above the roadway.
4. Remove undesirable live trees, shrubs, and all fruit trees to a depth of 0.5 m below natural ground.
5. Dispose of trash and debris.

END OF SECTION

SECTION 01891

MOVE STREET SIGNS AND MAIL BOX ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Move or reset street signs.

B. Move or reconstruct existing mail box supports.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 06055: Timber and Timber Treatment.

PART 2 PRODUCTS

2.1 CONCRETE

A. Class B. Refer to Section 03055.

B. Substitute higher class of concrete if desired.

2.2 WOOD POSTS FOR MAILBOX AND SIGN

A. Refer to Section 06055.

2.3 MAILBOX MOUNTING HARDWARE

A. Shelf, platform, and bracket.

B. Zinc plated bolts, washers, and nuts.

C. ASTM A 36M, and AASHTO M 111. Follow Standard Drawing 725-1 A.

PART 3 EXECUTION

3.1 MOVE STREET SIGN

A. Maintain existing signs until construction requires removal. Coordinate with ENGINEER 24 hours in advance of removal of any sign.

B. Relocate existing street signs as indicated or as directed by the ENGINEER.

C. Remove concrete from existing posts where posts are to be reused.

E. Reset post in 200 mm by 250 mm concrete base. Keep the box within 3 mm of the finished grade.

F. Fill and compact hole left by removing sign post. Compact to density of adjacent material.

3.2 MOVE MAIL BOX

A. Furnish and install new posts, shelf, and brace, firmly attaching boxes to the support. Refer to Standard Drawing 725-1A.

B. Repair or replace mailboxes damaged during construction.

C. Install temporary posts and mailboxes if required, then remove.

END OF SECTION

SECTION 01892

RECONSTRUCT CATCH BASIN, CLEANOUT, METER, VALVE, MANHOLE, AND MONUMENT BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reconstruct catch basin, cleanout, meter, valve, manhole, and monument boxes to meet the grade of the adjacent surfaces.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

PART 2 PRODUCTS

2.1 CONCRETE

A. Class AA(AE). Refer to Section 03055.

2.2 EXTENSION RINGS

A. Cast iron according to the approved Product Acceptability Listing (PAL).

PART 3 EXECUTION

3.1 RAISE BOXES

A. CONTRACTOR options:
   1. Remove the cover and frame and raise the box using concrete.
   2. Raise the box using precast concrete manhole sections.
   3. Raise the frame and cover using adjustable extension rings.

B. Set box so that all corners are within 3 mm lower than finished grade of roadway.

3.2 LOWER BOXES

A. Remove the frame and break off the existing walls.

B. Use concrete to provide a new seat for the frame.

C. Set box so that all corners are within 3 mm lower than finished grade of roadway.

3.3 PAVEMENT REPAIR

A. Place and compact approved material below the pavement structure.

B. Place and consolidate Portland Cement Concrete the full depth of the pavement to match the existing pavement surface.

END OF SECTION

DIVISION 2 - SITE CONSTRUCTION

SECTION 02056

COMMON FILL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Common Fill materials and procedures.

1.2 RELATED SECTIONS

A. Section 01741: Final Cleanup.

B. Section 02332: Embankment for Bridge.

C. Section 02912: Topsoil.

1.3 REFERENCES

A. AASHTO M 145: Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

B. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

1.4 DEFINITIONS

A. Common Fill: Topsoil and fill materials meeting requirements of this Section.

1.5 SUBMITTALS

A. Prior to delivering Common Fill to site, submit:
   1. Name of supplier and source of imported materials and materials analysis of each Common Fill to be used.
   2. Gradation analysis of Common Fill material.

B. If a change in source of material is required, submit name of supplier, source and gradation analysis of Common Fill prior to delivery to site.

1.6 QUALITY ASSURANCE

A. Reject Common Fill products which do not meet requirements of this Section.

B. Remove any product found defective after installation and install acceptable product at no additional cost to the DEPARTMENT.

1.7 ACCEPTANCE

A. Acceptance of Common Fill product placed in construction is based upon lot size and the gradation of Common Fill samples collected from the lot.

B. Lot Size is one day's production with 5,000 megagram sub-lots.

C. ENGINEER reserves the right to select and test Common Fill randomly from any location at the construction site, or from the Common Fill source.

PART 2 PRODUCTS

2.1 BORROW

A. Classifications A-1-a through A-4. Meet AASHTO M 145.

2.2 GRANULAR BORROW

A. Classification A-1-a. Meet AASHTO M 145.

B. Non-plastic, passing a 75 mm sieve (maximum size).

2.3 GRANULAR BACKFILL BORROW

A. Classification A-1-a. Meet AASHTO M 145.

B. Non-plastic, uniformly graded with a particle size of 50 mm maximum.

2.4 SAND

A. Friable natural river or bank aggregate, free of loam, detrimental, or soluble or organic matter.

Table 1

Sand		
Sieve Size	**Percent Passing (by weight)**	
	Min	**Max**
10 mm	100	--
100 mm	--	10

2.5 CLAY (As fill material or channel or pond liner)

A. Classification CL, CL-ML, or ML as defined by AASHTO M 145.

B. Free of organic matter, frozen material, debris, rocks, and deleterious materials.

C. Homogeneous, relatively uniform.

2.6 TOPSOIL

A. Refer to Section 02912.

2.7 EMBANKMENT FOR BRIDGE

A. Refer to Section 02332.

2.8 SOURCE QUALITY CONTROL

A. Verify gradation followingAASHTO T 27 requirements. Select samples uniformly on a random basis.

B. If tests indicate materials do not meet specified requirements, change materials and retest at no additional cost to DEPARTMENT.

C. CONTRACTOR-furnished Borrow may be used and excavation wasted provided there is no additional cost to DEPARTMENT. Provide borrow that is equal to or better quality than the wasted excavation.

PART 3 EXECUTION

3.1 STOCKPILING

A. Separate differing materials, and prevent mixing.

B. Prevent erosion or deterioration of stockpiles.

3.2 INSTALLING

A. Give ENGINEER 30 days notice to collect an existing topography, sample, and test materials before opening all borrow areas.

B. Give ENGINEER 5 working days notice to collect an existing topography, and test materials before enlarging all borrow areas.

C. Clear, strip, remove overburden, and blend material at no additional cost to the DEPARTMENT.

D. Place the best quality material in the top portion of the embankment.

E. Finishing Materials Sources: Refer to Section 01455, paragraph: Finishing Local Material Source Sites.

3.3 CLEANUP

A. Refer to Section 01741.

END OF SECTION

SECTION 02061

SELECT AGGREGATE - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Select Fill materials and procedures.

1.2 RELATED SECTIONS

A. Section 02721: Untreated Base Course (UTBC).

1.3 DEFINITIONS

A. Select Fill: Aggregate materials meeting requirements of this Section.

1.4 QUALITY ASSURANCE

A. Remove products found defective after installation and install acceptable products at no additional cost to the DEPARTMENT.

PART 2 PRODUCTS

2.1 FREE DRAINING GRANULAR BACKFILL BORROW

A. Natural aggregate or crushed slag to meet the following gradation:

Table 1

Free Draining Granular Backfill Borrow Gradation	
Sieve Size	**Percent Passing**
37.5 mm	100
25 mm	95 to 100
1.25 mm	25 to 60
4.75 mm	0 to 10

2.2 UNDERDRAIN GRANULAR BACKFILL

A. Use the following gradations:

Table 2

Underdrain Granular Backfill Gradation		
Sieve Size	Type A % passing	Type B % passing
63 mm	100	
37.5 mm	80 - 100	100
12.5 mm	55 - 75	50 - 80
4.75 mm	30 - 60	30 - 65
425 Fm	10 - 25	10 - 30
75 Fm	0 - 3	0 - 3

PART 3 EXECUTION

3.1 INSTALLATION

A. Underdrain:

1. Excavate a trench 75 mm below the underdrain pipe flow-line. Widen to 0.6 m plus the outside diameter of the underdrain pipe.
2. Place underdrain granular backfill in the trench and compact the bottom 75 mm with two passes of a vibratory roller.
3. Back fill to 300 mm above top of pipe with underdrain granular backfill.
4. Compact backfill material in 150 mm layers to a 96 percent density when placing the underdrain under a roadway.

END OF SECTION

SECTION 02075

GEOTEXTILES - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing geotextiles.

1.2 RELATED SECTIONS

A. Section 01571: Temporary Environmental Controls.

1.3 REFERENCES

A. AASHTO M 288: Geotextile Specification for Highway Applications.

B. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.4 SUBMITTALS

A. Submit prior to use:
   1. Manufacturer's certificate that each fabric complies with requirements of this Section.

1.5 ACCEPTANCE

A. DEPARTMENT will reject the geotextile at installation if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transport, handling or storage.

PART 2 PRODUCTS

2.1 SILT FENCE GEOTEXTILE

A. Refer to Section 01571.

2.2 EROSION CONTROL GEOTEXTILES

A. Furnish erosion control geotextile as specifed in AASHTO M 288.

2.3 DRAINAGE GEOTEXTILES

A. Furnish non-woven drainage geotextile as specified in AASHTO M 288.

2.4 WEED BARRIER GEOTEXTILE

A. Furnish non-woven silt fence geotextile with elogation < 50 percent as specified in AASHTO M 288 for all weed barrier applications.

2.5 POSTS FOR SILT FENCE

A. Refer to Section 01571, Part 2, paragraph: Sediment Trap.

2.6 SAMPLING AND TESTING

A. DEPARTMENT will take a representative sample from each lot furnished to conduct verification testing.

PART 3 EXECUTION

3.1 INSTALLING GEOTEXTILES FOR SILT FENCE

A. Refer to Section 01571, Part 3, paragraph: Installation.

3.2 INSTALLING GEOTEXTILES FOR EROSION CONTROL

A. Install fabric in locations shown on the Drawings.

B. Unless otherwise specified, overlap the geotextile a minimum of 0.6 m at all longitudinal and transverse joints, or sew the geotextile.

C. If overlapped, place the geotextile so that the upstream sheet overlaps the downstream sheet.

D. For placement on slopes, overlap each strip over the next downhill strip.

E. Anchor the geotextile using key trenches or aprons at the crest and toe of the slope.

F. Pins, usually 450 mm in length, may be helpful in securing the geotextile during installation.

G. Repair: Place patch over damaged area and extend 0.9 m beyond the perimeter of the tear or damage.

3.3 SUBSURFACE DRAINAGE

A. Excavate trench to size and depth indicated.

B. Cut geotextile to width required and place in trench. Prevent damage to geotextile.

C. Overlap geotextile 300 mm or the full width of the trench, whichever is less at the top of the trench.

D. Overlap successive pieces of geotextile a minimum of 300 mm in the direction of flow.

E. Place fill to hold geotextile in place.

F. Repair any damage to geotextile by placing patches extending 0.9 mm in all directions beyond the damaged area.

3.4 WEED BARRIER

A. Preparation:
   1. Remove sharp objects, large stones and undesirable vegetation.
   2. If placing geotextile over existing bed, cut an "X" over each plant and push geotextile under plant base. If placing over new bed, roll geotextile over soil and cut an "X" for each plant hole. Fold excess geotextile under and cover with specified landscaping materials.

B. Surface Cover: Provide a minimum of 100 mm of cover on all areas on the geotextile unless otherwise specified by ENGINEER. If using large landscape rock, increase thickness of cover material over geotextile up to 3 times the diameter of the largest rock material based on Landscape Architect's recommendations. Do not leave any portion of geotextile exposed to direct sunlight.

C. Repair: Repair immediately. Clear the damaged area plus an additional 0.9 mm and apply geotextile patch.

D. Maintenance: Maintain surfaces and supply additional landscape materials where necessary, including areas affected by erosion.

END OF SECTION

SECTION 02078

ASPHALT OVERLAY FABRIC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for preparing asphalt pavement surface, and installing asphalt overlay fabric.

1.2 RELATED SECTIONS

A. Section 02748: Prime Coat/Tack Coat.

1.3 REFERENCES

A. AASHTO M 288: Geotextile Specification for Highway Applications.

B. ASTM D 276: Identification of Fibers in Textiles.

C. ASTM D 4632: Grab Breaking Load and Elongation of Geotextiles.

D. TX DOT 3099: Asphalt Retention.

E. UDOT Minimum Sampling and Testing Requirements.

1.4 PACKAGING, SHIPPING, HANDLING, AND STORING

A. Identify each roll by a tag or label securely fastened to the outside. List the following required information on the tag or label:
   1. Name of the fabric manufacturer.
   2. Brand name of the product.
   3. Width, length, and package weight of fabric.
   4. UDOT Certification Sticker.

1.5 PROTECTION

A. Protect the fabric from direct sunlight, chemicals, moisture, mud, dirt and debris during shipment and storage.

B. Replace at the CONTRACTOR's expense, fabric damaged or deteriorated during shipping, storage or construction.

PART 2 PRODUCTS

2.1 ASPHALT OVERLAY FABRIC

A. Use needle-punched non-woven fabric constructed exclusively of manmade polymeric fibers.
   1. Resistant to rotting, mildew, insects, chemicals and ultraviolet (UV) light.
   2. Meet the following additional minimum average roll requirements when sampled and tested with the methods specified.
   3. Refer to AASHTO M 288, Table 7.

2.2 SOURCE QUALITY CONTROL

A. Meet UDOT Minimum Sampling and Testing Requirements.

B. Perform tests prior to shipment for each individual shipment and lot of fabric.

C. Include testing reports and Certificate of Compliance with the shipment to the job-site.

D. Basis for Rejection: In accordance with UDOT Minimum Sampling and Testing Requirements.

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare pavement surface:
   1. Remove all dirt, water, oil, and foreign materials.
   2. Clean out and fill cracks wider than 6 mm with a sand and asphalt emulsion filler material.

B. Apply tack coat to the prepared surface at a rate of 1.10 L to 1.30 L per square meter as approved by the ENGINEER.
   1. Additional tack coat is required on overlapped areas.
   2. ENGINEER shall consider manufacturer recommendations and the following performance requirements:
      a. Satisfy asphalt retention properties of fabric.
      b. Bond the fabric and overlay to the underlying surface.
      c. Do not create a slippage potential for the overlay.
   3. Uniformly spread excess tack coat before it cools.

3.2 INSTALL FABRIC

A. Place fabric over tack coat with a mechanical unit that produces a wrinkle free placement.
   1. Remove small wrinkles by hand brooming.
   2. For wrinkles in excess of 25 mm wide, cut the fabric overlapping in the direction of paving.

B. Overlap transverse joints 150 mm in the direction of paving and bond with additional tack coat.

C. Overlap longitudinal joints 100 mm and bond with additional tack coat.

END OF SECTION

SECTION 02082

WATER METER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing water meters as indicated on the plans.

1.2 RELATED SECTIONS

A. Section 02061: Select Aggregate.

1.3 REFERENCES

A. ASTM D 1784: Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

PART 2 PRODUCTS

2.1 WATER METERS AND ACCESSORIES

A. Meet the American Water Works Association's specifications.

B. Meter Yoke: 525 mm high (minimum) copper setter as manufactured by Ford or equal.

C. Meter Box:
1. Rigid PVC pipe meeting ASTM D 1784.
2. 450 mm in diameter by 900 mm in length.
3. Free standing crush factor of 13 350 N.

D. Meter Box Cover:
1. 300 mm minimum diameter lid with lock.
2. 500 mm minimum diameter ring constructed of cast iron.

E. Pipe:
1. Type K copper for sizes 50 mm and smaller.
2. Ductile iron class 51 for sizes larger than 50 mm.

F. Fittings:
1. Type K copper for connections 50 mm and smaller.
2. Ductile iron class 51 for sizes larger than 50 mm.

G. Aggregate: meet specifications for Free Draining Granular Backfill Borrow. Refer to Section 02061.

H. Corporation Stop and Service Saddle Clamp: Supplied by the water system authority unless otherwise noted on plans.

I. Joint Seal Tape (Teflon).

PART 3 EXECUTION

3.1 PREPARATION

A. Obtain all permits associated with the connection and installation.

B. Coordinate with the water system authority the installation of items not performed by own forces.

C. Before trenching:
   1. Stake water meter.
   2. Have utility companies locate and mark their lines.

D. Coordinate all water main shutdowns with the water system authority and notify the ENGINEER 72 hours before the shutdown.

3.2 INSTALLING CONTRACTOR FURNISHED WATER METERS

A. Water system authority products and installation specifications supercede those listed below.

B. Excavate a trench from the main supply line to the water meter location at the depth determined by local authorities.

C. Install water meter according to manufacturer's specifications.
   1. Place a 150 mm deep free draining granular backfill borrow sump in the bottom of the meter box.

D. Bed all pipe 50 mm minimum surrounding the pipe with sand.

E. After bedding material is placed, backfill and compact the trenches to the same density as the ground adjacent to the trench.

3.3 INSTALLING FURNISHED WATER METERS AND RELOCATED WATER METERS

A. Unless otherwise noted, replace all existing water service lines with new pipe from the main supply line to the water meter.

B. Coordinate the relocation of existing water meters with the water system authority.

C. For relocated water meters, use existing water meter, yoke, box, and cover. Furnish pipe and fittings as necessary.

D. Complete all work that is not completed by the water system authority.

END OF SECTION

SECTION 02221

REMOVE STRUCTURE AND OBSTRUCTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove and dispose of structures and utility items or other obstructions that interfere with construction on or off the site, including foundations, bridges, culverts, fences, guardrail, concrete work, septic tanks, trees.

B. Salvage as specified, or dispose of in an approved manner.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work.

B. Section 01355: Environmental Protection.

C. Section 02056: Common Fill.

D. Section 02231: Site Clearing and Grubbing.

E. Section 03055: Portland Cement Concrete.

1.3 PROJECT/SITE CONDITIONS

A. Protect adjacent structures and utilities and their contents which are designated to remain.

PART 2 PRODUCTS

2.1 CONCRETE

A. Use Class A Concrete. Refer to Section 03055.

2.2 COMMON FILL

A. Refer to Section 02056.

PART 3 EXECUTION

3.1 PREPARATION

A. Review all work procedures with ENGINEER.

B. Coordinate utility location in accordance with Section 00727, paragraph: Cooperation With Utilities.
   1. Locate and protect all active utilities.
   2. Before beginning work:
      a. Notify ENGINEER.
      b. Notify all affected utilities.
      c. Have the area Blue Staked.

C. Restore utility services disturbed by construction operations according to Subsection 00727, paragraph: Cooperation With Utilities.

D. Disconnect water service by excavating to the corporation stop and turning it off. Disconnect the service line from the corporation stop.

E. Plug disconnected storm drains or sewer lines near the right-of-way line with a watertight concrete plug extending at least 0.6 m into the remaining pipe.

F. Remove existing septic tanks, cess pools, leach lines, etc.

G. All materials not designated for use or salvage become the property of the CONTRACTOR unless owned by a utility company.

H. Excavate all material necessary to permit removal of structure.

3.2 BACKFILL AND COMPACTION GUIDELINES

A. Fill all holes or pits resulting from removal operations with suitable material.

B. Compact the backfilled areas to the density of the surrounding ground, or as specified.

3.3 REMOVAL AND DISPOSAL GUIDELINES

A. Remove and dispose of all material in a manner acceptable to the ENGINEER.

B. If damage occurs to adjacent area, repair damage at no additional cost to Department.

C. Remove all concrete to at least 0.6 m below the finished grade or 0.6 m below the natural ground surface, whichever is lower.

D. Provide an environmentally safe area for disposal of items removed. Refer to Section 01355. Obtain permits as required.

E. Dispose of removed obstructions at a site secured by the CONTRACTOR. Furnish a copy of the disposal permits or agreements following Section 02231.

3.4 BUILDING, BASEMENT, AND FOUNDATION DEMOLITION

A. Move or demolish designated buildings including basements, foundations, sidewalks, pavement slabs, porches, fences and outbuildings on each parcel.

B. Break the floor into pieces not over 0.3 m^2 in area. Remove and dispose of pieces over 0.3 m^2.

3.5 BRIDGE, BOX CULVERT DEMOLITION

A. Arrange detours for traffic flow according to traffic control plans.

B. Excavate all material necessary to permit removing structure.

C. Remove structure so that no remaining portion is closer than 1.0 m to any water course or closer than 0.6 m to the subgrade and embankment surface, or within 0.6 m of the natural ground surface.

D. Remove all structure that will interfere with proposed construction.

E. Complete blasting or other removal operations of existing structure that may damage new construction before placing the new work.

3.6 MANHOLE, CLEANOUT, DIVERSION, AND CATCH BASIN REMOVAL

A. Maintain satisfactory by-pass service during construction operations.

B. Plug unused sewers with a 0.6 m long concrete plug.

3.7 CATTLE GUARD REMOVAL

A. Remove the cattle guard to at least 0.6 m below the subgrade surface.

B. Excess materials become the CONTRACTOR's property, unless otherwise designated.

3.8 SEPTIC TANK, UNDERGROUND TANK REMOVAL

A. Empty and dispose of tank contents in accordance with Section 01355.

B. Break down and remove tank and appurtenances to at least 0.6 m below the subgrade surface or finished ground lines.

C. Break the floor into pieces not over 0.3 m^2 in area.

3.9 BURIED FUEL TANK DEMOLITION

A. Remove buried fuel storage tanks and dispose of tank contents in accordance with Laws and Regulations.

B. Do not spill fuel on subgrade.

C. Comply with the State and local authorities having jurisdiction over fuel tank removals.

3.10 GUARDRAIL REMOVAL

A. Remove and dispose of guardrail, posts, hardware, anchor assemblies, terminal assemblies, and attached posts, signs, and delineators.

B. For steel posts, remove to a minimum of 0.2 m below the subgrade surface or finished ground lines.

3.11 FENCE REMOVAL

A. Prevent people or livestock from entering work site from adjacent properties during removal and installation procedures.

B. Remove fence, fenceposts, and foundations to at least 0.6 m below subgrade or finished ground lines.

C. Do not damage vegetation and ground cover during removal operations.

3.12 RAILROAD TRACK REMOVAL

A. Remove all rails, ties, paving, track encasement, and other appurtenances.

B. Leave crushed stone or gravel ballast. Grade as necessary.

3.13 TREE REMOVAL

A. Refer to Section 02231.

B. Remove all trees with a circumference larger than 0.5 m measured at a point 0.6 m above existing ground.
   1. A tree consists of stump, root, trunk, branches, and foliage.
   2. Multiple leaders rising from a common root will not be counted separately.

3.14 CONCRETE HEADWALL REMOVAL

A. Remove headwalls where designated.

B. Replace pipes or structural plate pipes damaged while removing headwall at no additional cost to the DEPARTMENT.

3.15 UTILITY POLE REMOVAL

A. Remove pole and all appurtenances.

B. Remove foundation to at least 0.6 m below subgrade or natural ground.

3.16 PIPE CULVERT REMOVAL

A. Excavate all material necessary to permit removing pipe culvert, end sections, headwalls, etc.

B. Plugs:
   1. Cut existing pipe culvert 0.6 m inside the DEPARTMENT's right-of-way, and abandon culvert located on private property.
   2. Plug disconnected pipe lines near the right-of-way line with a water-tight concrete plug extending into the remaining pipe at least 0.6 m.

C. Seal openings in walls of remaining manholes or catch basins with water-tight concrete plug.

3.17 SALVAGE

A. Salvage designated equipment and materials.

B. All other materials become the property of the CONTRACTOR unless otherwise noted.

END OF SECTION

SECTION 02222

SITE DEMOLITION - PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Demolish, remove, and dispose of roadway pavement, curb, gutter, sidewalk, driveway approach, waterway, and similar hard surfaces.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

A. Review all work procedures with ENGINEER.

B. Coordinate utility location in accordance with Section 00727, paragraph: Cooperation With Utilities.

C. Preserve all active utilities.

D. Detours according to traffic control plan.

3.2 ASPHALT PAVEMENT, CONCRETE PAVEMENT REMOVAL

A. Saw cut existing pavement on the designated line perpendicular to the centerline of the pavement with straight vertical edges free from irregularities when joining new construction to existing pavement.

B. Completely remove pavement down to the underlying base course or subgrade.

3.3 OBLITERATION

A. Break up concrete and/or asphalt pavements into pieces not over 0.3 m^2 in area. Scarify and cover broken pavement with at least 0.3 m of suitable backfill material.

B. Fill depressions and blend with the surrounding contours.

C. Grade materials either along the toe of an embankment or into a depression or borrow pit. Cover with at least 0.3 m of suitable backfill material.

3.4 CONCRETE SIDEWALK, CONCRETE DRIVEWAY REMOVAL

A. Remove concrete to the nearest expansion joint or saw cut to provide proper grades and connections.

B. Make concrete cuts straight, vertical to the surface, full depth, and free from irregularities.

C. Thoroughly clean all adhering materials from existing reinforcement.

D. Do not damage concrete designated to remain.

3.5 CONCRETE CURB, CONCRETE CURB AND GUTTER, RAISED ISLAND, BITUMINOUS CURB REMOVAL

A. Remove curb, curb and gutter, gutters, raised island, bituminous curb, and parts of such improvements to an existing joint or joint sawed with a vertical face.

B. Remove material to provide proper grades and connections.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

SECTION 02231

SITE CLEARING AND GRUBBING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clear, grub, remove and dispose of trees, stumps, and debris within the staked limits of the roadways, channels, easements, and other designated areas.

1.2 DEFINITIONS

A. Clear: remove and dispose of trees, stumps, logs, limbs, sticks, vegetation, debris, and other material on the natural ground surface.

B. Grub: remove and dispose of roots, buried logs, debris, and other material under the ground surface.

1.3 RELATED SECTIONS

A. Section 01355: Environmental Protection.

B. Section 01571: Temporary Environmental Controls.

C. Section 02221: Remove Structure and Obstruction.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify with ENGINEER which vegetation or objects are to be removed.

B. Review work procedures with ENGINEER.

C. Schedule work carefully with consideration for property owners and general public.

D. Follow Section 01571.

3.2 VEGETATION REMOVAL

A. Grub the areas 0.6 m below natural ground within the limits of clearing of all stumps, roots, buried logs, and all other underground obstructions.

B. Stumps, roots, and non-perishable solid objects may remain in cleared areas where the embankment is
   1. 0.6 m or more above the natural ground.
   2. At least 0.6 m away outside the slope stake lines.

C. Completely grub stumps and roots where a structure is to be constructed, piles are to be driven, or unsuitable material is to be removed.

3.3 BACKFILLING

A. Backfill all stump holes, cuts, depressions, and other holes resulting from clearing and grubbing within areas to receive embankment. Compact backfilled areas to the density of the surrounding ground.

3.4 DISPOSAL

A. Dispose of material following Section 01355.

B. Do not dispose of material within the designated roadbed.

C. Do not end dump material over the side of the embankment.

D. Off the right-of-way:
   1. Acceptable when done according to prevailing laws (including environmental laws), ordinances, regulations, and rules, and at no additional cost to the DEPARTMENT.
   2. Furnish the ENGINEER with copies of the disposal permits or agreements.

E. On the right-of-way:
   1. Bury material at locations specified or acceptable to the ENGINEER.
   2. Use material to widen embankments and flatten embankment sides slopes as approved by the ENGINEER.
   3. Cover disposed material with a minimum of 0.6 m of earth and grade to drain properly at no additional cost to the DEPARTMENT.
   4. Reduce wood to chips a maximum of 12 mm thick for mulching cut and fill slopes. Chips may be buried or distributed uniformly on the ground surface and mixed with the underlying earth so the mixtures will not sustain burning.

3.5 TREE REMOVAL

A. Trees removed with a 0.5 m circumference or smaller trunk, measured at 0.6 m above existing ground are considered incidental construction.
   1. A tree consists of stump, root, trunk, branches, and foliage.

2. DEPARTMENT will not count multiple leaders rising from a common root separately.

B. Remove the root system to a minimum depth of 0.6 m below the finished ground level and within a 0.6 m radius of the stump.

C. For trees over 0.5 m in circumference: Refer to Section 02221.

3.6 PROTECTION

A. Land monuments, property markers, or official datum points
   1. Protect until their removal is approved.
   2. Reference for re-establishment before removing.

B. Protect trees designated to remain from damage to roots and branches.

C. Protect other vegetation and/or objects designated to remain.

END OF SECTION

SECTION 02312

GRADING FOR LANDSCAPES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for landscape grading.

1.2 RELATED WORK

A. Section 02056: Common Fill

B. Section 02912: Topsoil

1.3 QUALITY ASSURANCE

A. Landscape grading is aesthetic by nature and subject to continual monitoring and modification during backfilling. Work closely with ENGINEER particularly when grading and constructing berms, channels, or other aesthetic structures.

PART 2 PRODUCTS

2.1 BACKFILL MATERIALS

A. For fill areas which are to be landscaped, provide soils which comply with Section 02056.

B. Topsoil: Refer to Section 02912.

PART 3 EXECUTION

3.1 PREPARATION

A. Identify required line, levels, contours, and datum.

3.2 PROTECTION

A. Protect existing trees, shrubs, lawns, existing structures, fences, roads, sidewalks, paving, curb and gutter, and other features.

3.3 CLEANING

A. Remove stockpiles from the site. Grade site surface to prevent free standing surface water.
B. Leave borrow areas clean and neat.

END OF SECTION

SECTION 02316

ROADWAY EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavate all material within designated areas, including channels with a bottom width of 3.7 m or greater. Widen cuts as directed.

B. Rock excavation and removal.

C. Dispose of excavated material; place in embankment and/or other areas.

1.2 RELATED SECTIONS

A. Section 00820: Legal Relations and Responsibility to Public.

B. Section 01571: Temporary Environmental Controls.

C. Section 02056: Common Fill.

D. Section 02061: Select Aggregates.

E. Section 02075: Geotextiles.

F. Section 02231: Site Clearing and Grubbing.

G. Section 02324: Compaction.

H. Section 02912: Topsoil.

1.3 REFERENCES

A. NEPA 495: Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials.

B. UOSH Construction Standards Chapter U: Blasting and the Use of Explosives.

1.4 DEFINITIONS

A. **Rock**: Solid mineral material which cannot be removed with equipment reasonably expected to be used in the work without cutting, drilling or blasting.

1.5 SUBMITTALS

A. Submit proposed method of blasting, delay pattern, explosive types, type of blasting mat cover.

1.6 ACCEPTANCE

A. Grading Tolerance: Top surface of subgrade = ±30 mm of line and grade.

1.7 STOCKPILING AND HANDLING

A. Stockpile excavated material at approved locations.

B. Waste excess excavation as required.

PART 2 PRODUCTS

2.1 MATERIALS FOR OVER-EXCAVATED AREAS

A. Common Fill: Refer to Section 02056.

B. Select Aggregate: Refer to Section 02061.

C. Geosythetic Fabric: Refer to Section 02075.

2.2 EXPLOSIVES

A. Type recommended by explosives firm.

2.3 DELAY FUSES

A. Type recommended by explosives firm.

2.4 BLASTING MATERIALS

A. Type recommended by explosives firm.

PART 3 EXECUTION

3.1 PREPARATION AND PROTECTION

A. Refer to Section 01571.

B. Pothole, expose, or otherwise locate buried utilities as necessary.

C. Refer to Section 00820, paragraph: Protection and Restoration of Property and Landscape.

D. Finish clearing and grubbing within the designated area before starting excavation per Section 02231.

3.2 STORAGE OF BLASTING MATERIALS

A. Securely store all explosives in compliance with Laws and Regulations.

B. Mark all storage places clearly.

3.3 TOPSOIL

A. Remove topsoil following Section 02912.

3.4 DEWATERING

A. Keep excavation free from surface and ground water through all stages of construction.
   1. Maintain adequate drainage during all stages of construction through pumping, pipe culverts and drainage ditches.
   2. Provide temporary facilities when interrupting irrigation systems, sewer, underdrainage, etc.

3.5 EXCAVATION - STANDARD PROCEDURES

A. Finish excavation to reasonably smooth and uniform surface.

B. Provide and maintain satisfactory access to roads, streets, and adjacent property during all phases of construction according to the Traffic Control Plan.

C. Remove material in all cut section to the depth shown. When necessary to obtain compaction, scarify to a 0.2 m depth and compact to at least 96 percent of maximum laboratory density. Refer to Section 02324.

D. Excavate and waste unsuitable material.

E. Material for backfilling or finishing.
   1. Use suitable granular material encountered in excavation to construct the top layers of embankment, for finishing the roadbed, or for backfill when directed by the ENGINEER.
   2. When practical, haul the granular material directly from excavation to the final position on the roadbed.

F. CONTRACTOR-furnished borrow may be used and roadway excavation wasted if there is no additional cost to the DEPARTMENT. Provide borrow that is equal to or better quality than the wasted roadway excavation.

3.6 ROCK REMOVAL - NONEXPLOSIVE METHOD

A. Excavate solid rock 0.15 to 0.3 m below subgrade and backfill with acceptable material.
   1. Rock removed more than 0.3 m below subgrade will not be measured nor paid for.
   2. Backfilling of depth greater than 0.3 m below subgrade will not be measured nor paid for.

3.7 ROCK REMOVAL- EXPLOSIVE METHOD

A. Comply with UOSH Constructions Standards Chapter U rules and regulations.

B. Provide a qualified explosives expert to act as an advisor and consultant during drilling and blasting operations.

C. Do not blast beyond designated areas.

3.8 ROCK FACES

A. Scale rock cuts of all loose rocks and fragments and leave in a neat and safe condition.

END OF SECTION

SECTION 02317

STRUCTURAL EXCAVATION - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavate, backfill, and dispose of all material for constructing bridges, foundations, box culverts, pipe culverts, drains, and other structures.

1.2 RELATED SECTIONS

A. Section 00120: Bidding.

B. Section 00820: Legal Relations and Responsibility to Public.

C. Section 02056: Common Fill.

D. Section 02324: Compaction.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

A. The designated bottom elevation of the structure reflects information used for design and the ENGINEER may order changes in writing. Subsurface information shown in the plans reflects the information used for design.

B. Verify conditions in the field according to Section 00120, paragraph: Examination of Plans, Specifications, Special Provisions, and Work Site.

C. Provide a cofferdam for underwater work, so the excavation can be dewatered.
   1. With inside dimensions sufficient to provide access to all parts of the foundation forms.
   2. Remove all cofferdams, sheeting, and bracing when no longer needed.

3.2 EXCAVATION

A. Comply with Utah Occupational Safety and Health regulations when excavating and trenching. Refer to Section 00820, paragraphs: General Legal Compliance; Sanitary, Health and Safety; and Explosives.

B. Excavate to the established elevations and dimensions.

C. Excavate and waste unsuitable material to the depth directed.

D. Excavate rock, hardpan, or other material unsuitable for the structure foundation to at least 0.3 m below the designated elevation.

E. Rock and other hard strata for concrete and masonry foundations:
   1. Clean, and cut to a firm surface (level, stepped, or serrated as shown). Foundation cannot contain loose material.
   2. Clean out seams and fill with concrete, mortar, or grout.

F. Dispose of all unused excavation material that impairs the appearance and use of the roadway or waterway.
   1. Clean the space under structures, in channels, and adjacent areas affected by operations to prevent drift and scour.

3.3 BACKFILL AND COMPACTION

A. Compaction: Refer to Section 02324.

B. Moisten all areas of backfill inaccessible to roller equipment. Compact in successive 150 mm (loose measurement) layers.

C. Do not use excessive water in backfill material, and do not jet backfill.

D. Use a hand-operated vibratory compactor or small vibratory roller in a transverse direction in areas directly adjacent to abutments, backwalls, approach slabs, wing walls, retaining walls, and other structures.

E. Coordinate the rate of placing backfill materials with tamping operations.

F. Unsuitable excavation areas:
   1. Use granular backfill borrow or other suitable material.
   2. Compact to the density of surrounding ground.

END OF SECTION

SECTION 02318

DITCH EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for small ditch and surface ditch excavation.

1.2 RELATED SECTIONS

A. Section 02324: Compaction.

1.3 DEFINITIONS

A. Small ditch: Ditch or channel with a bottom width less than 3.7 m.

B. Surface ditch: V-shaped, 300 mm deep minimum, and 900 mm wide across the top, or as shown in the plans.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 SMALL DITCH EXCAVATION

A. Form the ditch as shown in the plans.

B. Place and compact excavated material in embankments as defined in Section 02324.

3.2 SURFACE DITCH EXCAVATION

A. Construct the ditch along the contour of the ground.

B. Place excavated material to form a berm on the downhill side of the ditch.

C. Shape the ditch and berm so that power-driven mowers can operate on the graded surface.

END OF SECTION

SECTION 02324

COMPACTION - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Compaction of common fill material for embankment foundations, areas through cuts, embankments, dikes, backfill, and other materials.

1.2 REFERENCES

A. AASHTO T 99: Moisture-Density Relations of Soils Using a 5.5 lb. (2.5 kg) Rammer and a 12 in. (305 mm) Drop. (Method D)

B. AASHTO T 180: Moisture-Density Relations of Soils Using a 10 lb. (4.54 kg) Rammer and a 18 in. (457 mm) Drop. (Method D)

C. AASHTO T 238: Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

D. AASHTO T 239: Moisture Content of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth).

1.3 ACCEPTANCE TESTING (BY DEPARTMENT)

A. Density Requirement: The ENGINEER will accept a test lot following the standard for average density - not less than 96 percent of maximum laboratory density, and when no single determination is lower than 92 percent of maximum laboratory density.

B. Test Lot for Embankment and Subgrade:
   1. Number of megagrams or cubic meters of embankment placed and compacted during each production day.
   2. Divide test lots into sublots of approximately 2700 Mg or 1500 m^3 and 5000 m^2 in cut sections, and take one random density test within each sublot.

C. Test Lot for Backfill:
   1. ENGINEER will accept backfill at pipe culverts, small structures, concrete box culverts, and bridges based on acceptance of the average of four density determinations in a test area.
   2. A test lot will not exceed 150 m^3 of material or be more than one pipe culvert or small structure.

D. Test Lot for Embankment for Bridge:

1. Take at least six random density tests at both ends of the bridge in each 0.3 m layer.
   a. Conform to AASHTO T 180, Method D.
   b. Randomly select four of the tests.
   c. Select two of the test within 0.6 m of the outside perimeter of each layer.
2. ENGINEER will take density tests
   a. In the backfill material replacing subexcavated areas.
   b. In the lower layers of required surcharge as shown.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 COMPACTION

A. Moisten or dewater backfill material to obtain optimum moisture for compaction operations.

B. Use a hand-operated vibratory compactor or a vibratory roller adjacent to backwalls of structure abutments and approach slabs.

C. Conform to:

1. AASHTO T 180, Method D for A-1 soils.
2. AASHTO T 99, Method D for all other soils.
3. AASHTO T 238 and T 239 for in-place field density.

END OF SECTION

SECTION 02330

EMBANKMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Place excavated materials in embankments.

B. Shape and maintain embankments.

C. Fill holes, pits, and other depressions left by removing unsuitable materials.

1.2 RELATED SECTIONS

A. Section 02231: Site Clearing and Grubbing.

B. Section 02324: Compaction.

C. Section 02912: Topsoil.

1.3 SUBMITTALS

A. Written approval to disturb areas outside the slope-stake limits. Submit request to the ENGINEER.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PREPARATION

A. Finish clearing and grubbing, and topsoil stripping before starting embankment. Refer to Sections 02231 and 02912.

B. Provide and maintain satisfactory access to roads, streets, and adjacent property during all phases of construction according to the traffic control plan.

3.2 STANDARD PROCEDURES

A. CONTRACTOR-furnished borrow may be used and excavation wasted provided there is no additional cost to the DEPARTMENT. Provide borrow that is equal to or better quality than the wasted excavation.

B. Maintain drainage
   1. Grade and maintain the roadway to ensure adequate drainage.
   2. Maintain pipe culverts and drainage ditches, or provide temporary facilities when interrupting irrigation systems, sewer, underdrainage, etc.

3.3 EXECUTION

A. For compaction process, follow Section 02324.

B. Scarify and compact the top 0.2 m of the ground to at least 90 percent of maximum laboratory density when the embankment height is 1.8 m or less and the underlying ground consists of loose material.

C. Remove and waste unsuitable material.

D. Break and scarify all underlying road surfaces in pieces not exceeding 0.3 m^2 in area.

E. Place an initial layer to act as a working platform over soft, wet ground when approved by the ENGINEER without meeting density specifications. Conform to density specifications when placing embankment above the working platform.

F. Complete preparation of area. The ENGINEER will inspect and accept the foundation before the embankment is placed.

G. Uniformly spread embankment materials in layers not exceeding 0.3 m (noncompacted depth) and compact to at least 96 percent maximum laboratory density before placing the next layer. Reduce the uncompacted lift thickness if tests show unsatisfactory density.

H. Finish subgrade surface within 30 mm ± of line and grade.

I. Do not use rock or pavement materials over 0.9 m in the largest dimension. Distribute so space exists for placing and compacting embankment material between large rocks or pavement materials.

J. Do not place large rock within 0.3 m below subgrade surface. Do not allow rocks to protrude above the subgrade surface.

K. Construct embankments placed against a hillside or an existing embankment as specified in Standard Drawing 815-1.

L. Route construction equipment uniformly over the layers to assist compaction.

M. Do not use compacting equipment that causes shear failure in the embankment.

N. Requirements for freezing or snowy conditions:
   1. Do not place embankment on frozen or snow-covered areas.
   2. Do not deliver or use frozen material in embankments.

3. The CONTRACTOR may remove snow and frozen material from embankments, foundations, and borrow areas, and furnish unfrozen, embankment material that can be compacted to the specified density. Remove, waste, and replace frozen embankment material at no additional cost to the DEPARTMENT.
4. Provide the ENGINEER time to measure wasted material.

O. Excess material, including rock, may be placed on fill slopes outside the clear zone provided it does not create an unsightly appearance. Meet density specifications for materials placed on fill slopes.

END OF SECTION

SECTION 02332

EMBANKMENT FOR BRIDGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing bridge approach embankments.

1.2 RELATED SECTIONS

A. Section 02324: Compaction

1.3 REFERENCES

A. AASHTO M 145: The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.

PART 2 PRODUCTS

2.1 MATERIALS

A. A-1 Material. AASHTO M 145. Conform with 100 mm maximum size.

B. Use 75 mm maximum size where piles are to be driven through the embankment.

PART 3 EXECUTION

3.1 INSTALLATION

A. Construct approach embankments within 90 m of the toe of the bridge approaches from the ground up with designated material.

B. Subexcavate unsuitable material (soft, springy, organic, or yielding material) at natural ground level as directed by the ENGINEER.

3.2 COMPACTION

A. Refer to Section 02324.

END OF SECTION

SECTION 02338

REFINISH SUBGRADE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Reshape and recompact existing subgrade constructed under a previous contract.

1.2 RELATED SECTIONS

A. Section 02056: Common Fill.

B. Section 02324: Compaction.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Scarify the upper 100 mm and compact following Section 02324.

B. Bring the subgrade to within ± 30 mm of line and grade.

C. Rework or remove material in soft and yielding spots as directed.
   1. Replace with granular borrow and compact to the specified density.
   2. For Granular Borrow, refer to Section 02056.

D. Maintain the subgrade until the pavement has been placed.
   1. Protect the finished subgrade from damage by construction operations or public traffic.
   2. Repair all cuts, ruts, and breaks in the surface before placing the pavement at no additional cost to the DEPARTMENT.

END OF SECTION

SECTION 02372

WIRE ENCLOSED RIPRAP

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for wire enclosed riprap.

1.2 RELATED SECTIONS

A. Section 02056: Common Fill.

B. Section 02316: Roadway Excavation.

C. Section 02324: Compaction.

D. Section 03211: Reinforcing Steel and Welded Wire.

1.3 REFERENCES

A. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

B. ASTM A 116: Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.

C. ASTM C 535: Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

1.4 SUBMITTALS

A. Manufacturer's product data including typical construction details and procedures.

1.5 QUALITY ASSURANCE

A. Construct to the line and grade as shown in the plans.

PART 2 PRODUCTS

2.1 MATERIALS

A. Stone: Durable, angular, field or quarry stone that is 125 mm to 250 mm in size.
   1. Sound, hard, and free of seams, cracks, or clay.
   2. Maximum 40 percent wear. AASHTO C 535.

3. Maximum 16 percent weighted loss when subjected to five cycles of sodium sulfate. AASHTO T 104.

B. Wire:
1. Selvages: gauge 9.
2. Tie wire: May be two gauges smaller than the body wire mesh.
3. ASTM A 116, Class 3.

C. Wire Mesh:
1. Not less than 11 gauge.
2. Maintain the galvanized coating of the wire mesh at not less then 240 gm/m^2 of wire surface. ASTM A 116, Class A.
3. Openings in the wire mesh are not to exceed 100 mm.
4. Must stretch in length a minimum of 10 percent without reducing the gauge or wire strand tensile strength more than one gauge in diameter.

D. Anchor Rods:
1. Provide 19 mm minimum diameter steel rods; reinforcing bars allowed following Section 03211.
2. Use 1 m long anchor rods with a 75 mm hook bend or a 150 mm "T" welded to the top of the rod.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove unacceptable material to a 0.3 m depth. Refer to Section 02316.

B. Replace with granular borrow material bringing the grade to the base of the wire enclosed riprap structure. Refer to Section 02056.

C. Finish excavation to reasonably smooth and uniform surface.

D. Compact with two passes of a vibratory roller on 1:3 or flatter slopes. Refer to Section 02324.

3.2 PLACING WIRE ENCLOSED RIPRAP

A. Assemble the base, lid, ends and sides into a single unit.
1. If not woven, then connect these members so that strength and flexibility at the connecting point is equal to or greater than that of the mesh.
2. Securely selvage all perimeter edges with continuous lacing wire or bound. The joints formed by tying must have approximately the same strength as the body mesh.

B. When the length of the wire baskets exceed the horizontal width, divide the baskets equally into cells using diaphragms of the same mesh as the body. Secure the diaphragms in the proper position on the base section so no additional tying will be required at the juncture.

C. Place the stone in the wire baskets according to manufacturer's recommendations. 1. Protect wire from being broken.

1. Protect sides and ends from being crushed and kinked.
2. Hand place stones on exposed vertical slopes to ensure satisfactory gradation.
3. Use a loading frame to support the wire fabric while placing rocks.

D. Begin assembly and stone placement at the lowest layer or row of wire structures.

E. Tie each subsequent layer or row to the one below and tie adjoining structures.

F. Use wire equal to that required for selvage wire.

G. Install anchors according to manufacturer's recommendation.

END OF SECTION

SECTION 02373

RIPRAP

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing loose riprap, hand-placed riprap, or keying riprap, and compacted riprap.

1.2 RELATED SECTIONS

A. Section 02075: Geotextiles.

1.3 REFERENCES

A. AASHTO T 96: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion by Impact in the Los Angeles Machine.

B. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

1.4 SUBMITTALS

A. Submit data showing riprap source gradation, wear and soundness, and placement technique 10 working days before use.

B. Submit samples for Quality Assurance testing before use.

PART 2 PRODUCTS

2.1 AGGREGATE

A. Durable, angular, hard, and free from seams and cracks and other structural defects.

B. Maximum wear not greater than 40 percent when tested. AASHTO T 96.

C. Maximum 16 percent weighted loss. AASHTO T 104.

D. Loose Riprap: The greatest dimension of 50 percent of the stone at least 0.67 times, but not more than 1.5 times the thickness of the specific riprap layer.

E. Hand-place riprap: Durable angular field or quarry stone not less than 75 mm in size, with 75 percent of stones being at least 0.01 m^3 in volume.

2.2 ACCESSORIES

A. Geotextile fabric: Refer to Section 02075.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove all brush, trees, stumps, and other objectionable materials and grade to a uniform surface.

B. Excavate to provide a firm foundation and protect against undercutting. Secure approval from ENGINEER before backfilling or installing geotextiles.

C. Install required geotextile following Section 02075 and plans.

3.2 LOOSE RIPRAP

A. Place stones to secure a rock mass with the minimum thickness and height indicated. Manipulate rock to secure a regular surface of graded size and mass stability.

B. Embed riprap below the ground surface as shown on the plans.

3.3 HAND-PLACED RIPRAP

A. Place and bed the rocks, one against the other, and key together. Fill irregularities between stones with suitable size stones.

B. Embed riprap below the ground surface as shown on plans.

3.4 COMPACTED RIPRAP

A. Place riprap where indicated.

B. Compact riprap eliminating all protrusions over 75 mm.

3.5 KEYING RIPRAP

A. Compact the riprap and break irregular protrusions off the top surfaces of stone by striking the riprap surface with an approximately 1.5 m x 1.5 m, 2800 kg steel (armor) plate, and repeatedly raising and dropping the steel plate from 1 m to 1.5 m.

B. Produce a reasonably uniform surface with maximum 100 mm protrusions.

3.6 KEYED RIPRAP

A. Key loose riprap to depth below the natural finished surfaces as shown on the plans.

END OF SECTION

SECTION 02376

EROSION CONTROL BLANKETS/CHANNEL LINERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Approved erosion control products for slopes and channels.

B. Installation requirements.

1.2 REFERENCES

A. TxDOT/TTI Hydraulics and Erosion Control Laboratory Field Performance Testing of Selected Erosion Control Products - Final Performance Analysis - Current Evaluation Cycle.

B. Utah Water Research Laboratory (UWRL) at Utah State University - Ongoing testing of erosion control blankets and channel liners.

1.3 DEFINITIONS

A. Erosion Control Blanket: Fabric applied on slopes to prevent soil erosion and protect the seedbed.
   1. Machine-produced fabric consisting of elongated wood or coconut fibers or straw that are bonded together.
   2. Hydraulically applied bonded fiber matrix.

B. Flexible Channel Liner: A machine-produced mat consisting of elongated materials that are bonded together and used to line channels.

1.4 SUBMITTALS

A. A sample of the blanket or liner, staples and other materials used, manufacturer's specifications, and recommended installation requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original wrapping showing the name of the manufacturer and product description.

PART 2 PRODUCTS

2.1 EROSION CONTROL BLANKETS

A. Contact UDOT Region Landscape Architect for Approved List of Erosion Control Blankets.

B. Approved products meet performance criteria based upon research at TxDOT/TTI and UWRL.

2.2 FLEXIBLE CHANNEL LINERS

A. Contact UDOT Region Landscape Architect for Approved List of Flexible Channel Liners.

B. Approved products meet performance criteria based upon research at TxDOT/TTI and UWRL.

C. TYPE A: Meet testing requirements for a sheer stress range 0-192 Pascal.

PART 3 EXECUTION

3.1 PREPARATION

A. All required grading and seeding in areas to receive erosion control blanket or channel liner should be completed and approved before placing the product.

B. Apply the blanket or liner within 24 hours after seeding or before precipitation falls.

C. If the blanket is not installed and a precipitation event occurs creating soil erosion, replace eroded material, rework the soil, and reseed before installing the blanket or liner.

3.2 INSTALLATION

A. Install the erosion control blanket or channel liner strictly following manufacturer's specifications.

B. Minimize disturbance of the prepared seedbed.

C. Allow the blanket or liner to lay loosely on the soil to achieve maximum soil contact. Do not stretch the blanket during installation.

D. Staple the blanket or liner using manufacturer's specifications. Staple requirements vary according to the steepness and length of the slope.

E. Place additional staples in areas such as: swales, base of humps, against rock outcrops and as required to achieve maximum contact between the blanket and the soil.

END OF SECTION

SECTION 02455

DRIVING PILES - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials, equipment and procedures for driving steel piles.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

1.3 REFERENCES

A. AASHTO M 31M: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. ASTM A 36: Carbon Structural Steel.

C. ANSI/AASHTO/AWS D 1.5

1.4 SUBMITTALS

A. "Pile and Driving Equipment Data" form. Located at the end of this Section.
   1. Used by DEPARTMENT in the Pile Driver Wave Equation Analysis.
   2. Within 14 days after submitting the form, DEPARTMENT will notify CONTRACTOR with either an approval to continue or a notification of inadequate equipment.
   3. Do not drive piles until the wave equation analysis indicates that the equipment can drive piles to the ultimate capacity without damage(twice the allowable capacity shown on the plans).
   4. When notified of inadequate equipment, modify the equipment or the proposed technique until the wave equation analysis indicates that the equipment is adequate.

PART 2 PRODUCTS

2.1 PILE SHELLS

A. New pile shells with a minimum thickness of 8 mm and a minimum yield strength of 248 000 kPa. See "Pile and Driving Equipment Data" form at the end of this Section.

2.2 "H" PILES

A. As specified on the plans.

B. Follow ASTM A 36.

2.3 PORTLAND CEMENT CONCRETE

A. Class A Concrete following Section 03055.

2.4 REINFORCING STEEL

A. Meet AASHTO M 31M, Grade 400.

B. Refer to Section 03211.

2.5 PILE DRIVER

A. Equip following the manufacturer's recommendations.

B. Leads:
   1. With all types of hammers.
   2. Free moving.
   3. Hold the leads in the required position with guys, stiff braces, or both. Hold the pile parallel to the leads.
   4. Must accommodate the maximum length of the pile segment, and extend to the lowest point the hammer must reach. Obtain approval before using followers.

C. Driving Heads: must fit the top of the pile and provide full bearing.

D. Hammer:
   1. With adjustable settings.
   2. A maximum rated energy greater than 61 000 J.
   3. Install a new hammer cushion before beginning pile driving.
      a. Inspect the hammer cushion with the ENGINEER present after completing 100 hours of pile driving.
      b. Replace the cushion when it loses 25 percent of its original thickness.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete foundation excavation before driving piles.

3.2 INSTALLATION

A. Pre-drill if the designated stratum cannot be reached by driving. Do not drill holes greater than the diameter of the pile.

B. Keep driven piles within 150 mm of the designated position, and keep exposed portion of the pile within 20 mm/m from the direction shown.

C. Drive additional piles at locations designated by ENGINEER when replacing damaged piles and piles driven more than 150 mm from specified location.

D. Drive down piles that were raised because of driving adjacent piling.

E. Remove all loose and displaced materials from around the completed piles leaving clean, solid surfaces to receive the concrete.

F. Splicing: Butt weld the entire pile cross section using full penetration welds. ANSI/AASHTO/AWS D 1.5.

G. Cutting and capping piles:
   1. Remove all damaged material from the top of the pile.
   2. Keep the sides of piles at least 225 mm away from the nearest edge of footing.
   3. Cut off piles with clean, straight-line cuts to the designated elevation at right angles to the pile axis. Level all irregularities before placing bearing caps.

H. Embed the tops of foundation piles in the concrete footing as shown on the plans.

3.3 DYNAMIC ANALYSIS

A. DEPARTMENT will perform dynamic testing during the driving of at least one pile at each abutment and bent location. Additional piles may be monitored if driving conditions change significantly.

B. Install dynamic analysis instruments after placing the pile in the leads. Allow approximately one hour per pile for dynamic measuring equipment installation. If splicing is necessary, allow one additional hour per splice.

C. Provide a platform at least 1.2 m square with a 1.2 m high safety rail and equipped to be raised to the top of the pile located in the leads.

D. The stresses in the piles will be monitored to ensure that the stress does not exceed 0.9 Fy. Reduce the energy of the hammer if the stress exceeds 0.9 Fy.

E. Drive piles to the required resistance to obtain the specified ultimate loads.

F. DEPARTMENT will evaluate the driving resistance of the ultimate loads using the pile driver wave equation analysis and the pile driving analyzer.

G. Re-tap the pile a maximum of 50 blows within a minimum of 24 hours after driving the pile.

1. ENGINEER may revise the pile driving criteria during the dynamic test pile driving period.
2. DEPARTMENT will use the results of the re-tap to establish pile tip elevations at that location.

END OF SECTION

Sheet # _____

Pile and Driving Equipment Data

Project No: _____

Project Name: _____ County: _____

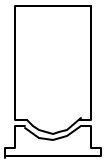
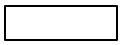
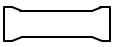
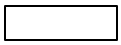
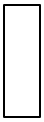
Drawing No: _____

Pile Driving Contractor or Subcontractor: _____

_____

_____ Phone: _____

(Piles Driven By)

Hammer Components			
		**Hammer**	Manufacturer: _____ Model: _____ Type: _____ Serial No: _____ Rated Energy: _____&_____ Length of Stroke Explosive Force: _____ (for diesel hammers)
		Ram	Ram Weight: _____ Ram Length: _____ (for diesel hammers)
		Anvil	Ram Cross Sectional Area: _____ (With diesel hammers) Anvil Weight: _____
		**Hammer Cushion**	Material: _____ Area: _____ Thickness: _____ Each: _____ Modulus of Elasticity - E: _____ kPa Coefficient of Restitution - e: _____
		**Pile Cap**	Helmet Bonnet Anvil Block Weight: _____ Drive Head
		**Pile Cushion** **(Concrete or Timber Press Only)**	Cushion Material: _____ Area: _____ Thickness: _____ Modulus of Elasticity - E: _____ kPa Coefficient of Restitution - e: _____
		**Pile**	Type: _____ Full Size: Length (in leads): _____ Diameter: _____ Wall Thickness: _____ Taper: _____ Material: _____ Weight/m: _____ Design Pile Capacity: _____(t) Description of Splice: _____ _____ Tip Treatment Description: _____ _____ Submitted by: _____ Date: _____

Separate Data Sheet Is Required for Each Structure

SECTION 02466

DRILLED CAISSON - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Material, equipment and procedures for constructing drilled caissons.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

1.3 QUALITY ASSURANCE

A. If caisson installation is unsatisfactory:
1. Immediately remove the reinforcing steel cage and the concrete.
2. Replace the reinforcing cage and concrete in a satisfactory manner.
3. Submit proposed remedial action for approval if the reinforcing steel and concrete cannot be removed.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. Class A. Follow Section 03055.

B. Modify as follows when placed under water:
1. Maintain the same minimum compressive strength at 28 days.
2. Add at least 55.7 kg additional cement per cubic meter or concrete for a minimum of 390.3 Kg of cement per cubic meter.
3. Proportion concrete to facilitate pumping.
4. Use water reducers or plasticizers per Section 03055.
5. Keep slump at 200 mm ± 25 mm when tested at the truck.

2.2 REINFORCING STEEL

A. Refer to Section 03211.

2.3 CAISSON DRILLING EQUIPMENT

A. Capable of:
   1. Drilling holes of the required diameter and depth in the type of materials located at the footings.
   2. Installing and removing casing.

PART 3 EXECUTION

3.1 PREPARATION

A. Drilling holes:
   1. Drill straight, vertical holes to the tip elevations on plans or as determined by ENGINEER.
   2. Remove all loose material from the bottom of the drilled holes before placing concrete.
   3. Do not use water for drilling operations.

B. Casing:
   1. Furnish and place casing when required to prevent the drilled hole from caving in and remove casing as the concrete is placed.
   2. Keep the bottom of the casing between 0.6 m and 1.5 m below the top of the concrete surface when withdrawing.
   3. Prevent concrete separation when withdrawing the casing.

3.2 PLACING CONCRETE

A. Fill drilled holes within 24 hours after drilling.

B. Prevent concrete from striking the steel reinforcing cage during free-fall.

C. Do not vibrate concrete during initial placement. Remove all muck and degraded concrete from the caisson.

D. Vibrate the concrete during placement to at least 3 m below top of casing.

3.3 PLACING CONCRETE UNDER WATER

A. Submit procedure to ENGINEER and secure ENGINEER's written approval to place concrete under water.

B. Use concrete pumping equipment capable of pumping at least 38 m^3/h against a minimum 6.1 m head of concrete measured from the discharge end of the pump hose extension.

C. Use a rigid, steel pipe pump hose extension with tight couplings straight to within 12.5 mm in 3 m.
   1. Length of extension must be greater than or equal to the depth of the caisson.

2. Inside diameter must be greater than or equal to the concrete pump discharge hose, but not more than one-half of the inside diameter of the reinforcing cage.

D. Purge the pipe of water.
1. Insert a sturdy plastic ball or equipment into the top of the pump hose extension before connecting the hose from the concrete pump.
2. The ball must fit snugly into the pump hose extension when it is inflated and it must be strong enough to resist rupture.
3. Prime the hose and pipe with portland cement slurry.

E. Lower a small diameter pole with an attached flat plate into the hole to determine the top surface of concrete.
1. Both pole and pipe should be marked so that the length of penetration can be determined immediately.
2. Prevent the end of the pipe from becoming plugged with soil from the bottom of the hole.

F. Begin pumping the concrete immediately after setting the reinforcing cage and pipe in the hole. Do not begin raising the pipe until the concrete surface is 3 m above the bottom of the pipe.

G. Keep the bottom of the pipe at least 1.5 m below the top of the concrete until the pour is complete and all muck, laitance, and all unsuitable concrete is removed.

H. Provide a positive hold down if the pipe floats to ensure that the minimum 1.5 m penetration is maintained.

3.4 FIELD QUALITY CONTROL

A. If plugging of the pipe, equipment breakdown, or loss of the seal at the end of the pipe occur:
1. Pull the pipe, reset it 0.6 m below the top of the concrete, and purge it.
2. Lower the pipe to at least 1.5 m below the top of the placement, and continue pumping concrete until all degraded concrete has lifted to the top of the caisson.
3. Remove all degraded concrete.

END OF SECTION

SECTION 02610

PIPE CULVERTS - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing pipe culvert.

B. Class, type, size, and thickness designations.

C. Asphalt coating for pipe culvert.

1.2 RELATED SECTIONS

A. Section 00820: Legal Relations and Responsibility to Public.

B. Section 02317: Structural Excavation.

C. Section 02330: Embankment.

D. Section 03055: Portland Cement Concrete.

E. Section 03310: Structural Concrete.

1.3 REFERENCES

A. AASHTO M 36M: Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

B. AASHTO M 55: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. AASHTO M 86M: Concrete Sewer, Storm Drain, and Culvert Pipe.

D. AASHTO M 170: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

E. AASHTO M 190: Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

F. AASHTO M 196M: Corrugated Aluminum Pipe for Sewers and Drains.

G. AASHTO M 197M: Aluminum Alloy Sheet for Corrugated Aluminum Pipe.

H. AASHTO M 198M: Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

I. AASHTO 207: Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

J. AASHTO M 243: Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe Arches, and Arches.

K. AASHTO M 245M: Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains.

L. AASHTO M 246M: Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe.

M. AASHTO M 294M: Corrugated Polyethylene Pipe, 305 to 915-mm (12- to 36-in.) Diameter.

N. AASHTO M 304M: Polyvinyl Chloride (PVC) Profile Wall Drain Pipe andFittings Based on Controlled Inside Diameter.

O. ASTM A 849: Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe.

P. ASTM D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

Q. ASTM F 477: Elastomeric Seals (Gaskets) or Joining Plastic Pipe.

PART 2 PRODUCTS

2.1 PIPE CULVERT CLASSES

A. Pipe Culvert Classes:
   1. Class A: Pipe used in mostly non-reactive soils, and which require no special materials, treatment, or coating.
   2. Class B: Pipe used in moderately reactive and corrosive soils.
   3. Class C: Pipe used in soils which are highly reactive and corrosive.
   4. Class D: Untreated structural plate pipe used in mostly non-reactive and non-corrosive soils.
   5. Class E: Structural plate pipe used in highly reactive and corrosive soils.

B. Pipe Culvert Class Substitutions: May be made at no additional cost to the DEPARTMENT.
   1. Class B and C may be substituted for Class A.
   2. Class C may be substituted for Class B or A.
   3. Class E may be substituted for Class D.

C. Refer to Table 1.

Table 1 AASHTO Reference Specifications for Pipe Culverts

Pipe Culvert Type		Pipe Culvert Class				
		A	B (4)	C (4)	D	E (4)
1.0	**Corrugated Pipe Culverts and Pipe Arch Culverts:**					
1.1 1.1(a)	Corrugated steel: pipe. Pipe arch. **(2)**	M 36M	M 36M Bituminous Coating (Type A) M 190M. OR Polymeric Coating (Type B) M 245M & M 246M	M 36M Bituminous Coating (Type A) M 190M. **(1)** OR Polymeric Coating (Type B) M 245M & M 246M **(5)**		
1.2 1.2 (a)	Corrugated aluminum: Pipe. Pipe arch. **(2)**			M 196M M 197M		
1.3	Corrugated Polyethelene (HDPE) Pipe			M 294M		
2.0	**Smooth-Lined Pipe Culverts and Pipe Arch Culverts:**					
2.1	Concrete lined corrugated steel pipe (Use Type V cement. Refer to Section 03055)	M 36M	M 36M Bituminous Coating (Type A) M 190M OR: Polymeric Coating (Type B) M 245M and M 246M	M 36M Bituminous Coating (Type A) M 190M **(1)** OR: Polymeric Coating (Type B) M 245M and M 246M **(5)**		
2.2	Smooth lined Polyethylene pipe.			M 294M		
2.3	Smooth lined Poly Vinyl Chloride (PVC) pipe **(3)**			M 304M		
2.4 2.4 (a)	Bituminous, smooth lined corrugated steel: Pipe Pipe arch. **(2)**	M 36M	M 36M Bituminous Coating (Type D) M 190M	M 36M Bituminous Coating (Type D) M 190M **(1)**		
2.5	Spiral rib steel pipe	M 36M	M 36 M Bituminous Coating (Type A) M 190M OR: Polymeric Coating (Type B) M 245M and M 246M	M 36 M Bituminous Coating (Type A) M 190M **(1)** OR: Polymeric Coating (Type B) M 245M and M 246M **(5)**		
2.6	Spiral rib aluminum pipe			M 196& and M 197M		

2.7	Reinforced concrete pipe		M 170M Type II Cement	M 170M Type V Cement		
2.8	Non-reinforced concrete pipe		M 86M Type II Cement	M 86M Type V Cement		
2.9	Elliptical reinforced concrete pipe		M 207M Type II Cement	M 207M Type V Cement		
2.10	Clay pipe			M 65M		
3.0	**Structural Plate Pipe and Pipe Arch Culverts**					
3.1	Structural steel plate pipe culverts and pipe arch	N/A	N/A	N/A	M 167M	M 167M M 243M
3.2	Aluminum alloy structural plate pipe culverts and pipe arch	N/A	N/A	N/A		M 219M

Footnotes:
(1) Bond the bituminous coating to the pipe by the special process of embedding fiber in molten zinc galvanizing before applying the bituminous coating.
(2) Minimum corner radii conforming to the details shown on the standard drawings.
(3) Flexible connectors required at all rigid (concrete) connections.
(4) Refer to Section 2.1.B
(5) Apply a 0.25 mm coating to both inside and outside surfaces of pipe.

2.2 PIPE CULVERT TYPES

A. Pipe, Pipe Arch, Structural Plate Pipe and Structural Plate Pipe Arch Culvert Types: Refer to Table 1.

2.3 RELATED PRODUCTS

A. Asphalt Coating: Furnish Material Class M-Mastic, either asphalt or tar base, cold applied. ASTM A 849.

1. Asphalt base mastic design criteria:
   - a. Functions as a cool-applied waterproofing membrane.
   - b. Provides a protective coating to aluminum or steel highly resistant to corrosion and chemical fumes.
   - c. Is not affected by freezing temperatures and does not flow in hot weather.
   - d. Has high cohesive strength and readily hardens in to a tough elastic seal after application.
   - e. Is mixed until the fibers and mineral filler are uniformly dispersed.

2.4 PIPE SELECTION

A. At the preconstruction conference, declare choice of pipe, type, diameter and thickness to be used.

B. Use the same type and strength of concrete pipe or thickness of steel, aluminum, polyethelene or polyvinyl chloride (PVC) pipe for the entire length of pipe.

C. Use the maximum height of cover to determine the strength or thickness. Refer to Standard Drawings 605-01, 605-1A, 605-2B, and 605-2D.

D. Do not use aluminum pipe culvert when a paved invert is required, unless protective measure are taken. Follow 3.7 - C.

E. Corrugated and smooth-lined polyethylene pipes and PVC pipes: Use only 300 mm to 900 mm diameter.

F. Precast, non-reinforced concrete pipe: Use only 450 mm to 900 mm diameter.

G. Do not allow pipes of different types of metal to contact each other. Use matching materials to make direct extensions of existing pipes.

H. Do not use aluminum pipe, corrugated aluminum pipe, corrugated polyethylene pipe, or pipe containing longitudinal lap seams if watertight pipe or watertight joints are called for. Meet AASHTO M 86.

I. The proprietary flexible connection system provided by the manufacturer is mandatory for all connections of PVC pipe to rigid concrete structures such as manholes, headwalls, catch basins, oil skimmer boxes, etc.

J. Do not use PVC pipe manufactured without UV inhibitors approved by the materials Engineer in applications subject to direct sunlight.

PART 3 EXECUTION

3.1 PREPARATION

A. Excavating, Trenching, Bedding and Backfill:
   1. Refer to Section 02317.
   2. Refer to Standard Drawings 605-5, 605-5A and 605-20.
   3. Comply with Utah Occupation Safety and Health regulations when excavating and trenching. Note safety restrictions for trenches deeper than 1.2 meters. Follow Section 00820.
   4. Use Type I bedding unless Type II or Type III is required due to foundation conditions.

3.2 INSTALLATION

A. Lay culvert starting at the downstream end.

B. Keep the bottom of the culvert in contact with the bedding throughout its length.

C. Camber the grade line to offset anticipated settlement to prevent a sag from developing in the flow line.

D. Place bell or socket end of culvert facing upstream.

E. Place culverts fabricated with longitudinal laps or seams so that such seams are located at the sides, away from the invert or crown.

F. Place paved invert or partially lined culvert so that the centerline of the paved segment matches the flow line.

G. Place elliptical culvert with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the culverts.

H. Place outside circumferential laps of flexible corrugated (annular corrugations) culvert facing upstream.

I. Close the joints tightly. Follow AASHTO M36M.

3.3 JOINTS FOR RIGID CULVERTS

A. Use rubber gasket joints.

B. Meet AASHTO M 198.

C. Storm drains and irrigation applications shall sustain 20 kPa minimum pressure after first test.

D. Elliptical reinforced concrete pipe in storm drain and irrigation applications require joint systems capable of sustaining a minimum pressure of 20 kPa; acceptable after the first test.

3.4 JOINTS OR COUPLING BANDS FOR FLEXIBLE PIPE CULVERTS

A. Metal Pipe Culverts:
   1. Use standard joints or coupling bands unless special joints or special coupling bands are called for on the plans. Refer to Standard Drawing 605-3.
   2. Conform to AASHTO Standard Specifications for Highway Bridges and AASHTO M 36M or AASHTO M 245M with the following modifications:
      a. Use connecting bands of the same class as the pipe. Maintain a minimum thickness of 1.6 mm for the connecting bands.
      b. Use bands with projections (dimple bands) only in extension of the existing pipes where annular corrugations do not exist.
      c. The ends of helically corrugated pipe must be re-rolled to form at least two full annular corrugations each before being joined.
      d. Use flat bands only when approved in writing by the ENGINEER.
      e. Gasketed joints or coupling bands in storm drains and irrigation applications required gasketed joints or coupling bands capable of sustaining a minimum pressure of 20 kPa; acceptable after the first test. Follow Standard Drawing 605-3.

B. Polyethylene (HDPE) Pipe Culverts:
   1. Unless otherwise specified, use standard joints conforming to Section 7 "Requirements," and Section 9 "Test Methods" of AASHTO M 294M.
   2. Use joints that sustain 20 kPa minimum pressure for storm drains and irrigation applications as approved by the Materials Engineer.

C. Joints for PVC Pipe Culverts:
   1. Show no leakage when tested in accordance with ASTM D3212.
   2. Sustain 20 kPa minimum pressure for storm drains and irrigation applications as approved by the Materials Engineer.
   3. Meet ASTM F 477 for gaskets.

3.5 WATERTIGHT CULVERTS AND JOINTS

A. Use one of the following water tight culverts:
   1. Reinforced concrete pipe. Do not use elliptical pipe.
   2. Non-reinforced concrete pipe.
   3. Corrugated steel pipe culvert (O-ring gasket placed in lock seam).
   4. Helical rib steel pipe (O-ring gasket placed in lock seam).
   5. Helical rib aluminum pipe (O-ring gasket placed in lock seam).

B. Provide watertight joints as follows:
   1. Pass the AASHTO M 86M field test requirements by sustaining a 70 kPa minimum pressure for a 10 minute period with no leakage observed.

3.6 SMOOTH LINING FOR CORRUGATED STEEL PIPE AND PIPE ARCH CULVERTS

A. Clean all surfaces to be lined including removal of all oil and grease from the metal. Allow the surface to dry before proceeding.

B. Concrete Lining: Follow ASTM A 849, Subsections 5 and 9.

C. Bituminous Lining: Follow Table 1.

3.7 PIPE AND PIPE ARCH CULVERTS

A. Use materials described in Table 1.

B. Remove moisture, dirt, oil, un-bonded or incompatible paint, grease residual oil, alkalies, or other foreign matter from the surface to be coated.

C. Spray or brush-coat all aluminum culvert contacting concrete with an asphalt mastic or tar base material to a minimum thickness of 1.25 mm.

3.8 STRUCTURAL PLATE PIPE AND PLATE PIPE ARCH CULVERTS

A. Use materials described in Table 1.

B. Repair or replace all damaged plates or coatings before installation.

C. Installation: Follow Standard Drawings 605-5 and 605-5A.
Embankment: Refer to Section 02330.

D. Assembly:
1. Give the ENGINEER a copy of the detail plan showing the position of each plate and the assembly order.
2. Follow the manufacturer's instructions.
3. Clearly mark each modified plate, designating its position in the finished structure.
4. Place outside circumferential pipe-laps facing upstream.
5. Attain approved seam fit-up. All bolts must be in place and have a torque ranging from 70 N"m to 140 N"m for aluminum pipe and 140 N"m to 410 N"m for steel pipe.
6. Form structural plates so that the finished pipe is elliptical in shape with the vertical diameter approximately 5 percent greater than the nominal diameter.

E. Asphalt Coating (structural plate pipe and structural plate pipe arch):
1. Thoroughly clean all plates to be coated. Remove any oil or grease from the surface of the plates. Keep plates clean and dry prior to coating.
2. Apply coating to dry plates:
   a. Spray or brush-coat the entire exterior surface of the culverts with an asphalt-fiber (mastic) to a minimum 2 mm thickness. Follow AASHTO M 243.
   b. Spray or brush-coat the inside invert for 1/4 of the circumference of round pipe and the full span width of pipe arch with the same compound.
   c. Spray or brush coat all metal surfaces in contact with the ground at the time of erection before assembly. The remaining surfaces may be treated after erection.
3. Apply uniformly to a minimum thickness of 1.5 mm to structural plate for pipe, pipe arches, or arches on inside and outside surfaces measured on the crest of the corrugations.

4. Furnish as follows, according to the application used:
   a. Spraying consistency: Spray with an air gun without the use of additional thinners when temperatures are 4 degrees C and above.
   b. Troweling consistency: Apply with a knife or trowel.
   c. Brushing consistency: Apply with an ordinary roofing brush.

3.9 PAVED INVERT

A. Use corrugated steel pipe or pipe arch and structural steel plate pipe or pipe arch culverts.

B. Complete backfill and embankment over the pipe before placing paved invert material.

C. Use 10-gage wire fabric with wire spaced at 150 mm centers. AASHTO M 55.

D. Arc-weld the wire mesh reinforcement to the corrugation at not more than 0.6 m centers.

E. Place concrete at least 50 mm above the crest of the corrugations, at least 1/4 the width of the circumference of round pipe, or the span width of arch pipe. Refer to Section 03055.

F. Finish the concrete to a floated surface finish. Follow Section 03310.

G. After curing, coat the joint between the culvert and concrete with liquid asphalt at a rate of 0.4 L/m^2 of residual asphalt. Coat 150 mm above and below the joints.

3.10 QUALITY CONTROL

A. Provide adequate cover or protection for all culvert to protect them during project construction. Replace all damaged culverts before acceptance by UDOT.

B. The following constitute poor workmanship and any one is cause for rejection:
   1. Irregular or distorted shape (not as provided or designed)
   2. Dents or bends in the metal
   3. Damaged, broken, or scaled coating
   4. Loose bolts or nuts
   5. Uneven laps
   6. Improper fitting joints
   7. Any other damage which compromises the functionality and design life of the pipe.

C. Coatings:
   1. Furnish a Certificate of Compliance from the manufacturer.
   2. DEPARTMENT will take a representative sample from each lot furnished to conduct verification testing.

END OF SECTION

SECTION 02611

DIVERSION BOX GATE AND FRAME

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing gate and frame for hand slide gates or for screw gates and frames.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

C. Section 03310: Structural Concrete.

1.3 REFERENCES

A. AASHTO M 218: Steel Sheet, Zinc-Coated (Galvanized) for Corrugated Steel Pipe.

B. ASTM A 36: Carbon Structural Steel.

C. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

E. ASTM A 575: Steel Bars, Carbon, Merchant Quality, M-Grades.

F. ASTM D 2000: Rubber Products in Automotive Applications.

1.4 SUBMITTALS

A. Submit for approval two weeks in advance of fabrication:
   1. Diversion box screw gate and frame shop drawings
   2. Installation procedures
   3. Fabrication methods

PART 2 PRODUCTS

2.1 BLADES AND METAL FRAMES FOR HAND-SLIDE GATES

A. Zinc coated steel. Comply with AASHTO M 218, as specified.

2.2 CONCRETE

A. Class AA(AE) concrete per Section 03055.

2.3 REINFORCING STEEL

A. Refer to Section 03211, Part 2.

2.4 FRAME AND FLUSH BOTTOM CLOSURE

A. Carbon steel for frame and flush bottom meeting ASTM A 36, as specified.

B. Galvanizing frame and flush bottom meeting ASTM A 123, as specified.

C. Galvanized fastener meeting ASTM A 307, as specified.

D. Threaded carbon steel meeting ASTM A 575, as specified.

E. Rubber seal for flush bottom: as specified, ASTM D 2000, Grade AA 625 or BC 610 to 615.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hand-Slide Gate: Finish the concrete frame following Section 03310.

B. Install the screw gate and frame following conforming to shop drawings, and such that gate opens and closes smoothly.

END OF SECTION

SECTION 02613

CULVERT END SECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing culvert end sections.

1.2 RELATED SECTIONS

A. Section 02610: Pipe Culverts.

1.3 REFERENCES

A. AASHTO M 294: Corrugated Polyethylene Pipe, 305 to 915 mm (12- to 36-in.) Diameter.

PART 2 PRODUCTS

2.1 END SECTION

A. Polyethylene end section as specified. AASHTO M 294.

B. Refer to Pipe Class Definitions, Section 02610.

C. Coat metal end section identically to pipe material.

PART 3 EXECUTION

3.1 INSTALLATION

A. Use end section made of the same materials as the pipe or pipe arch to which it is connected.
   1. **Exception: Use a metal end section with concrete.**

B. Place end section according to construction methods specified for the type and class of pipe to which they connect. Refer to Standard Drawings 605-2 and 605-2B, and Section 02610.

END OF SECTION

SECTION 02614

SALVAGE AND/OR RELAY PIPE CULVERT AND END SECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Salvage and/or relay existing pipe, and relay culvert end section.

1.2 RELATED SECTIONS

A. Section 02610: Pipe Culverts.

B. Section 02613: Culvert End Section.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 REMOVE, RELAY OR SALVAGE PIPE

A. Remove pipe from existing location.

B. Replace pipe damaged during operations at no additional cost to the DEPARTMENT.

C. Clean pipe.

D. Relay according to Section 02610.

E. Salvage as directed.

3.2 RELAY CULVERT END SECTION

A. Relay the culvert end sections according to Section 02613.

B. Replace culvert end sections damaged by operations at no additional cost to the DEPARTMENT.

END OF SECTION

SECTION 02622

UNDERDRAIN

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing pipe underdrains.

1.2 RELATED SECTIONS

A. Section 02061: Select Aggregate.

B. Section 02075: Geotextile.

C. Section 02610: Pipe Culverts.

1.3 REFERENCES

A. AASHTO M 252: Corrugated Polyethylene Drainage Tubing.

PART 2 PRODUCTS

2.1 PIPE

A. Corrugated Steel Pipe and Pipe Arch: Refer to Section 02610.

2.2 DRAINAGE GEOTEXTILES

A. When required refer to Section 02075.

2.3 UNDERDRAIN GRANULAR BACKFILL

A. Refer to Section 02061.

PART 3 EXECUTION

3.1 PLACEMENT

A. Excavate a trench to a depth of 75 mm below the underdrain pipe flow-line and to a width of the outside diameter of the pipe plus 0.6 m.

B. If required, place drainage geotextiles to plan requirements, and following Section 02075.

C. Place underdrain granular backfill in the trench, compacting the bottom 75 mm. Follow Sections 02061.

D. Place pipe with slots or perforations down, or as specified in the plans.

E. Lay an open joint concrete underdrain pipe with the bell or groove end up and the spigot end fully entered into the bell.

F. Compact backfill material in 150 mm layers to 96 percent of maximum laboratory density. Follow AASHTO T 99, Method C.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

SECTION 02643

CONCRETE-LINED DITCH

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing concrete-lined ditch.

1.2 RELATED SECTIONS

A. Section 02324: Compaction.

B. Section 03055: Portland Cement Concrete.

C. Section 03152: Concrete Joint Control.

PART 2 PRODUCTS

2.1 CONCRETE

A. Class A(AE). Refer to Section 03055.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Construct concrete-lined ditch placing contraction joints at 3 m intervals, and expansion joints at 9 m intervals. Refer to Section 03152.

B. Finish inside of ditch with a moist, wooden float to remove projections and honeycomb.

C. Slip-form pavers may be used.

D. When placing ditch on a raised berm, compact berm following Section 02324.

END OF SECTION

SECTION 02645

PRECAST CONCRETE BOX CULVERT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Material and procedures for fabricating and installing single cell precast concrete box culverts.

1.2 RELATED SECTIONS

A. Section 02056: Common Fill.

B. Section 02317: Structural Excavation.

C. Section 02324: Compaction.

D. Section 03055: Portland Cement Concrete.

E. Section 03211: Reinforcing Steel and Welded Wire.

1.3 REFERENCES

A. AASHTO M 198: Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

B. AASHTO M 259: Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers.

C. AASHTO M 273: Precast Reinforced Concrete Box Sections for Culverts, Storm Drains, and Sewers with Less Than 2 Feet Of Cover Subjected to Highway Loadings.

1.4 SUBMITTALS

A. Shop Drawings: Furnish 5 copies to the ENGINEER.
   1. Make shop drawings on "A1" metric series size, 841 mm x 94 mm sheets with a 50 mm blank margin on the left-hand edge.
   2. Place the State project designation data in the lower right-hand corner of each sheet.
   3. Prepare shop drawings under seal of a Professional Engineer.

B. Units fabricated prior to written approval will be rejected.

1.5 ACCEPTANCE

A. DEPARTMENT will reject pre-cast box sections with an average compressive strength of the three cylinders that is less than 34 500 kPa.

PART 2 PRODUCTS

2.1 CONCRETE

A. Wet Cast Concrete: Class 4A(AE). Follow Section 03055.

B. Dry Cast Concrete:

1.	Minimum cement content:	335 kg/m^3 of concrete.
2.	Maximum Water/cement Ratio:	0.33 L/kg.
3.	Mix Design:	Submit for approval.

2.2 REINFORCING STEEL AND WELDED WIRE

A. Refer to Section 03211.

B. Meet AASHTO M 259M, and AASHTO M 273M.

2.3 FLEXIBLE GASKET

A. Meet AASHTO M 198.

B. 25 mm minimum initial thickness.

C. 1290 mm^2 minimum in cross section.

2.4 QUALITY ASSURANCE

A. DEPARTMENT will pre-qualify manufacturers of pre-cast concrete box culvert sections as a supplier of pre-cast concrete products in accordance with "Quality Management Plan: Pre-cast/Prestressed Concrete Structures."

B. Permanently mark each precast unit with date of casting and identification number supplied by the inspector. Stamp markings in fresh concrete.

C. Prevent cracking or damage during handling and storage of precast units.

D. Replace cracked or damaged precast units at no additional cost to the DEPARTMENT.

PART 3 EXECUTION

3.1 MANUFACTURE

A. Meet AASHTO M 259M, and AASHTO M 273M.

B. Portland Cement Concrete: Follow Section 03055.

3.2 INSTALLATION

A. Installation with 0.6 m or less cover, follow AASHTO M 273M.

B. Installation with greater than 0.6 m of cover, follow AASHTO M 259M.

3.3 STEEL REINFORCEMENT

A. Follow Section 03211.

3.4 JOINTS

A. Make joint opening between box sections less than 25 mm measured face to face of the concrete.
   1. Reject the box section(s) when the installation tolerance cannot be met due to casting variations.
   2. Prevent soil from being forced into the joint as the box sections are placed.

3.5 LIFTING HOLES

A. A maximum of four lifting holes may be provided in the top slab, each having a maximum diameter of 75 mm.

B. Locate holes to avoid interference with the reinforcing steel.

C. Plug holes with a 1/1 sand to cement grout.

3.6 CONNECTION TO CAST-IN-PLACE CONCRETE

A. Where precast box sections join cast-in-place concrete, project the reinforcing steel a minimum of 300 mm out of the precast box section and square off the concrete face.

3.7 REPAIRS

A. Box sections may be repaired as allowed in the referenced specification only when approved in advance by the ENGINEER.

B. Making repairs in advance of approval will be cause for rejection.

3.8 MINIMUM LENGTH

A. No individual standard box segment may be less than 1.5 m.

3.9 BEDDING AND BACKFILL

A. Excavate the material under the box location in compliance with Section 02317, paragraph 3.2 to a minimum depth of 100 mm.

B. Backfill with granular backfill borrow as specified in Section 02056, Part 2.

C. Compact following Section 02324.

END OF SECTION

SECTION 02705

PAVEMENT SAWING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Saw pavements, curb and gutter, sidewalk, and/or any appurtenances as required to provide a smooth surface to match.

1.2 RELATED SECTIONS

A. Section 02748: Prime Coat/Tack Coat.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 PROCEDURE

A. Make a vertical cut through the full depth of surface in a straight line.

B. Where the edge of the existing surface is cracked, broken, or deteriorated, make the cut so the defective surface can be removed.

C. Do not allow traffic or construction equipment to cross the cut edge.

D. When appropriate, apply a tack coat to the cut edge before placing hot mix asphalt surfacing. Refer to Section 02748.

END OF SECTION

SECTION 02708

HOT MIX ASPHALT (QC/QA) - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control measures concerning products and procedures for laying and compacting a surface course of one or more layers of asphalt concrete pavement composed of aggregate, asphalt cement, lime, and other additives.

1.2 RELATED SECTIONS

A. Section 01452: Profilograph.

B. Section 02741: Hot Mix Asphalt.

C. Section 02745: Asphalt Material.

D. Section 02746: Hydrated Lime.

E. Section 02748: Prime Coat/Tack Coat.

F. Section 02961: Rotomilling.

G. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects).

1.3 REFERENCES

A. AASHTO PP 28: Practice for Superpave Volumetric Design for Hot Mix Asphalt.

B. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

C. AASHTO T 19: Unit Weights and Voids in Aggregate.

D. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

E. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

F. AASHTO T 40: Sampling Bituminous Materials.

G. AASHTO T 89: Determining the Liquid Limit of Soils.

H. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

I. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

J. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

K. AASHTO T 112: Clay Lumps and Friable Particle in Aggregate.

L. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

M. AASHTO T 195: Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures.

N. AASHTO T 255: Total Moisture Content of Aggregate by Drying.

O. AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.

P. AASHTO TP 4: Method of Preparing and Determining the Density of Hot Mix Asphalt (HMA) specimens by means of the SHRP Gyratory Compactor.

Q. Asphalt Institute SP-2: Compaction of Bituminous Gyratory Specimen.

R. ASTM D 979: Sampling Bituminous Pavement Mixtures.

S. ASTM D 2726: Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

T. ASTM D 2950: Density of Bituminous Concrete In-Place by Nuclear Methods.

U. ASTM D 3549: Thickness or Height of Compacted Bituminous Paving Mixtures Specimens.

V. ASTM D 3665: Random Sampling of Construction Materials.

W. ASTM D 3666: Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials.

X. ASTM D 4561: practice for Quality Control Systems for an Inspection and Testing Agency for Bituminous Paving Materials.

Y. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

Z. ASTM D 5506: Practice for Organizations Engaged in the Certification of Personnel Testing and Inspecting Bituminous Paving Materials.

AA. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

BB. ASTM D 6307: Asphalt Content of Hot-Mix Asphalt by Ignition Method.

CC. ASTM E 178: Dealing with Outlying Observations.

DD. ASTM E 1274: Measuring Pavement Roughness Using a (California) Profilograph.

EE. Modified GDT-115: Georgia Loaded Wheel.

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. Refer to Section 02741, Part 2.

2.2 AGGREGATE

A. Refer to Section 2741, Part 2.

2.3 HYDRATED LIME

A. Refer to Section 2746, Part 2.

2.4 JOB-MIX DESIGN REQUIREMENTS

A. Satisfy all the requirements for Superpave Volumetric Mix Design. Refer to Section 02741, Part 2, paragraph: Job Mix Design Requirements. Exclude Calibration Factor for Burn Off Oven.

B. Submit the Volumetric Mix Design data. Refer to Section 02741, Part 2, paragraph: Job-Mix Design Requirements. Add the following:

1. Supply QC data for target job mix gradation selection. Use these target values for price adjustments in Table 1 in Section 02741 of the Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).
2. Perform design on each side of target values based on upper and lower limits (Table 6 in Section 02741 of the Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book), to determine the sensitivity of the target design.

C. Submit Lottman test data. Refer to Section 02741, Part 2, paragraph: Job-Mix Design Requirements.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN REQUIREMENTS

A. Comply with the requirements of Section 20741, Part 2, paragraph: Job-Mix Design Requirements.

2.6 CONTRACTOR INITIATED CHANGES IN JOB-MIX DESIGN

A. Follow requirements of Section 02741, Part 2.

PART 3 EXECUTION

3.1 ADDITION OF HYDRATED LIME

A. Follow requirements of Section 02741, Part 3.

3.2 ASPHALT CONCRETE MIXTURE

A. Follow requirements of Section 02741, Part 3.

3.3 ASPHALT STORAGE TANKS

A. Follow requirements of Section 02741, Part 3.

3.4 HMA PLANTS

A. Follow requirements of Section 02741, Part 3.

3.5 SURFACE PREPARATION

A. Follow requirements of Section 02741, Part 3.

3.6 SURFACE PLACEMENT

A. Follow requirements of Section 02741, Part 3.

3.7 COMPACTION

A. Follow requirements of Section 02741, Part 3.

3.8 LIMITATIONS

A. Follow requirements of Section 02741, Part 3.

3.9 CONTRACTOR QUALITY CONTROL

A. Reference the following standards for qualification, control, and guidelines:
   1. ASTM D 3666.

2. ASTM D 4561.
3. ASTM D 5506.

B. Include the following tests in Part 2, "Referenced Documents," for the three ASTM standards:
1. ASTM D 6307.
2. Asphalt Institute, SP-2.
3. UDOT 8-957, Lottman Test.
4. ASTM E 1274.

C. Establish and maintain a quality control system which will provide assurance that materials and completed construction submitted for acceptance conform to contract requirements.

D. Present a quality control plan demonstrating an understanding of the quality control responsibilities for specific items as included in these specifications at the Preconstruction Conference.

E. Identify the Quality Control Manager by name. The Quality Control Manager will implement and maintain the Quality Control Plan.

F. Provide the ENGINEER a certification stating that all the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures. As a part of the process for approving the CONTRACTOR's Plan, the ENGINEER may require the CONTRACTOR's technician to perform testing of samples to demonstrate an acceptable level of performance.

G. Perform quality control sampling, testing, and inspection during all phases of the work.

3.10 QUALITY CONTROL PLAN

A. Provide and maintain a Quality Control Plan (QCP) covering all personnel, equipment, supplies, and facilities necessary to obtain samples, perform and document tests, and otherwise ensure the quality of the product.

B. Describe the QCP in a written document prior to the start of any production or construction.

C. Submit the written QCP to the ENGINEER for verification at least 10 days before the start of operations.

D. The DEPARTMENT will make no partial payments for materials that are subject to specific quality control requirements without a verified QCP.

E. The QCP may be operated wholly or in part by the CONTRACTOR or an independent organization. The Plan's administration remains the responsibility of the CONTRACTOR, including compliance with the Plan and its modification.

F. Address the following minimum items:
   1. Quality control organization chart and area of responsibility and authority of each individual.
   2. Names and qualifications of personnel as required by this Section, paragraph: Quality Control Organization Personnel Requirements.
   3. Provide a description of outside organizations and their services (such as testing laboratories etc.) if employed.
   4. Tests required to be performed, the frequency of testing, sampling locations, and location of the testing facilities.
   5. Documentation of test procedures verifying tests are conducted in accordance with the testing plan, and that proper corrective actions are taken when required.
   6. Procedures for verifying that testing equipment is available, complies with specified standards, and has been calibrated against certified standards.
   7. Procedures for verifying that tests are conducted in accordance with the appropriate ASTM and AASHTO standards.
   8. Procedures for submitting test results to the ENGINEER daily.

G. Plan elements: address all elements that affect the quality of the HMA including:
   1. Mix Design
   2. Aggregate Grading
   3. Quality of Materials
   4. Stockpile Management
   5. Proportioning
   6. Mixing
   7. Placing and Finishing
   8. Sampling and Testing Procedures
   9. Joints
   10. Compaction
   11. Surface smoothness

3.11 QUALITY CONTROL ORGANIZATION

A. Implement the QCP by
   1. Establishing a separate Quality Control Organization.
   2. Developing an organization chart to show all quality control personnel and how these personnel integrate with other management, production, and construction functions and personnel.

B. Identify all quality control staff on the organization chart by name and function, and indicate the total staff required to implement all elements of the quality control programs, including inspection and testing functions for different items of work.

C. If an outside organization or an independent laboratory is used for implementation of all or part of the Plan, the personnel assigned are subject to the qualification requirements of this Section. Indicate on the organization chart which personnel are contractor employees and which are provided by an outside organization.

3.12 QUALITY CONTROL ORGANIZATION PERSONNEL REQUIREMENTS

A. As outlined in ASTM D 3666, Part 7, with the following modifications. Quality Control Manager:
   1. Institutes any and all actions necessary for the successful operation of the QCP to comply with specifications.
   2. Reports directly to a responsible officer in the CONTRACTOR's organization.
   3. May supervise the QCP on more than one project provided that the Quality Control Manager can be at the job site within one hour after being notified of a problem.

B. Certification of Personnel. As outlined in ASTM D 5506 with the following changes:
   1. Provide a sufficient number of quality control technicians to adequately implement the Plan. These personnel will be either engineers, engineering technicians, or experienced craftsmen with qualifications equivalent to NICET Level II or higher in their appropriate field and have a minimum of 2 years experience in their area of expertise.

C. Quality Control Technicians:
   1. Report directly to the Quality Control Manger.
   2. Inspect all plant equipment used in proportioning and mixing to verify proper calibration and operating condition.
   3. Perform quality control tests necessary to adjust and control mix proportioning in accordance with the job mix formula.
   4. Inspect all equipment used in placing, finishing, and compacting material to verify proper operating condition.
   5. Inspect placing, joint construction, and compaction during construction to verify conformance with the specifications and a finished product that meets specification requirements.
   6. Perform all quality control testing as required by this Section, paragraph: Quality Control Testing, including density monitoring.
   7. Detail the criteria to be used in correcting unsatisfactory production processes and construction practices.

3.13 QUALITY CONTROL TESTING LABORATORY

A. Reference ASTM D 4561 with the following additions:
   1. Provide a fully equipped asphalt laboratory located a maximum of 30 minutes travel time from the plant or job site.
   2. Keep laboratory facilities clean and all equipment maintained in proper working condition.
   3. Permit the ENGINEER unrestricted access to inspect the CONTRACTOR's quality control testing laboratory facility and witness quality control activities. The ENGINEER will advise in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies or testing personnel and procedures.
   4. Suspend work when test results indicate materials are out of specifications tolerances. Resume only when the deficiencies are corrected.

a. Perform quality audits under this standard.
b. Refer to UDOT QA Manual.

B. Sampling:
1. Use a statistically based procedure of random sampling that provides all materials being produced an equal chance of being selected for sampling and testing for final product.
2. The Engineer has the right to witness all sampling.

C. Noncompliance:
1. In cases where quality control activities do not comply with either the CONTRACTOR's Quality Control Program or the Contract provisions, or where the CONTRACTOR fails to properly operate and maintain an effective Quality Control Program, the ENGINEER may:
a. Order the Contractor to replace ineffective or unqualified personnel.
b. Carry out the functions and operation of the Contractor's approved Quality Control Program.
c. Deduct costs incurred by the Department to operate the program or otherwise remedy the noncompliance from the total amount due the Contractor.

3.14 QUALITY CONTROL TESTING

A. Perform all quality control tests necessary to control the production and construction processes applicable to these specifications and listed in the approved Quality Control Plan.

B. Establish a testing program to control as a minimum: asphalt content, aggregate gradation, VMA, post Lottman, temperatures, aggregate moisture, field compaction, and surface smoothness.

C. Monitoring: The Department reserves the right to monitor any or all of the above testing.

D. Follow the requirements of Table 1.

E. Field Gyratory Specimens:
1. Verify mix design parameters in this Section are met. Adjust the mix as required to meet the design parameters.
2. Mold field Gyratory specimens at mix design temperatures determined by the Region Materials Engineer.
3. Perform three tests (two Gyratory specimens for each test) of VMA and Air Voids for each lot.

Table 1

Quality Control Testing for Hot Mix Asphalt QC/QA			
Testing Method/ Acceptance Documentation	**Testing Frequency**	**Point of Acceptance**	**Required Action for out of Specification Material**
ASTM D 6307 **Asphalt content:** of Hot mix asphalt by the ignition method	4 tests per lot	Project Site	Correction information
AASHTO T 11, T 27, and T 30 **Gradation:** Mechanical analysis of the remains of the Ignition test.	4 tests per lot	Project Site	Correction Information
AASHTO T 255 **Moisture content:** of aggregate used in production by drying	One test per lot	Hot Plant	Correction for batch weight
Temperature for: dryer, bitumen in the storage tank, mixture at the plant, and mixture at the job site.	Record at least four times per lot	Project Site	Correction
ASTM D 2950 **In-place Density Monitoring**	10 densities per lot	Project Site	Change rolling pattern to meet density
AASHTO T 283 modified by UDOT 8-957 - **Lottman Method.**	Two tests per week.	Project Site	Maintain Index of retained strength of 72% minimum (90% of 80% TSR)
AASHTO TP 4 Field gyratory specimens for VMA	3 tests per lot, 2 gyratory per test	Project Site	Make corrections as needed.

3.15 CONTROL CHARTS

A. Maintain daily linear control charts both for mean and range. Include in charts aggregate gradation, asphalt content, stockpile gradation, VMA and in-place air voids.

B. Post control charts daily in a location satisfactory to the Engineer. As a minimum, identify:

1. Project number
2. Contract item number
3. Test number
4. Each test parameter
5. The upper and lower limits applicable to each test parameter

6. Test results

C. Use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the projected data during production indicates a problem and no corrective action is taken, the ENGINEER may suspend production or acceptance of the material.

3.16 QUALITY CONTROL REPORTS

A. Maintain records and submit daily reports of quality control activities.

3.17 AGENCY ACCEPTANCE TESTING

A. The ENGINEER performs the acceptance testing for gradation, asphalt content, VMA, density and thickness.

B. Obtain the samples for density and thickness.

C. Cease production when two days out of any three consecutive days of production result in a price deduction.

D. Before production continues, submit a corrective action plan to the ENGINEER indicating the changes in production procedures is implemented to correct the deficiencies in the mix before production continues.

3.18 GRADATION, ASPHALT CONTENT, VOIDS IN MINERAL AGGREGATE (VMA), AND POST LOTTMAN TESTS

A. Refer to Section 02741, Part 3, paragraph Gradation, Asphalt Content, VMA, and Post Lottman Tests.

B. ENGINEER will split samples three ways: one each for DEPARTMENT, CONTRACTOR, and referee sample. Clearly label the portion retained as a referee sample.

3.19 FIELD QUALITY CONTROL TESTS

A. Density. Refer to Section 02741, Part 3, paragraph: Density Tests.

B. Thickness. Refer to Section 02741, Part 3, paragraph: Thickness Testing.

C. Smoothness. Refer to Section 01452, Part 3, paragraph: Testing and Correcting Pavement.

D. Finished Surface and Surface Requirements. Refer to Section 01452, part 3, paragraph: Testing and Correcting Pavement.

3.20 REFEREE TESTING

A. Refer to Section 02741, Part 3, paragraph: Referee Testing.

3.21 SMALL QUANTITIES TESTING

A. To reduce over testing of small quantity production days, e.g. ramps, bridgework, etc. the ENGINEER may choose to combine production from several days to form a single lot.

END OF SECTION

SECTION 02712

LEAN CONCRETE BASE COURSE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing a Lean Concrete Base Course.

1.2 RELATED SECTIONS

A. Section 02752: Portland Cement Concrete Pavement.

1.3 REFERENCES

A. AASHTO M 85: Portland Cement.

B. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete.

C. AASHTO M 154: Air-Entraining Admixtures for Concrete.

D. AASHTO M 194: Chemical Admixtures for Concrete.

E. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

F. AASHTO T 19: Unit Weight and Voids in Aggregate.

G. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

H. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

I. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

1.4 ACCEPTANCE

A. Refer to Section 02752, Part 1, paragraph: Acceptance - Over Lean or Untreated Base Course, with the following modifications:
   1. No strength tests will be required for acceptance.
   2. ENGINEER will take cores to determine thickness-acceptance criteria at random locations with one core representing 1000 m^2 (a sublot).

3. Three measurements (using a tape measure) will be made on each core. The average of these measurements will be used as the length of x.

x = Average length of core
n = Number of cores (1 per sublot)
= Average length for entire project (lot)

$$= \frac{3\ x}{n}$$

1.5 QUALITY ASSURANCE - STOCKPILES

A. DEPARTMENT will require new trial batches and tests if the stockpile gradation changes from the job-mix gradation by more than the allowable variation as shown in Table 1.

B. Provide adequate supplies of aggregate and stockpiles for sampling and testing 7 days before construction.

C. Make sufficient quantity of material available in the stockpiles to supply the mixing plant at full capacity and to provide continuous placing.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT

A. Type I or Type II following AASHTO M 85.
   1. The DEPARTMENT may retest cement that has been stored over 60 days.
   2. Do not use cement containing lumps or cement that has partially set.

2.2 AGGREGATE

A. Portion of aggregate passing the 425 Fm sieve: non-plastic. AASHTO T 90.

B. Wear: Cannot exceed 50 percent. AASHTO T 96.

C. Dry-rodded unit weight: At least 1200 kg/m3. AASHTO T 19.

D. Aggregate Job-Mix Gradation: AASHTO T 11, and AASHTO T 27.

E. Meet Table 1.

Table 1

Aggregate - Lean Concrete Base Course		
	Job-Mix Gradation Band	**Allowable Variation From Job-Mix Gradation**
Sieve Size	**Percent Passing**	**Percent**
37.5 mm	100	-
25 mm	85 - 100	-
19 mm	50 - 100	±8
9.5 mm	30 - 75	±8
4.75 mm	25 - 60	±8
425 Fm	8 - 25	±4
75 Fm	0 - 9	±3

2.3 WATER

A. Refer to Section 02752, Part 2.

2.4 ADMIXTURES

A. Air-entraining agents. AASHTO M 154.

B. Water-reducing admixtures: AASHTO M 194, Type A, except:
   1. Relative durability factor: at least 90.
   2. Chlorides content (as Cl^-): not exceeding one percent by weight of the admixtures.

C. Do not use calcium chloride.

2.5 CURING COMPOUND

A. As specified for white, pigmented material with wax base.

B. Meet AASHTO M 148, Type II.

2.6 BOND BREAKER

A. Use curing compound following paragraph 2.5 above.

2.7 EQUIPMENT

A. Refer to Section 02752, Part 2, paragraphs: Batch Plant, Testing Platform, Vehicles for Hauling, Cylinder Storage Device, Slip Form Paver, Finishing Equipment Requirements; and Pavement Surface Roughness Testing Device - Profilograph.

2.8 JOB-MIX DESIGN

A. Provide the ENGINEER with a written job-mix design for approval before placing lean concrete base course.
   1. Base the job-mix design on trial batch results that verify the concrete mix design strength.
   2. Do not change the job-mix design without written approval.
   3. Meet the requirements in Table 2.

Table 2

Job-Mix Design Requirements		
Slump	Air Content	Minimum Design Compressive Strength
Millimeters	Percent	(kPa, 7 days)
60 ±35	4.5 ±1.5	5200

   4. Use a minimum of 150 kg of cement per cubic meter of concrete.
   5. Do not exceed the water-cement ratio determined by the trial batches.

PART 3 EXECUTION

3.1 CONSTRUCTION METHODS

A. Line and Grade Control: Refer to Section 02752, Part 3.

B. Pre-Wetting Base Course:
   1. Moisten the subbase prior to placement.
   2. If the subbase dries, sprinkle it without forming puddles or mud.
   3. Keep at least 150 m of subbase prepared ahead of the paver.

C. Formed paving option: Refer to Section 02752, Part 3.

D. Batching materials: Refer to Section 02752, Part 3.

E. Placing lean concrete base: Refer to Section 02752, Part 3.

F. Finishing:
   1. Screed the lean concrete base course to maintain line and grade within 10 mm ± in 3m.
   2. Hand methods of strike-off and consolidation will be permitted when the base width is less than 3 m or where machine screeding is impractical.

3. Fill porous areas.

3.2 CURING

A. Curing Compound:
   1. Warm curing compound (to a temperature not exceeding 38 degrees C) when it is too viscous for application.
   2. Do not dilute or alter the compound.
   3. Thoroughly mix the compound before application, and agitate the compound continuously during application.

B. Application:
   1. Immediately following finishing operations, spray entire exposed area of lean concrete base course (top and sides) with curing compound at a rate of 0.25 L/ m^2 of surface.
   2. Apply compound with fully atomizing mechanical sprayers equipped with wind-protective hoods.
   3. Hand spraying will be permitted on small areas and areas inaccessible to mechanical spraying equipment.
   4. Amply cover edges, corners, sides, and rough spots with curing compound.

C. Immediately repair damage to the film of curing compound occurring within 72 hours of application.

3.3 BOND BREAKER

A. Apply a second application of curing compound (0.25 L/m^2) within 48 hours before placing portland cement concrete pavement.

3.4 TRAFFIC CONTROL

A. Do not allow traffic or construction equipment until 72 hours after placing.

B. After 72 hours, trucks hauling portland cement concrete for pavement will be permitted to maneuver (for only the minimum length necessary to back into paver).

C. After the lean concrete base has cured for seven days, legal loads may be hauled provided that:
   1. Hauling is limited to the lane adjacent to the median.
   2. Hauling does not cause damage.

D. Reduce the load or refrain from hauling if damage occurs.

E. Repair all damage at no additional cost to the DEPARTMENT.

END OF SECTION

SECTION 02715

HYDRATED LIME TREATED ROADBED

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing a compacted hydrated lime treated roadbed.

1.2 RELATED SECTIONS

A. Section 02745: Asphalt Material.

B. Section 02746: Hydrated Lime.

1.3 REFERENCES

A. AASHTO T 26: Quality of Water to be Used in Concrete.

B. AASHTO T 99: The Moisture-Density Relations of Soils Using a 5.5 lb (2.5 kg) Rammer and a 12 inch (305 mm) Drop.

C. AASHTO T 238: Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth).

D. AASHTO T 239: Moisture Content of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth).

1.4 ACCEPTANCE

A. The DEPARTMENT will conduct random sample tests on the grade.

B. Acceptance Criteria for Density:
   1. Lot-by-lot basis where a lot consists of a single layer of not more than 6500 m^2 placed.
   2. A lot is divided into five approximately equal-sized sublots (1300 m^2).
   3. The DEPARTMENT will conduct one random moisture and density test within each sublot. AASHTO T 238 and AASHTO T 239.
   4. DEPARTMENT will accept a lot when the results of the five density tests indicate that the average of 96 percent of maximum laboratory density has been met, with no test less than 92 percent. AASHTO T 99, Method D.

C. Rework unacceptable lot layer at no additional cost to the DEPARTMENT.

PART 2 PRODUCTS

2.1 HYDRATED LIME

A. Refer to Section 02746.

2.2 WATER

A. Potable water or water that meets the specified test standard. AASHTO T 26.

B. Screen out extraneous material when pumping water from streams, ponds, lakes, etc., by enclosing and positioning the water intake.

2.3 ASPHALTIC MATERIAL

A. Refer to Section 02745.

PART 3 EXECUTION

3.1 PREPARATION

A. Compact and finish the roadbed to the lines and grades shown.

B. Scarify the surface over the entire width to the depth shown.

C. Mechanically pulverize the material until all soil lumps are broken up.

D. Remove all unacceptable material and stones greater than 75 mm.

E. Windrow scarified/pulverized material to facilitate compaction.

F. Firmly compact the subgrade below the scarified soil to 90 percent of maximum density. AASHTO T 99, Method B.

G. Correct soft or yielding areas before adding hydrated lime.

3.2 LIMITATIONS

A. Do not mix and place lime-treated roadbed when the material is frozen.

B. Begin work when the air temperature is at least 5 degrees C in the shade and rising.

3.3 PROPORTION AND MIX

A. Uniformly spread the material to be treated over the full width of the roadbed to obtain the compacted thickness shown.

B. Combine hydrated lime and water for the slurry.

1. Measure water with a calibrated meter and weigh hydrated lime on approved scales.
2. Mix at a ratio of approximately 1000 kg of hydrated lime to 2000 L of water in a central mixing tank or in the tanks used for distribution.
3. The mixing tank must agitate the slurry, providing uniform moisture and preventing settlement of the lime after mixing.

C. Apply the water-lime slurry with distributors that agitate the slurry during hauling and spreading.

D. Adjust the number and rate of applications to achieve the required quantity of residual lime without runoff.

E. Lightly scarify the surface to facilitate absorption of the slurry and to prevent runoff.

F. Maintain the moisture content of the material during processing within two percent of the optimum. AASHTO T 99, Method D.

G. Thoroughly blend the material and lime slurry with a traveling mixer until the mixture is uniform in appearance, texture, and moisture content, and is free from pockets of segregated material.

H. Cure the mixture for at least 48 hours before final spreading and compaction.

I. Sprinkle the surface lightly during this curing period to compensate for evaporation loss.

3.4 COMPACTION

A. Spread the mixture over the roadbed and roll the surface with a steel wheel, sheep's foot, pneumatic roller, or a combination.

B. Maintain the optimum moisture content during compaction within two percent of optimum as shown in paragraph 3.3.G. Dry or sprinkle the mixture uniformly to meet the above moisture requirement.

3.5 FINISHING

A. Bring the roadbed to within ±15 mm of line and grade.

3.6 MEMBRANE SEAL

A. When shown on the typical section, seal the compacted roadbed with asphaltic material according to the type and rate shown.

B. Keep the membrane seal intact until it is covered by base or surface material.

C. Apply additional membrane seal to those areas where it has been destroyed under construction traffic or adjacent work at no additional cost to the DEPARTMENT.

END OF SECTION

SECTION 02721

UNTREATED BASE COURSE (UTBC) - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Production, construction and compaction of untreated base course material.

1.2 REFERENCES

A. AASHTO T 11: Materials Finer than 75 Fm (no. 200) Sieve in Mineral Aggregates by Washing.

B. AASHTO T 19: Unit Weight and Voids in Aggregate.

C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

D. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

E. AASHTO T 96: Resistance to Degradation of Small-Sized Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

F. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb) Rammer and 457 mm (18 in) Drop.

G. AASHTO T 238: Density of Soil and Soil Aggregate (In-Place) by Nuclear Methods (Shallow Depth).

H. AASHTO T 239: Moisture Content of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. **Mean of the Deviations:** The sum of the absolute values of the deviations divided by the number of tests in the lot. Refer to Table 2.

1.4 SUBMITTALS

A. Ten days before placement begins, submit a written report on the following:
   1. Aggregate suitability. Refer to this Section, Part 2.
   2. Name of supplier and source.
   3. Job mix gradation including single values for each sieve size based on the dry weight of the aggregate.

B. Resubmit all documents before a day's production starts if a change in source is required.
   1. Changes must fall within bands of Table 4 in this Section, and are subject to approval.
   2. Retroactive changes are allowed only for the first day's production for each construction season.

1.5 QUALITY ASSURANCE

A. Remove products found defective after installation and install acceptable products at no additional cost to the DEPARTMENT.

1.6 ACCEPTANCE

A. ENGINEER will take random sample tests on the grade.

B. Acceptance will be on a lot-by-lot basis where a lot consists of a single layer of not more than 6500 m^2 placed, with five approximately equal sublots of 1300 m^2.
   1. Conduct one random moisture and density test within each sublot. AASHTO T 238, and AASHTO T 239.
   2. The results of five density tests must indicate that the average of 97 percent of maximum laboratory density has been met with no test less than 94 percent. AASHTO T 180, Method D.
   3. Lot Size: One day's production.

C. Do not place additional material on any unaccepted layer.

D. Rework unacceptable material at no additional cost to the DEPARTMENT.

E. Number of samples taken per lot is shown in Table 1.

Table 1

Number of UTBC Samples Per Lot	
Lot Quantity (Megagram)	Number of Samples
Lot > 2500	5
1500 # Lot # 2500	4
Lot < 1500	3

F. Pay Factors: Pay factors for Contract Price adjustment are as follows:

Table 2

Pay Factors for Noncomplying Aggregate Gradation						
Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

PART 2 PRODUCTS

2.1 AGGREGATES

A. Clean, hard, tough, durable and sound mineral aggregates that consist of crushed stone, crushed gravel or crushed slag; free of detrimental and organic matter; and complies with the following.

Table 3

Aggregate Properties		
Dry Rodded Unit Weight	Not less than 1200 kg/m^3	AASHTO T 19
Material Passing 425 Fm Sieve	Non plastic	AASHTO T 90
Aggregate Wear	Not to exceed 50 percent.	AASHTO T 96
Dry Weight Values	Within bands shown in Table 4	
Gradation Limits	Table 4	AASHTO T 11 AASHTO T 27

Table 4

Gradation Limits - Single Value Job-Mix Formula			
Sieve Size	**Percent Passing of Total Aggregate (Dry Weight)**		
	37.5 mm	25 mm	19 mm
37.5 mm	100	--	--
25 mm	--	100	--
19 mm	81 -91	--	100
12.5 mm	67 - 77	79 - 91	--
9.5 mm	--	--	78 - 92
4.75 mm	43 - 53	49 - 61	55 - 67
1.18 mm	23 - 29	27 - 35	28 - 38
75 Fm	6 - 10	7 - 11	7 - 11

Untreated Base Course: Based on fine and coarse aggregate having approximately the same bulk specific gravities.

2.2 SOURCE QUALITY CONTROL

A. Aggregate: Comply with AASHTO T 27.
   1. Select samples randomly.
   2. Determine the suitability of the aggregate source.
   3. Document the following.
      a. Date of test analysis.
      b. Sieve Analysis.

c. Organic impurities.

B. If tests indicate materials do not meet specified requirements, change material source and retest at no additional cost to DEPARTMENT.

PART 3 EXECUTION

3.1 STOCKPILING

A. Stockpile in sufficient quantities for construction, separate different materials and prevent mixing.

B. Maintain optimum moisture content of stockpiles.

C. Prevent erosion or deterioration of stockpiles.

3.2 INSTALLATION

A. Mixing: Provide an optimum moisture content of ±2 percent at the time of placement. AASHTO T 180, Method D.

B. Placing: Place layers in equal thickness and compact each layer to a thickness not to exceed 150 mm in depth. Do not place on a frozen subgrade or a frozen layer.

C. Compacting: Compact to 97 percent of maximum laboratory density. Maintain optimum moisture content ±2 percent. AASHTO T 180, Method D.
   1. Adjacent to back walls of structure abutments and approach slabs, use a hand-operated vibratory compactor or a vibratory roller.

D. Finishing: Uniform line and grade with surface deviations no more than 10 mm ± in 3 m.

END OF SECTION

SECTION 02741

HOT MIX ASPHALT - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for mixing, laying, and compacting a surface course of one or more layers of asphalt concrete pavement for standard projects less than 50,000 Mg. (Volumetric - gyratory design)

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 01452: Profilograph.

B. Section 02745: Asphalt Material.

C. Section 02746: Hydrated Lime.

D. Section 02748: Prime Coat/Tack Coat.

E. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects).

1.3 REFERENCES

A. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

B. AASHTO T 19: Unit Weights and Voids in Aggregate.

C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

D. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

E. AASHTO T 40: Sampling Bituminous Materials.

F. AASHTO T 89: Determining the Liquid Limit of Soils.

G. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

H. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

I. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.

J. AASHTO T 112: Clay Lumps and Friable Particles in Aggregate.

K. AASHTO T 168: Sampling Bituminous Paving Mixtures.

L. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

M. AASHTO T 195: Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures.

N. AASHTO T 209: Maximum Specific Gravity of Bituminous Paving Mixtures.

O. AASHTO T 255: Total Moisture Content of Aggregate by Drying.

P. AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.

Q. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

R. Asphalt Institute SP-1.

S. Asphalt Institute SP-2: Compaction of Bituminous Gyratory Specimen.

T. ASTM D 979: Sampling Bituminous Paving Mixtures.

U. ASTM D 2041: Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

V. ASTM D 2726: Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.

W. ASTM D 3549: Thickness or Height of Compacted Bituminous Paving Mixture Specimens.

X. ASTM D 3665: Random Sampling of Construction Materials.

Y. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

Z. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

AA. ASTM D 6307: Asphalt Content of Hot-Mix Asphalt by Ignition Method.

BB. ASTM E 178: Dealing With Outlying Observations.

CC. ASTM E 1274: Measuring Pavement Roughness Using a (California) Profilograph.

DD. Modified GDT-115: Georgia Loaded Wheel.

1.4 ACCEPTANCE

A. Obtain samples for density and thickness.

B. Thickness acceptance based on the average thickness of a lot. ASTM D 3549.
   1. The DEPARTMENT will accept a lot when:
      a. The average thickness of all sublots is not more than 12 mm greater nor 6 mm less than the total thickness specified.
      b. No individual sublot shows a deficient thickness of more than 9 mm.

C. Density: The target density for determining pay adjustment will be 93.5 percent of maximum Rice density. AASHTO T 209.

D. The ENGINEER will conduct the acceptance testing for gradation, asphalt content, VMA, density, and thickness. AASHTO T 30.

E. ENGINEER or designated representative may sample any portion of HMA production that appears non-uniform or defective.

F. Cease production when two days of three consecutive days result in a price reduction.

G. Before production continues, submit a corrective action plan to the ENGINEER indicating the changes in production procedures that will be implemented to correct the deficiencies.

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. Refer to Plans Summary Sheet and/or specifications for designated PG Binder.

B. Asphalt material: Refer to Section 02745.

C. Sampling procedure: UDOT Test Procedure 8-209.

2.2 AGGREGATE

A. Refer to the Minimum Testing Requirements.

B. 100 percent crushed virgin aggregate material consisting of crushed stone, gravel, or slag. Conform to Section 02969 for recycled mixes.

C. Use the following requirements, including Table 1, to determine the suitability of the aggregate sources.

1. Coarse aggregates:
   a. Clean, hard, durable, angular, and sound fragments.
   b. Free from organic matter or other detrimental substances.
2. Fine aggregates:
   a. Clean, hard grained, angular.
   b. Passing the 4.75 mm sieve.
   c. Containing no more than 2 percent by mass of organic matter or other detrimental substances. AASHTO T 112
   d. Plasticity Index of 1. AASHTO T 89, and AASHTO T 90.
3. Uniform density and quality with a minimum dry-rodded unit mass of 1200 kg/m^3. AASHTO T 19.
4. Maximum mass loss of 16 percent when subjected to five cycles of sodium sulfate. AASHTO T 104.
5. Maximum mass loss of 35 percent for Category 1 and 40 percent for Category 2 highways on L. A. Wear Test. AASHTO T 96.

Table 1

Aggregate Properties - Hot Mix Asphalt			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	ASTM D 5821	95% min. All three gradations.	85% min. (25.0 and 19.5 mm) 90 % min. (12.5 mm)
Two Fractured Face	ASTM D 5821	90% min. All three gradations	80% min. (25.0 and 19.5 mm) 90 % min. (12.5 mm)
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 % max.
Sand Equivalent	AASHTO T 176	60 min.	45 min.
Natural Fines	None	Not Allowed	10 % max.
Category 1: National Highway System and Truck Routes - Table 4. Category 2: All Other Routes			

D. Meet gradation requirements in Table 2. AASHTO T 30.

Table 2

Aggregate Gradations (Percent Passing by Dry Mass of Aggregate)				
		Hot Mix Asphalt		
Nominal Sieve Size (mm)		**25.0**	**19.0**	**12.5**
Control Sieves	**37.5**	100.0	-	-
	25	90.0 - 100.0	100.0	-
	19	<90	90.0 - 100.0	100.0
	12.5	-	<90	90.0 - 100.0
	9.5	-	-	<90
	2.36	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0
	0.075	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0
Caution Zone Boundaries (Informa-tion only)	**4.75**	39.5	-	-
	2.36	26.8 - 30.8	34.6	39.1
	1.18	18.1 - 24.1	22.3 - 28.3	25.6 - 31.6
	0.6	13.6 - 17.6	16.7 - 20.7	19.1 - 23.1
	0.3	11.4	13.7	15.5

2.3 HYDRATED LIME

A. Meet the requirements of Section 02746, Part 3, paragraph: Quality Control, Verification.

2.4 JOB-MIX DESIGN REQUIREMENTS

A. Satisfy all the requirements for Superpave Volumetric Mix Design according to Asphalt Institute, SP-1, and SP-2, including:
   1. Lottman
   2. Calibration Factor for Burn Off Oven
   3. Pavement Analyzer
   4. Submit Post Lottman data on HMA, and meet the system Tensile Stress Requirement.
   5. Hamburg Rut Tester (by DEPARTMENT) on production mix, for information only.
   6. Use a Hot Mix Asphalt AASHTO Materials Reference Laboratory (AMRL) accredited lab to perform the mix design, in accordance with Asphalt Institute SP-1, SP-2.

7. Use a FHWA-protocol approved Superpave Gyratory Compactor in accordance with the Asphalt Institute Superpave Series No. 2 (SP-2).
8. Meet all volumetric mix design requirements for the selected target gradations.

B. Submit the Volumetric Mix Design data for verification at least 10 working days before beginning paving. Do not begin paving until verification is complete.
1. Include all information regarding selection of design aggregate structure showing the target values of percent passing on all standard sieves and the design asphalt binder content.
2. After the design is complete, run 4 sets of 2 Gyratory specimens to verify the optimum asphalt and all other design requirements.
3. Provide information that job mix gradation meets requirements of Table 1.

C. Submit Lottman test data including both Method A and Method B lime slurry. Refer to Section 02746.
1. Comply with UDOT Materials Manual 8-957.
2. Index of retained strength required: minimum 80 percent.
3. AASHTO T 283.

D. The Region Materials Lab will verify that the Volumetric Mix Design meets all requirements of this Section and Asphalt Institute SP-2.

E. Designate asphalt binder supplier.

F. Comply with limits supplied by the Region Materials Engineer for Gyratory mixing and compaction temperatures.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN

A. Comply with requirements in Table 3.
1. Hot Plant Mixing Temperature: Set by the ENGINEER.
2. Voids in Mineral Aggregate (VMA) at N_{design} (Laboratory Mix): (Asphalt Institute SP-2, p.45; Equation based on percent of Total Mixture).
   a. 12.0 percent - 14.0 percent for 25.0 mm.
   b. 13.0 percent - 15.0 percent for 19.0 mm.
   c. 14.0 percent - 16.0 percent for 12.5 mm.
3. Pavement Analyzer: < 3.81 mm. (At high temperature of PG Asphalt). Modified GDT-115.
4. Hamburg Rut Test: < 10 mm. (By DEPARTMENT) on production mix, for information.
5. G_{mm}: Maximum Specific Gravity of Rice Mix.
6. 20 years Design ESALS as defined in the plan summary sheets.

B. Prepare and submit 2 sets (5 samples each) of ignition oven calibration samples at the verified design binder content. DEPARTMENT will use these samples to determine the correction factors for the Region and Field lab ignition oven.

Table 3

Superpave Volumetric Mix Design - Hot Mix Asphalt Number of Gyrations Table				
20 Years Design ESALS (Million)	**Compaction Parameters**			**Void Villed with Asphalt (VFA) (%)**
	$N_{initial}$ / % of G_{mm}			
0.3	6/# 91.5	50/96	75/ # 98	70 - 80
0.3 to <3	7/# 90.5	75/96	115/ # 98	65 - 78
3 to < 30	8/# 89	100/96	160/ # 09	65 - 75
$30	9/ # 89	125/96	205/ # 98	65 - 75

2.6 CONTRACTOR INITIATED CHANGES IN JOB-MIX DESIGN

A. Submit a field volumetric mix design if changes occur in either or both the target gradation value, or the design asphalt cement content.
   1. Field volumetric design to verify volumetric properties consists of six gyratory specimens run a the new gradation or asphalt content.
   2. If the field volumetric design does not meet the volumetric requirements, submit a new job mix design from an AMRL-accredited laboratory, allowing at least 4 working days for verification of the new design target values.
   3. Use new target values only after verification is complete.

B. Submit a new volumetric mix design if changes occur in either or both the aggregate source, or the asphalt binder source or grade.

C. The ENGINEER will review, and the Region Materials Engineer will verify the submittal. Meet all the requirements of this Section, Part 2, paragraph: Job Mix Design Requirements, and paragraph: Superpave Volumetric Mix Design. Asphalt Institute SP-1, SP-2.

D. The Region Materials Lab will perform up to 2 free volumetric mix design verifications (initial plus one revised) for each project and will charge $2000 for each additional CONTRACTOR initiated change.

PART 3 EXECUTION

3.1 ADDING HYDRATED LIME

A. Method A, Lime Slurry; or Method B, Lime Slurry Marination: Refer to Section 02746. AASHTO T 283.
   1. Comply with UDOT Materials Manual 8-957.

2. Incorporate (1 percent for Method A and 1 ½ percent for Method B) minimum hydrated lime by dry weight of aggregate into all mixtures.
3. Perform Lottman tests to determine if additional hydrated lime is required.
4. Minimum retained strength: 80 percent.

3.2 HOT MIX ASPHALT (HMA)

A. Dry aggregate to an average moisture content of not more than 0.2 percent by weight. AASHTO T 255. Do not allow damage or soot contamination.

B. Maintain temperature of the HMA between established limits.
1. Do not overheat the materials or cause thermal damage to the asphalt cement.
2. DEPARTMENT will reject and CONTRACTOR will remove materials heated over the established limits.

C. Coat with asphalt cement 100 percent of the particles passing and 98 percent of the particles retained on the 4.75 mm sieve.
1. AASHTO T 195.
2. Discontinue operation and necessary corrections if material is not properly coated.

3.3 HMA PLANTS

A. Provide:
1. Positive means to determine the moisture content of aggregate.
2. Positive means to sample all material components.
3. Sensors to measure the temperature of the hot mixture at discharge.
4. The ability to maintain discharge temperature of the mix in accordance with the mix design.

B. Asphalt Storage Tanks:
1. Provide calibrated tanks so the quantity of material remaining in the tank can be determined at any time.
2. Provide a positive means of sampling the asphalt cement from the tanks.

3.4 SURFACE PREPARATION

A. Locate, reference, and protect all utility covers, monuments, curb and gutters, and other components affected by the paving operations.

B. Remove all moisture, dirt, sand, leaves, and other objectionable material from the prepared surface before placing the mix.

C. Complete spot leveling 48 hours before placing pavement courses.
1. Place, spread, and compact leveling mix on portions of the existing surface.
2. Fill and compact any localized potholes more than 25 mm deep.

D. Apply prime coat/tack coats following Section 02748.

E. Allow sufficient cure time for prime coat/tack coat prior to placing HMA.

3.5 SURFACE PLACEMENT

A. When full-width or echelon paving is impractical and more than one pass is required, provide a 1:3 (vertical to horizontal) sloped edge adjacent to the next lane to be paved.

B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.

C. Offset longitudinal joints 150 mm to 300 mm in succeeding courses.
   1. Place top course joint within 300 mm of the centerline or lane line.
   2. If the previous pass has cooled below 80 degrees C, tack the longitudinal edge before placing the adjacent pass.

D. Offset transverse construction joints at least 2 m longitudinally to avoid a vertical joint through more than one course.

E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.

F. Taper the end of a course subjected to traffic at approximately 1:50 (vertical to horizontal).
   1. Make a transverse joint by saw or wheel cutting and removing the portion of the pass that contains the tapered end.
   2. Tack the contact surfaces just before fresh mix is placed against the compacted mix.

G. Use a motor grader, spreader box, or other approved spreading methods for projects under 150 m^2, irregular areas, or for miscellaneous construction such as sidewalks, and leveling courses.

3.6 COMPACTION

A. Use a hand-operated vibratory compactor or small vibratory roller in addition to normal rolling at the end of structures, and at locations inaccessible to regular rollers.

B. Operate in a transverse direction next to the back wall and approach slab.

C. Operate in a direction parallel to other structures.

3.7 LIMITATIONS

A. Do not place hot mix asphalt on frozen base or subbase.

B. Use a UDOT approved release agent for all equipment and hand tools used in mixing, hauling and placing of the hot mix asphalt. Refer to UDOT Products Acceptability Listing (PAL).

C. Do not place hot mix asphalt during adverse climatic conditions, i.e. precipitation, or when roadway surface is icy or wet.

D. Place hot mix asphalt only between April 15 and October 15, and when the air temperature in the shade and the roadway surface temperature is above 10 degrees C and rising.

3.8 GRADATION, ASPHALT CONTENT, VMA, AND POST LOTTMAN TESTS

A. Conform to AASHTO T 11, AASHTO T 27, AASHTO T 30 and ASTM D 6307.

B. The pay adjustment for each lot is the lowest adjustment among the individual measurement adjustments.

C. A lot equals the number of megagrams of mix placed during each production day.

D. The DEPARTMENT will:
1. Take random samples generated from random numbers table as the mix is being placed.
2. Take samples behind the paver before any further compaction is allowed.
   a. Circular or square samples, distributed randomly.
   b. Representative of all the material in the lot.
   c. Take samples large enough for acceptance.
   d. Meet requirements of ASTM D 979 and ASTM D 3665.
3. Inform the CONTRACTOR of the time and place for the sample not more than 15 minutes prior to the sampling.
4. Add the lot to the next day's production if appropriate samples cannot be taken, and evaluate with the appropriate sample size.
5. Add the lot to the previous day's production if four samples cannot be taken, and evaluate pay adjustment with the appropriate sample size.

E. Sampling and Testing conducted by the ENGINEER: UDOT Test Method 8-957.
1. Asphalt content: Four samples and four tests per lot using burn-off oven.
2. Aggregate gradation: Four samples and four tests per lot on the residue of the burn-off oven tests.
3. VMA: Three samples and three tests per lot.
4. Post Lottman: One random sample per week for information only. AASHTO T 283.

F. Acceptance and pay adjustment: Refer to Section 02741: Hot Mix Asphalt, in Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).
1. Asphalt content and aggregate gradations: Table 1.
2. VMA: Table 2.

3. Post Lottman: Table 3.
4. Take the lowest adjustment among the individual measurement adjustments for the pay adjustment for each lot for gradation and asphalt content. Lowest adjustment is a lower bonus and higher deduction value.

3.9 DENSITY TESTS

A. ENGINEER will determine location of core samples:
1. A lot equals the number of megagrams placed each production day.
2. Divide the lot into five sublots of approximately equal sizes.
3. Conduct a minimum of two density tests (random numbers table) for each sublot.
4. If the random location for density cores falls within 0.5 meter of the edge of the overall pavement section (outer part of shoulders), then move transversely to a point 0.5 meter from the edge of the pavement.
5. Take a minimum of one core (random numbers table) per sublot from the longitudinal joint for density tests at the joint. The core density will be used for information only.

B. Take ten cores per lot randomly as instructed, and in the presence of the ENGINEER.
1. Take the cores within two days after the pavement is placed.
2. DEPARTMENT will take possession of the cores immediately, and will begin testing the cores within 24 hours for density acceptance and payment.
3. Fill in the core holes with an acceptable asphalt mixture and compact.
4. Comply with ASTM D 979 and D 2726.

C. ENGINEER will take three Rice samples for each lot. One Rice result is two replicates.

D. ENGINEER will use current consecutive running average of up to 5 lots for the day adjustment computation.

E. Pay adjustment: Refer to Section 02741, Tables 1, 4, 5, and 6 in Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).

3.10 THICKNESS TESTS

A. Core samples:
1. ENGINEER will determine location.
2. Use the density lots and sublots for thickness lots and sublots.
3. The same core samples taken for density may be used for thickness verification.
4. Take a minimum of two randomly selected thickness tests within each sublot.

B. Place additional materials in lots or sublots that are deficient in thickness. The minimum depth of compacted surface for correcting deficient thickness is 3 times the nominal maximum aggregate size.

C. The ENGINEER may allow excess thickness to remain in place or may order its removal. Remove and replace the entire depth of the course, if it is necessary to remove portions of the course.

D. The thickness tolerances established above do not apply to leveling courses, overlays, and cushion courses shown; however, final surfaces in stage construction will be checked for thickness.

E. For pay adjustments and partial payment: Refer to Section 02741, Quantity Adjustments in Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).

3.11 SMOOTHNESS TESTS

A. Determine pavement lane smoothness factor using a Profilograph as described in Section 01452. Calibrate, certify and verify the profilograph prior to use.

3.12 REFEREE TESTS

A. Allow asphalt cement content, gradation, density, thickness, VMA, and post Lottman measurements.

B. CONTRACTOR or ENGINEER may request referee testing up to 5 working days after the acceptance test results have been issued.

C. Use the results of the referee testing in place of the previous acceptance testing to determine the pay. Retest the entire lot if an individual test from a sublot is deemed an outlier based on ASTM E 178.

D. Referee testing will be performed by an independent, accredited laboratory.
   1. May use UDOT Central Laboratory as the referee lab.
   2. Submit AASHTO accreditation documentation for an independent, private lab to the ENGINEER for verification.
   3. DEPARTMENT will not accept referee test data from a non-verified accredited lab.
   4. Submit all test data and paperwork to the DEPARTMENT immediately after test conclusion. All original test data and paperwork will become the property of the DEPARTMENT.
   5. The ENGINEER may request copies of the test data at any point in the testing procedure. Failure to produce original paperwork or test data immediately will disqualify the testing lab and the referee test in question.

E. Pay for the referee test if the referee test results in lower or equal pay adjustment. The DEPARTMENT will pay for the referee test if the pay adjustment improves.

F. For asphalt cement content and gradation: Use the referee samples taken during production.
   1. DEPARTMENT will establish a new set of random numbers.

2. Take a minimum of four samples for gradation and asphalt content for each lot.
3. DEPARTMENT will retain sample for no less than 5 working days after the acceptance results are issued.

G. For density and thickness.
1. Take two random cores from each sublot in the presence of the ENGINEER for referee testing.
2. Use the referee test results to determine pay adjustments.

3.13 SMALL QUANTITIES TESTING

A. To reduce over-testing of small quantity production days, i.e. ramps, bridgework, etc., the ENGINEER may, in concurrence with the CONTRACTOR, choose to combine production from several days to form a single lot.

3.14 NATIONAL HIGHWAY SYSTEM AND TRUCK ROUTES

Table 4

National Highway System and Truck Routes Category 1		
Interstate Routes	**Beginning**	**Ending**
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 - Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I -15 - North Salt Lake
US Routes		
US-6	Nevada State Line	Jct US-50 - Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US -40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 - Holden
US -89	Arizona State Line	Jct I-70 - Sevier
US -89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 - Lehi
US-89	Jct I-15 - Draper, Exit 295	Jct SR-269 - 5th and 6th South
US-89	Jct I-15 - Farmington	Jct I-80 - Uintah
US-89	Jct I-84 - Uintah	Jct SR-134 - North Ogden
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Jct US-89 - Logan
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-666	Jct US-191 - Monticello	Colorado State Line

State Routes	Beginning	Ending
SR-9 - Zions Park		
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 - Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-26 - Riverdale Road	Uct I-15 - Exit 342	Jct US-89 - Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 20th and 21st Odgen	Jct I-15 - Exit 344	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct 1-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance - Wilberg Coal Mine
SR-71 - 7th and 9th East Street Salt Lake City	Jct SR0-209 - 90th South Street	Jct SR-186 - 4th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi
SR-79 - 12th Street Ogden	Jct I-15 - Exit 347	Jct SR-203 - Harrison Blvd.
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21st South Expressway
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 - Draper	Jct I-80 - Salt Lake Intl Airport
SR-171 - 33rd and 35th South Salt Lake City	Jct SR-172 - 56th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street Salt Lake City	Jct 6200 South - Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12th Street
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90th and 96th South
SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 East, Exit 5
SR-266 - 45th & 47th South Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South Salt Lake City	Jct I-215, Exit 310	Jct SR-71 - 7th East Street

END OF SECTION

SECTION 02742

HOT MIX ASPHALT - THIN LIFTS

Maintenance Only

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for mixing, laying, and compacting a surface course of one or more layers of asphalt concrete pavement for thin lift projects of (50 mm or less).

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 01452: Profilograph.

B. Section 02745: Asphalt Material.

C. Section 02746: Hydrated Lime.

D. Section 02748: Prime Coat/Tack Coat.

E. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects).

1.3 REFERENCES

A. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

B. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

C. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

D. AASHTO T 209: Maximum Specific Gravity of Bituminous Paving Mixtures.

E. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

F. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

G. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

1.4 ACCEPTANCE

A. Refer to Section 02741, Part 1, excluding thickness acceptance.

B. Density: The target density for determining pay adjustment will be 92.5 percent of maximum Rice density. AASHTO T 209.

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. Refer to Section 02741, Part 2.

2.2 AGGREGATE

A. Refer to Section 02741, Part 2, except use the following tables for Aggregate Properties and Gradation requirements.

Table 1

Aggregate Properties - Thin Lifts			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	ASTM D 5821	99 % min.	90 % min.
Two Fractured Face	ASTM D 5821	99% min.	90 % min.
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 % max.
L.A. Wear	AASHTO T 96	35 % max	40 % max.
Sand Equivalent	AASHTO T 176	60 min.	45 min.
Natural Fines	None	Not Allowed	10 % max.
Category 1: National Highway System and Truck Routes - Section 02741, Table 4 in Section 02741. Category 2: All Other Routes			

B. Meet gradation requirements in Table 2. AASHTO T 30.

Table 2

Aggregate Gradations - Thin Lifts (Percent Passing by Dry Mass of Aggregate)			
Nominal Sieve Size		**12.5**	**9.5**
Control Sieves	**25.0**	-	
	19.0	100.0	
	12.5	90.0 - 100.0	100.0
	9.5	<90.0	90.0 - 100.0
	4.75	-	<90.0
	2.36	28.0 - 58.0	32.0 - 67.0
	0.075	2.0 - 10.0	2.0 - 10.0
Caution Zone Boundaries (Informa-tion only)	**4.75**	-	-
	2.36	39.1	47.2
	1.18	25.6 - 31.6	31.6 - 37.6
	0.6	19.1 - 23.1	23.5 - 27.5
	0.3	15.5	18.7

2.3 HYDRATED LIME

A. Meet the requirements of Section 02746, Part 3, paragraph: Quality Control, Verification.

2.4 JOB-MIX DESIGN REQUIREMENTS

A. Refer to Section 02741, Part 2. Exclude Calibration Factor for Burn-off Oven.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN

A. Comply with requirements in Section 02741, Part 2, including Table 3, substituting the following requirements:

1. Voids in Mineral Aggregate (VMA) at N_{design} (Laboratory Mix):
   a. 14.0 percent - 16.0 percent for 12.5 mm.
   b. 15.0 percent - 17.0 percent for 9.5 mm.

2.6 CONTRACTOR INITIATED CHANGES IN JOB-MIX DESIGN

A. Refer to Section 02741, Part 2.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Refer to Section 02741, Part 3 for the following.
   1. Adding Hydrated Lime.
   2. Hot Mix Asphalt (HMA).
   3. HMA Plants and Asphalt Storage Tanks.
   4. Surface Preparation and Placement.
   5. Compaction.
   6. Limitations.

3.2 FIELD QUALITY CONTROL TESTING

A. Refer to Section 02741, Part 3 for the following tests:
   1. Gradation, Asphalt Content, VMA, and Post Lottman Tests.
   2. Density.
   3. Thickness.
   4. Smoothness.
   5. Small Quantities.

3.3 SMOOTHNESS TESTING

A. Determine pavement lane smoothness factor using a Profilograph as described in Section 01452. Calibrate, certify, and verify the profilograph prior to use.

END OF SECTION

SECTION 02743

HOT MIX ASPHALT - SMALL PROJECTS/BIKE AND PEDESTRIAN PATHS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for mixing, laying, and compacting a surface course of one or more layers of asphalt concrete pavement for:
   1. Small projects, such as utility work, traffic signals, etc.
   2. Bike and pedestrian paths.

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt

B. Section 02745: Asphalt Material.

C. Section 02746: Hydrated Lime.

D. Section 02748: Prime Coat/Tack Coat.

1.3 REFERENCES

A. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

B. AASHTO T 40: Sampling Bituminous Materials.

C. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

D. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

E. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

F. Asphalt Institute SP-2: Compaction of Bituminous Gyratory Specimen.

G. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

H. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

I. Modified GDT-115: Georgia Loaded Wheel.

1.4 ACCEPTANCE

A. Comply with AASHTO T 30.

B. ENGINEER or designated representative may sample any portion of HMA production that appears non-uniform or defective.

C. Certify that the mix meets the gradation and asphalt cement requirements of Aggregate Gradation Table (Table 2) and Job Mix Design Requirements. Submit design data sheet to support.

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. AASHTO T 40.

B. Asphalt Binder
   1. Small Projects: PG 64-34.
   2. Bike/Pedestrian Path: PG 58-22. Rejuvinator Type B, modified.

2.2 AGGREGATE

A. Refer to Section 02741, Part 2, Aggregate, except for Aggregate Properties Table.

B. Use Table 1 following for Aggregate Properties.

Table 1

Aggregate Properties			
Test Method	**Test Number**	**Small Projects 12.5 mm Laydown**	**Bike/Ped Path 9.5 mm Laydown**
One Fractured Face	ASTM D 5821	N/A	N/A
Two Fractured Face	ASTM D 5821	90 % min.	90 % min.
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 max.
L.A. Wear	AASHTO T 96	35 % max.	35 % max.
Sand Equivalent	AASHTO T 176	60 min.	60 min.
Natural Fines	None	Not allowed	10 % max.

C. Meet broad band gradation as specified in Table 2.

D. Meet gradation requirements of Asphalt Institute SP-2.

Table 2

Aggregate Gradations (Percent Passing by Dry Mass of Aggregate)			
		Small Projects	**Bike/Ped Path**
Nominal Sieve Size (mm)		**12.5**	**9.5**
Control Sieves	**19**	100.0	-
	12.5	90.0 - 100.0	100.0
	9.5	< 90.0	90.0 - 100.0
	4.75	-	<90.0
	2.36	28.0 - 58.0	32.0 - 67.0
	0.075	2.0 - 10.0	2.0 - 10.0
Caution Zone Boundaries (Informa-tion only)	**4.75**	-	-
	2.36	39.1	47.2
	1.18	25.6 - 31.6	31.6 - 37.6
	0.6	19.1 - 23.1	23.5 - 27.5
	0.3	15.5	18.7

2.3 HYDRATED LIME

A. Minimum one percent hydrated lime.

B. Meet requirements of Section 02746.

2.4 JOB-MIX DESIGN REQUIREMENTS

A. Hot Mix supplier is responsible for satisfying all requirements for Superpave Volumetric Mix Design including:
   1. Using a mix design for 9.5 aggregate for Bike/Pedestrian Paths, and/or 12.5 aggregate for small projects.
   2. Certify that the mix design meets requirements for Volumetric Mix Design outlined in this section.
   3. The Region Materials Lab will approve the Volumetric Mix Design from a previous mix design with the same aggregate size.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN

A. Comply with requirements in Tables 3 and 3A.
   1. Hot Plant Mixing Temperature: Set by the ENGINEER.

2. Voids in Mineral Aggregate (VMA) at N_{design} (Laboratory Mix): (Asphalt Institute SP-2, p.45; Equation based on percent of Total Mixture).
3. Pavement Analyzer: <3.81 mm. At high temperature of PG Asphalt. Modified GDT-115.
4. Hamburg Rut Tester: under water.
5. G_{mm}: Maximum Specific Gravity of Rice Mix.

Table 3

Superpave Volumetric Mix Design - Small Projects				
Compaction Stage	**Number of Gyrations (N)**	**% of G_{mm}**	**Voids in Mineral Aggregate**	**Pavement Analyzer**
Initial	6	<89.0	14.0 % min. for 12.5 mm	<3.5 mm
Design	50	96.0		
Maximum	75	<98.0		

Table 3A

Superpave Volumetric Mix Design - Bike and Pedestrian Path				
Compaction Stage	**Number of Gyrations (N)**	**% of G_{mm}**	**Voids in Mineral Aggregate**	**Pavement Analyzer**
Initial	6	91.5	15.0 % min for 9.5 mm	N/A
Design	50	98.5		
Maximum	75	<100.0		

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Refer to Section 02741, Part 3.

3.2 COMPACTION

A. Use mechanical compaction equipment to obtain density.

3.3 REJUVINATING AGENT

A. For Bike and Pedestrian Path: Spray the finished Hot Mix Asphalt with a Type “B” rejuvinator at a rate of 0.45 L/m^2 to 0.68 L/m^2, diluted one to one.

END OF SECTION

SECTION 02744

HOT MIX ASPHALT - PROCUREMENT - See Supplemental

Maintenance Only

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procurement (Laydown and Blade Work), and compaction of a surface course of one or more layers of asphalt concrete pavement.

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02745: Asphalt Material.

C. Section 02746: Hydrated Lime.

D. Section 02748: Prime Coat/Tack Coat.

1.3 REFERENCES

A. AASHTO T 40: Sampling Bituminous Materials.

B. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

C. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

D. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

E. Asphalt Institute SP-2: Compaction of Bituminous Gyratory Specimen.

F. ASTM D 2041: Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.

G. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

H. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

I. Modified GDT-115: Georgia Loaded Wheel.

1.4 ACCEPTANCE

A. Testing:
   1. DEPARTMENT truck: sample at Hot Mix Plant.
   2. CONTRACTOR truck: sample at roadway.
   3. CONTRACTOR will provide a sampling device.
   4. The DEPARTMENT or its representative will conduct the acceptance testing for gradation and asphalt content.
   5. Testing will be based on a minimum of three samples per 2500 megagrams. CONTRACTOR may take several days or locations to obtain minimum samples.
   6. The DEPARTMENT or its representative may:
      a. Sample any portion of the day's production that exhibits a non-uniform appearance.
      b. Reject materials when results show deviations beyond acceptance limits from the job-mix design.

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. Asphalt Binder: Refer to Section 02745.
   1. PG Binder: Refer to Table 3.
      a. Blade work or Laydown: (0.3 M# 3.0 M ESALs): PG 58-22.
      b. Laydown only:
         (0.3# 3.0 M ESALs and 3.0 # 3.0 M ESALs)): PG 64-34.
   2. AASHTO T 40.

2.2 AGGREGATE

A. Follow Section 02741, Part 2, Aggregate, except for Aggregate Properties Table.

B. Use the following Table 1 for Aggregate Properties.

Table 1

Aggregate Properties - Procurement			
Test Method	**Test Number**	**9.5 mm Blade Work**	**12.5 mm Laydown**
One Fractured Face	ASTM D 5821	90 % min.	90 % min.
Two Fractured Face	ASTM D 5821	90 % min.	90 % min.
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 % max.
L.A. Wear	AASHTO T 96	40 % max.	40 % max.
Sand Equivalent	AASHTO T 176	45 min.	45 min.
Natural Fines	None	10 % max.	Not allowed

C. Meet design requirements of Asphalt institute SP-2.

D. Meet aggregate broad band gradation as specified in Table 2.

Table 2

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate) Procurement			
Nominal Sieve Size (mm)		**12.5**	**9.5**
Control Sieves	**25.0**	--	--
	19.0	--	--
	12.5	90.0 - 100.0	100.0
	9.5	<90.0	90.0 - 100.0
	4.75	-	<90.0
	2.36	28.0 - 58.0	32.0 - 67.0
	0.075	2.0 - 10.0	3.0 - 10.0

2.3 HYDRATED LIME

A. Minimum one percent hydrated lime.

B. Refer to Section 02746.

2.4 JOB-MIX DESIGN REQUIREMENTS

A. Hot Mix supplier is responsible for satisfying all the requirements for Superpave Volumetric Mix Design including:
   1. The low bid supplier will be required to submit the job-mix design from certified laboratory in writing prior to the award of contract. Design includes gradation, asphalt content, and hydrated lime in percentage.
   2. Supply target job mix gradation and binder content. Target information will be used for price adjustments.
   3. The Region Materials Lab will verify the Volumetric Mix Design meets all requirements. The verification must meet all requirements prior to the award of contract.

B. DEPARTMENT will credit the CONTRACTOR $5,000 for mix verified design work.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN

A. Comply with requirements in Table 3.
   1. Hot Plant Mixing Temperature: Set by the ENGINEER.
   2. Voids in Mineral Aggregate (VMA) at N_{design} (Laboratory Mix):
      15.0 percent for 9.5 mm.
      14.0 percent for 12.5 mm.
      (Asphalt Institute SP-2, p.45; Equation based on percent of Total Mixture).
   3. Pavement Analyzer: < 3.5 mm.
      (At high temperature of PG Asphalt. Modified GDT-115)
   4. Hamburg Rut Test: < 10 mm.
      (By DEPARTMENT) on production mix for information.

Table 3

Superpave Volumetric Mix Design - Procurement Number of Gyrations Table				
20 Years Design ESALS (Million) as defined in the plan summary sheets	**Compaction Parameters**			**Void Villed with Asphalt (VFA) (%)**
	$N_{initial}$ / % of G_{mm} Maximum Specific Gravity of Mix (Rice)			
0.3 to <3	7/# 90.5	75/96	115/ # 98	65 - 78
3 to < 30	8/# 89	100/96	160/ # 98	65 - 75

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Refer to Section 02741, Part 3.

END OF SECTION

SECTION 02745

ASPHALT MATERIAL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt materials.

1.2 REFERENCES

A. AASHTO M 81: Cut-Back Asphalt (Rapid-Curing Type).

B. AASHTO M 82: Cut-Back Asphalt (Medium-Curing Type).

C. AASHTO M 140: Emulsified Asphalt.

D. AASHTO M 208: Cationic Emulsified Asphalt.

E. AASHTO M 226: Viscosity Graded Asphalt Cement.

F. AASHTO MP 1: Performance Graded Asphalt Cement.

G. AASHTO T 44: Solubility of Bituminous Materials.

H. AASHTO T 49: Penetration of Bituminous Materials.

I. AASHTO T 50: Float Test for Bituminous Materials.

J. AASHTO T 51: Ductility of Bituminous Materials.

K. AASHTO T 59: Testing Emulsified Asphalt.

L. AASHTO T 201: Kinematic Viscosity of Asphalts.

M. AASHTO T 228: Specific Gravity of Semi-Solid Bituminous Materials.

N. AASHTO T 240: Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test).

O. AASHTO T 300: Force Ductility of Bituminous Materials.

P. AASHTO T 301: Elastic Recovery Test of Bituminous Materials by Means of a Ductilometer.

Q. ASTM D 92: Flash and Fire Points by Cleveland Open Cup.

R. ASTM D 1190: Concrete Joint Sealer, Hot-Applied Elastic Type.

S. ASTM D 2007: Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method.

T. ASTM D 2026: Cutback Asphalt (Slow-Curing Type).

U. ASTM D 3405: Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

V. ASTM D 4402: Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus.

W. ASTM D 5167: Melting of Hot-Applied Joint and Crack Sealant and Filler for Evaluation.

X. ASTM D 5329: Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

Y. ASTM D 5801: Toughness and Tenacity of Bituminous Materials.

Z. CA 332: California Test Method Torsional Recovery of Modified Asphalt Cement Residue.

1.3 SUBMITTALS

A. For each shipment of material, supply a vendor-prepared bill of lading showing the following information:
   1. Type and grade of material
   2. Type and amount of additives, used, if applicable
   3. Destination
   4. Consignee's name
   5. Date of Shipment
   6. Railroad car or truck identification
   7. Project number
   8. Loading temperature
   9. Net weight in metric units (or net liters corrected to 16 degrees C, when requested)
   10. Specific gravity
   11. Bill of lading number
   12. Manufacturer of asphalt material

1.4 DELIVERY, STORAGE AND HANDLING

A. Each shipment of asphalt material must:
   1. Be uniform in appearance and consistency.
   2. Show no foaming when heated to the specified loading temperature.

B. Do not supply shipments contaminated with other asphalt types or grades than those specified.

1.5 GRADE OF MATERIAL

A. The ENGINEER will determine the grade of material to be used based on the supply source designated by the CONTRACTOR when the bid proposal lists more than one grade of asphalt material.

PART 2 PRODUCTS

2.1 PERFORMANCE GRADED ASPHALT BINDER (PGAB)

A. Supply PGABs under the Approved Supplier Certification (ASC) System. Refer to UDOT Materials Manual, Part 8-209.

B. As specified in AASHTO MP 1, with the following modifications:
   1. Delete superscript (f) for all specified grades having design cold temperatures of -28 degrees C or colder.
   2. Add Direct Tension test for all specified grades having design cold temperatures of -28 degrees C or colder.
      a. Failure Strain, minimum of 1.3 percent at 1.0 mm/min.
      b. Refer to UDOT Materials Manual, Part 8-966.
   3. Add Toughness and Tenacity Test for all specified grades having algebraic differences of 90 degrees C or greater between the high and low design temperatures.
      a. Test specimen shall meet a minimum of 8.50 N·m and 5.65 N·m respectively.
      b. Refer to ASTM D 5801.

2.2 ASPHALTIC CEMENT

A. As specified in AASHTO M 226, Table 2 with the following modifications:
   1. Delete and replace ductility at 25 degrees C with ductility at 4 degrees C with values as detailed below.

AC - 2.5	AC - 5	AC - 10	AC - 20
50+	25+	15+	5+

B. As specified for cationic and anionic emulsified asphalt.
   1. Supply under the Approved Supplier Certification System (ASC).
   2. Meet AASHTO M 208 and M 140.
   3. UDOT Materials Manual, part 8-208.

C. Conform to the requirements of:
   1. Cationic Emulsified Polymerized Asphalt (CRS-2R): Table 1, or
   2. Latex Modified Rapid Setting Emulsion (LMCRS-2): Table 2, or
   3. Polymerized High Float Rapid Setting Emulsified Asphalt (HFRS-2P):Table 3: or
   4. Cationic Rapid Set Asphalt (CRS-2A,B): Table 4.

D. Curing cut-back asphalt:
   1. As specified for slow curing (SC) in ASTM D 2026.
   2. As specified for medium curing (MC) in AASHTO M 82.
   3. As specified for rapid curing (RC) in AASHTO M 81.

E. Conform to requirements for Asphalt Pavement Rejuvenating Agent:
   1. Type B: Table 5.
   2. Type B Modified: Table 6.
   3. Type C: Table 7.
   4. Type D: Table 8.

Table 1

Cationic Emulsified Polymerized Asphalt (CRS-2R)			
AASHTO Test Method		**Min.**	**Max.**
Tests on Emulsion:			
T-59	Viscosity Saybolt Furol @ 60 EC, sec	100	400
T-59	Settlement (a) 5 days, %		5
T-59	Storage Stability Test (b) 1 d, 24 h, %		
T-59	Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, %	40	
T-59	Particle Charge Test	Positive	
T-59	Sieve Test, %		0.10
Distillation:			
	Oil distillate, by vol of emulsion, %		0
	Residue (d), %	68	
Tests on Residue from Distillation Test:			
T-49	Penetration, 25 EC, 100 g, 5 s	80	150
T-51	Ductility, 4 EC, 10 mm/min, mm	350	
	Toughness, N@m	8.50	
	Tenacity, N@m (e)	5.67	
T-44	Solubility in trichloroethylene, %	97.5	

(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.

(b) The 24-hour (1-day) storage stability test may be used instead of the five-day settlement test.
(c) The demulsibility test will be made within 30 days from date of shipment.
(d) Distillation will be determined by AASHTO T 59, oven-evaporated method.
(e) ASTM D 5801.

The asphalt cement will be rubberized (polymerized) prior to emulsification.

Table 2

Latex Modified Rapid Setting Emulsion (LMCRS-2)			
AASHTO Test Method		**Min.**	**Max.**
Tests on Emulsion:			
T 59	Viscosity Saybolt Furol @ 50 EC, sec	75	300
T 59	Settlement (a) 5 days, %		5
T 59	Storage Stability Test (b) 1 d, 24 h, %		1
T 59	Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, %	40	
T 59	Particle Charge Test	Positive	
T 59	Sieve Test, %		0.3
Distillation:	Oil distillate, by vol of emulsion, %		0
	Residue (d), %	65	
Tests on Residue from Distillation Test:			
T 49	Penetration, 25 EC, 100 g, 5 s	40	200
	Torsional Recovery, (e)	18	

(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
(b) The 24-hour (1-day) storage stability test may be used instead of the five-day settlement test.
(c) The demulsibility test will be made within 30 days from date of shipment.
(d) Distillation will be determined by AASHTO T 59, oven-evaporated method.
(e) CA 332 (California Test Method).

Latex and asphalt shall be co-milled during the emulsification process.

Table 3

Polymerized High Float Rapid Setting Emulsified Asphalt (HFRS-2P)			
AASHTO Test Method		**Min.**	**Max.**
Tests on Emulsion:			
T 59	Viscosity Saybolt Furol @ 50 EC, sec	50	450
T 59	Storage Stability Test (a) 1 d, 24 h, %		1
T 59	Demulsibility (b) 0.02 N Ca Cl2, %	40	
T 59	Sieve Test, %		0.1
Distillation:	Oil distillate, by vol of emulsion, %		3
	Residue (c), %	65	
Tests on Residue from Distillation Test:			
T 49	Penetration, 25 EC, 100 g, 5 s	70	150
T 50	Float Test, 60 EC, sec	1200	
T 44	Solubility in trichloroethylene, %	97.5	
T 301	Elastic Recovery, 25 EC, %	58	

(a) The 24-hour (1-day) storage stability test may be used instead of the five-day settlement test.
(b) The demulsibility test will be made within 30 days from date of shipment.
(c) Distillation will be determined by AASHTO T 59, oven-evaporated method.

Table 4

Cationic Rapid Setting Emulsified Asphalt (CRS-2A,B)			
AASHTO Test Method		**Min**	**Max**
Tests on Emulsion:			
T 59	Viscosity, Saybolt-Furol at 50 EC, s	140	400
T 59	Storage stability test, 24 h, percent		1
T 59	Demulsibility, 35 mL 0.8 percent Sodium Dioctyl Sulfosucinate, percent	40	
T 59	Particle charge test	positive	positive
T 59	Sieve test, percent		0.10
<u>Tests on Distillation:</u>	Oil distillate, by volume of emulsion, percent		0
T 59	Residue, percent	65	

The base asphalt cement used to manufacture the CRS2A,B, shall meet the requirements for Asphaltic Cement in this Section for AC 10 and AC 20, respectively.

Table 5

Type B Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity @ 25 EC SFS	AASHTO T 59	25-150
Residue, % W	AASHTO T 59 (mod) (a)	62 Min.
Sieve Test, % W	AASHTO T 59	0.10 Max.
5-day Settlement	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Tests of Residue from Distillation:		
Viscosity @ 60 EC mm^2/s	AASHTO T 201	2500-7500
Solubility in 1,1,1 Trichloroethylene, %	AASHTO T 44	98 Min.
Flash Point, COC	ASTM D 92	204 EC, Min.
Asphaltenes, % W	ASTM D 2007	15 Max.
Saturates, % W	ASTM D 2007	30 Max.
Aromatics, % W	ASTM D 2007	25 Min.
Polar Compounds, % W	ASTM D 2007	25 Min.
(a) AASHTO T 59 evaporation test for sample residue is modified by heating 50 gram sample to 149 EC until foaming ceases, then cooling immediately and calculating results.		
(b) Pumping stability is tested by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 25 EC through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.		
Type B: an emulsion of lube oil and/or lube oil extract blended with petroleum asphalt.		

Table 6

Type B Modified Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity @ 25 EC SFS	AASHTO T 59	50-200
Residue by distillation or Evaporation (a), percent W	AASHTO T 59 (mod) (a)	62 Min.
Sieve Test, % W	AASHTO T 59	0.20 Max.
5-day Settlement, % W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Tests of Residue from Distillation or Evaporation:		
Viscosity (c) @ 135 EC mm^2/s	ASTM D 4402	150 - 300
Penetration @ 25 EC, dmm	AASHTO T 49	180 Min.
Solubility in 1,1,1 Trichloroethylene, %	AASHTO T 44	98 Min.
Flash Point, COC	AASHTO T 48	204 EC, Min.
Asphaltenes, % W	ASTM D 2007	20-40
Saturates, % W	ASTM D 2007	20 Max.
Polar Compounds, % W	ASTM D 2007	25 Min.
Aromatics, % W	ASTM D 2007	20 Min.
PC/S Ratio	ASTM D 2007	1.5 Min.
(a) AASHTO T 59 evaporation test for sample residue is modified by heating 50 gram sample to 149 EC until foaming ceases, then cooling immediately and calculating results.		
(b) Pumping stability is tested by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 25 EC through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.		
(c) Brookfield Thermocel Apparatus-LV model at 6 rpm with a #28 spindle at 2-98 torque.		
As required by the Asphalt Emulsion Quality Management system (Materials Manual Part 8-208), the supplier shall certify that the base stock contains a minimum of 15 % by weight of Gilsonite Ore. The HCL precipitation method shall used as a qualitative test to detect the presence of Gilsonite.		

Table 7

Type C Asphalt Pavement Rejuvenating Agent		
Property	**Test Method**	**Limits**
Viscosity @ 25 EC SFS	AASHTO T 59	10-100
Residue (a), % W (Type C supplied ready to use 1:1 or 2:1.	AASHTO T 59 (a)	30 Min. 1:1 40 Min. 2:1
Sieve Test, % W (b)		0.10 Max.
5-day Settlement, % W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
pH (May be used if particle charge test is inconclusive)		2.0 - 7.0
Pumping Stability (c)		Pass
Tests of Residue from Distillation:		
Viscosity (c) @ 135 EC mm^2/s	AASHTO T 201	475-1500
Solubility in 1,1,1 Trichloroethylene, %	AASHTO T 44	97.5 Min.
RTFO mass loss, % W	AASHTO T 240	2.5 Max.
Specific Gravity	AASHTO T 228	0.98 Min.
Flash Point, COC	AASHTO T 48	232 EC, Min.
Asphaltenes, % W	ASTM D 2007	25 Min., 45 Max.
Saturates, % W	ASTM D 2007	10 Max.
Polar Compounds, % W	ASTM D 2007	30 Min.
Aromatics, % W	ASTM D 2007	15 Min.
(a) AASHTO T 59 evaporation test for sample residue is modified by heating 50 gram sample to 149 EC until foaming ceases, then cooling immediately and calculating results.		
(b) Test method identical to AASHTO T 59 except that distilled water is used in place of 2 % sodium oleate solution.		
(c) Pumping stability is tested by pumping 475 ml of Type diluted 1 part concentrate to 1 part water, at 25 EC through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.		
As required by the Asphalt Emulsion Quality Management system (Materials Manual Part 8-208), the supplier shall certify that the base stock contains a minimum of 10 % by weight of Gilsonite ore. The HCL precipitation method shall be used as a qualitative test to detect the presence of Gilsonite.		

Table 8

Type D Asphalt Pavement Rejuvenating Agent		
Property	**Test Method**	**Limits**
Viscosity @ 25 EC SFS	AASHTO T 59	30-90
Residue, (a) % W	AASHTO T 59 (mod) (a)	65
Sieve Test, % W	AASHTO T 59	0.10 Max.
pH		2.0 - 5.0
Tests of Residue from Distillation:		
Viscosity @ 60 EC mm^2/s	AASHTO T 201	300-1200
Viscosity @ 135 EC mm^2/s	AASHTO T 201	300 Min.
Modified Torsional Recovery (b)	CA 332 (Mod)	40 % Min.
Toughness @ 25 EC, N.m	ASTM D 5801	0.9 Min.
Tenacity @ 25 EC N.m	ASTM D 5801	0.6 Min.
Asphaltenes, % W	ASTM D 2007	16 Max.
Saturates, % W	ASTM D 2007	20 Max.
(a) California test method #331 for recovery of residue.		
(b) Torsional recovery measurement to include first 30 seconds.		

2.3 HOT-POUR CRACK SEALANT FOR BITUMINOUS CONCRETE

A. Combine a homogenous blend of materials to produce a sealant meeting properties and tests in Table 9.

B. Packaging and Marking: Supply sealant pre-blended, pre-reacted, and pre-packaged in lined boxes weighing no more than 13.6 kg.

1. Use a dissolvable lining that will completely melt and become part of the sealant upon subsequent re-melting.
2. Deliver the sealant in the manufacturer's original sealed container.
3. Clearly mark each container with the manufacturer's name, trade name of sealant, batch or lot number, and recommended safe heating and application temperatures.

Table 9

Hot-Pour Bituminous Concrete Crack Sealant			
Application Properties:			
Workability:	Pour readily and penetrate 6.35 mm and wider cracks for the entire application temperature range recommended by the manufacturer.		
Curing:	No tracking caused by normal traffic after 45 minutes from application.		
Asphalt Compatibility: ASTM D 5329, Sec 14.	No failure in adhesion. No formation of an oily ooze at the interface between the sealant and the bituminous concrete or softening or other harmful effects on the bituminous concrete.		
Material Handling:	Follow the manufacturer's safe heating and application temperatures.		
Test Method	**Property**	**Minimum**	**Maximum**
AASHTO T 51	Flexibility (a) Ductility Modified, 1 cm/min @ 4 EC	 30 cm	No cracks
AASHTO T 300 (b)	Force-Ductility		17.79 N
ASTM D 5329	Flow 60 EC, 5 hrs 75 E angle		3 mm
ASTM D 3405 (c)	Tensile-Adhesion, modified	300%	
AASHTO T 228	Specific Gravity @ 15.6 EC		1.140
ASTM D 5329	Cone Penetration, 25 EC, 150 g, 5 sec.		90 dmm
ASTM D 5329	Resilience, 25 EC, 20 sec.	30	
ASTM D 4402	Viscosity @ 193.3 EC, Pa.s SC4-27 spindle, 20 rpm.		2.5
ASTM D 5329	Bond as per ASTM D 1190, Section 6.4		Pass
(a) Melt a sample of the sealant in accordance to ASTM D 5167. Prepare a specimen (3.175 X 25.4 X 152.4 mm). Condition at 25 ± 2 EC for 1 hr ± 5 min. Further condition at -27 ± 2 EC for 3 hr. ± 5 min. Immediately bend the conditioned specimen 90 E over a 28.6 mm diameter steel mandrel conditioned at -27 ± 2 EC. Accomplish bending within 2 seconds.			
(b) Maximum of 17.79 N during the specified elongation of 30 cm @ 1 cm/min @ 4 EC.			
(c) Use ASTM D 4305, Section 6.4.1. Delete bond and substitute tensile-adhesion test in accordance to D 5329.			

PART 3 EXECUTION Not used.

END OF SECTION

SECTION 02746

HYDRATED LIME - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for incorporating hydrated lime into all asphalts mixes.

1.2 REFERENCES

A. ASTM C 110: Physical Testing of Quicklime, Hydrated Lime, and Limestone.

B. ASTM C 1097: Hydrated Lime for Use in Asphaltic-Concrete Mixtures.

C. AASHTO M 303: Lime for Asphalt Mixtures.

D. AASHTO T 26: Quality of Water to be Used in Concrete.

E. AASHTO T 84: Specific Gravity and Absorption of Fine Aggregate.

F. AASHTO T 85: Specific Gravity and Absorption of Coarse Aggregate.

G. AASHTO T 255: Total Moisture Content of Aggregate by Drying.

PART 2 PRODUCTS

2.1 HYDRATED LIME

A. Hydrated Lime: Meet AASHTO M 303, Type I, as specified.
   1. Conform physical requirements to ASTM C 1097, subparagraph d.1.
   2. Use test method ASTM C 110, paragraph 5.4.

2.2 WATER

A. Potable Water. AASHTO T 26.

PART 3 EXECUTION

3.1 APPLICATION

A. Add hydrated lime to all asphalt pavement mixes.
   1. Add the determined quantity of lime, following mix design.
   2. Base the amount of hydrated lime used on the dry weight of the aggregate.
   3. Use either Method A or B, following AASHTO T 84, AASHTO T 85, AND AASHTO T 255, unless Method B is called for in the bid schedule.

B. Method A: Lime Slurry: One part lime and three parts water by weight.
   1. Maintain the lime slurry mix in a malted milk consistency.
   2. Deliver lime slurry to the twin shaft pugmill for mixing with aggregate.

C. Method B: Lime and Aggregate Stockpile Marination:
   1. Marinate the aggregate in the stockpile for 24 hours.

D. Mixing Methods A and B: Provide a horizontal twin shaft pugmill.
   1. Adjust mixing paddles in the pugmill so that the aggregate being discharged is completely coated by the lime slurry.
   2. Do not allow volume of material in the pugmill to extend above the vertical position of the blade tips.

3.2 CONTROLLING AND MONITORING

A. Control the lime batching operation by the Program Logic Control (PLC) System based upon production set up data.

B. Monitor the following aspects and record on the computer data log printout:
   1. Display target and actual rates.
   2. Belt weight bridge for lime.
   3. Locked-in water meter.
   4. Meter to transfer lime slurry.
   5. Closed end loop to mainframe computer.

3.3 QUALITY CONTROL

A. Tolerance Controls
   1. Tolerance lime weight vessel static calibration ± 1.5 percent.
   2. Dynamic delivery calibration ± 1.5 percent.
   3. Inlet flow meter ± 2 percent.
   4. Discharge flow meter ± 1.5 percent.

B. Verification
   1. Submit to the ENGINEER Post Lottman Data on Hot Mix Asphalt.

2. Meet the system Tensile Stress Requirement.

END OF SECTION

SECTION 02747

ROAD MIX ASPHALT SURFACE COURSE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing, spreading, and compacting a surface of mineral aggregate and asphalt cement.

1.2 RELATED SECTIONS

A. Section 02721: Untreated Base Course.

B. Section 02745: Asphalt Materials.

C. Section 02746: Hydrated Lime.

D. Section 02748: Prime Coat/Tack Coat.

1.3 REFERENCES

A. AASHTO T 19: Unit Weight and Voids in Aggregate

B. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

C. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

D. AASHTO T 110: Moisture or Volatile Distillates in Bituminous Paving Mixtures.

E. AASHTO T 201: Kinematic Viscosity of Asphalts.

F. AASHTO T 265: Laboratory Determination of Moisture Content of Soils.

1.4 ACCEPTANCE

A. For aggregate gradation acceptance: Refer to Section 02721, Part 1.

B. Test lots:
   1. A test lot equals the number of megagrams of surface course placed to the required lines and grade and compacted during each production day.
   2. Divide lots into sublots of approximately 1300 m^2.

3. ENGINEER will take one randomly selected thickness test within each sublot.

C. ENGINEER will accept a lot when:
1. The average thickness of all sublots is within 13 mm of the total designated surface course thickness.
2. Each individual sublot is within 19 mm.

D. These thickness tolerances do not apply to areas where additional thickness is required for leveling existing surfaces.

1.5 LIMITATIONS

A. Apply only between May 1 and September 30, and when the air temperature in the shade and the roadbed temperature is above 15 degrees C.

B. Do not apply during rain, fog, or other adverse weather conditions.

PART 2 PRODUCTS

2.1 AGGREGATE

A. Crushed gravel, rock or slag. For combined aggregate, meet the 19 mm gradation specified in Section 02721, Part 2, Table 4.

B. Determine the suitability of the aggregate source.
1. Aggregate passing the 425 Fm sieve: Non-plastic. AASHTO T 90.
2. Dry-rodded unit weight: at least 1200 kg/m^3. AASHTO T 19.
3. Wear: Not to exceed 40 percent. AASHTO T 96.

2.2 ASPHALT MATERIAL

A. Refer to Section 02745.

B. The ENGINEER may change the specified asphalt one grade with no change in the unit bid price.

2.3 HYDRATED LIME

A. Refer to Section 02746.

2.4 REVISED JOB MIX GRADATION

A. May submit a revised job-mix gradation for approval within 24 hours following the first day's placement.

1. This option retroactively applies only to the first day's operation.
2. Conform to Section 02721, Table 4, for all changes.
3. Make changes before beginning a day's production and submit changes in writing to the ENGINEER.
4. Obtain approval for the revised job-mix gradation before starting the second day's operation.

B. Submit a written job-mix gradation for approval including single values for each sieve size based on the dry weight of the aggregate.
   1. Conform to Section 02721, Table 4 for all dry weight values.
   2. Make changes before beginning a day's production and submit changes in writing to the ENGINEER.
   3. For each construction season changes are allowed for the first day's production on a retroactive basis.

2.5 JOB MIX

A. Submit a written job mix gradation for approval including single values for each sieve size based on the dry weight of the aggregate.
   1. Conform to Section 02721, Table 4 for dry weight values.
   2. Make changes before beginning a day's production and submit changes in writing to the DEPARTMENT.
   3. For each construction season, changes are allowed only for the first day's production on a retroactive basis.

PART 3 EXECUTION

3.1 PREPARATION

A. Aggregate:
   1. Place on the base in a uniform windrow(s).
   2. Limit moisture content to 2 percent. AASHTO T 265.
   3. ENGINEER may increase maximum allowable moisture content for porous material when laboratory tests indicate that exceeding 2 percent moisture content produces a stable mix.
   4. Allow at last 24 hours to verify volume, moisture content, unit weight, and asphalt quantity before applying asphalt material.

B. Choose from the three mixing options listed in this Section in paragraphs:
   1. Traveling Mixer
   2. Blade Mixing
   3. Stationary Mixer.

3.2 TRAVELING MIXER

A. Use a mixer that thoroughly blends the aggregate and asphalt, and introduces a pre-measured flow of asphalt cement during the mixing process.

B. Produce a mixture uniform in appearance, texture, asphalt content, and free from pockets of segregated aggregates.

C. Obtain the desired degree of aeration, using supplemental blade mixing if necessary.

D. Continue mixing until not more than 50 percent of the original volatiles remain in the mix. AASHTO T 110.

3.3 BLADE MIXING

A. Spread the windrowed aggregate on the prepared base.

B. Uniformly apply the asphalt material over the aggregate with a pressure distributor.
   1. Apply the asphalt material in two or more applications over a section with preset limits.
   2. Do not spread more than 2.3 L/m^2 of asphalt cement in any one application.
   3. Do not overlap spreads onto adjoining sections.

C. Partially mix the asphalt material with the aggregate immediately after each application.

D. Windrow and mix the entire surface course after the last application of asphalt cement.
   1. Mix by blading the material from side to side of the roadway.
   2. Produce a mixture uniform in appearance, texture, asphalt content, and free from pockets of segregated aggregates.
   3. Continue mixing until not more than 50 percent of the original volatiles remain in the mix. AASHTO T 110.
   4. Do not cut into the underlying base course or contaminate the mixture with earth or other foreign matter while mixing.

3.4 STATIONARY MIXER

A. Mix and apply asphalt material in compliance with the mixer manufacturer's requirements.
   1. After mixing, haul and place the material on the roadway surface in a uniform windrow.
   2. Conform to the requirements in this Section, paragraph: Traveling Mixer for uniformity, percent of volatiles, and texture.

B. Supplemental blade mixing may be required.

3.5 TEMPERATURE CONTROL

A. Asphalt viscosity range: maintain at 50 centistokes to 200 centistokes at application. AASHTO T 201.

B. ENGINEER will designate the exact temperature range.

3.6 SPREADING AND COMPACTING

A. Form the completed mixture in a windrow of approved cross section and spread in a single course to the plan elevations, grades, and cross sections.

B. Rolling:
   1. Use a pneumatic roller for initial rolling.
   2. Use a steel-wheel roller for final rolling.
   3. Roll without shoving and causing distortion to the surface.

C. At the end of each day's work or when the work is interrupted by inclement weather, blade all non-compacted spread material into a windrow whether mixing is completed or not. Do not leave non-compacted spread material on the roadbed overnight.

3.7 FINISHING

A. Finish to a smooth, uniform line and grade with surface deviations not exceeding 10 mm, ± in 3 m.

B. Determine smoothness compliance using a straightedge or string line.

3.8 PROTECTION

A. Protect all structures including curb, gutter, sidewalk, precast concrete barrier, and guardrail when applying the material and manipulating the mixture.

END OF SECTION

SECTION 02748

PRIME COAT/TACK COAT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for applying:
   1. Prime coat: Liquid or emulsified asphalt to a prepared subgrade or untreated base course.
   2. Tack coat: Cutback or emulsified asphalt to the existing surface or new pavement surface and intermediate lifts.

B. Blotter materials and procedures for absorbing excess asphalt as required.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

B. Section 02745: Asphalt Material.

C. Section 02324: Compaction.

1.3 REFERENCES

A. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

B. AASHTO T 201: Kinematic Viscosity of Asphalts.

PART 2 PRODUCTS

2.1 PRIME COAT

A. Liquid or emulsified asphalt: Refer to Section 02745.

B. Blotter material: Granular materials following AASHTO T 27, meeting the following criteria:

Sieve Size	Percent Passing
4.75 mm	90 to 100
2.00 mm	25 to 80
75 Fm	0 to 15

2.2 TACK COAT

A. Cutback or emulsifed asphalt of the type and grade called for in the bid proposal and Section 02745.

B. Tack coat referred to for paving fabrics is a PG 58-22 or PG 64-22.

C. Do not use an emulsion or cutback in paving fabric placement.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

A. Prime Coat:
1. Shape the surface to the required grade and section.
2. Keep the surface free from ruts, corrugations, or other irregularities.
3. Compact the surface following Section 02324.

B. Tack Coat:
1. Clean the surface of all materials that prevent the tack coat from bonding to the existing surface (e.g. mud, dirt, leaves, etc.)
2. Cover all tacked surface areas with surfacing materials. This must be done the same day the tack coat is applied.

3.2 APPLICATION

A. Do not apply prime coat or tack coat:
1. On a wet surface.
2. When the surface temperature is below 10 degrees C.
3. When weather conditions prevent it from adhering properly.

B. Protect all structures including guardrails, guide posts, etc. from being spattered or marred.

C. Secure approval for the quantities, rate of application, temperatures, and areas to be treated.

D. Use a pressure distributor to apply the asphalt in a uniform, continuous spread.

E. Keep the viscosity between 50 and 100 centistokes. AASHTO T 201.

F. Immediately apply another application to underprimed surface.

G. Apply a prime or tack coat to all surfaces, including vertical which will come in contact with Hot Mix Asphalt.

H. Spread blotter material if the prime coat fails to penetrate. Use the quantities required to absorb the excess asphalt.

3.3 TRAFFIC CONTROL

A. Refer to Section 01554.

B. Maintain the prime coat/tack coat until the next course is placed.

C. Keep all traffic off the prime coat until it has cured and dried.

D. Provide detours for existing traffic.

E. Restrict operations to allow at least one-way traffic.

END OF SECTION

SECTION 02749

ASPHALT DRIVEWAY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construct asphalt concrete driveways.

1.2 RELATED SECTIONS

A. Section 02721: Untreated Base Course.

B. Section 02316: Roadway Excavation.

C. Section 02741: Hot Mix Asphalt.

D. Section 02748: Prime Coat/Tack Coat.

PART 2 PRODUCTS Not used.

PART 3 EXECUTION

3.1 SUBGRADE

A. Refer to Section 02316.

3.2 UNTREATED BASE COURSE

A. Refer to Section 02721.

3.3 PRIME COAT

A. Refer to Section 02748.

3.4 ASPHALT CONCRETE

A. Refer to Section 02741.

END OF SECTION

SECTION 02752

PORTLAND CEMENT CONCRETE PAVEMENT - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing Portland Cement Concrete Pavement.

1.2 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 01452: Profilograph.

C. Section 03055: Portland Cement Concrete.

D. Section 03152: Concrete Joint Control.

E. Section 03211: Reinforcing Steel and Welded Wire.

F. Section 03390: Concrete Curing.

1.3 REFERENCES

A. AASHTO M 154: Air Entraining Mixtures for Concrete.

B. AASHTO M 157: Air Entraining Admixtures for Concrete.

C. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

D. AASHTO T 23: Making and Curing Concrete Test Specimens in the Field.

E. AASHTO T 24: Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

F. AASHTO T 26: Quality of Water to be Used in Concrete.

G. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

H. AASHTO T 97: Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading).

I. AASHTO T 119: Slump of Portland Cement Concrete.

J. AASHTO T 121: Weight Per Cubic Foot, Yield, and Air Content (Gravimetric) of Concrete.

K. AASHTO T 141: Sampling Fresh Concrete.

L. AASHTO T 152: Air Content of Freshly Mixed Concrete by the Pressure Method.

M. AASHTO C 457: Microscopical Determination of Parameters of the Air-Void System in Hardened Concrete.

N. ASTM D 3405: Joint Sealant, Hot-Applied, for Concrete and Asphalt Pavements.

1.4 SUBMITTALS

A. Profilograph: Submit to the ENGINEER the day following testing, a copy of measured profile data and generated graphic reports containing a scaled reproduction of the measured profile with stationing, deviation information, and document points.

B. Concrete:
1. Use 3A(AE).
2. Refer to Section 03055.
3. Furnish the ENGINEER with mix design, trial batch gradation, and 28-day compressive strength test results from the trial batches before placing concrete.
4. Use the same materials and admixtures intended for production in the trial batches.
5. From the batch trial results, determine the cement content, aggregate ratio, and quantities of other mix components necessary to meet a design 28 day compressive strength of 36 MPa and a 7 day flexural strength of 3.4 MPa.
6. The proportioning and mixing of the trial batches are subject to inspection.
7. Do not place pavement until written approval of the mix design is obtained.
8. Meet the approved trial batch proportions. Changes in the mix proportions may require new trial batches.

1.5 PROJECT CONDITIONS/LIMITATIONS

A. **Seasonal:** Do not pave from October 15 to April 15. Submit cold weather concrete plan to the ENGINEER for written approval to pave outside these limits.

B. **Hot Weather:** Discontinue paving when mix temperature reaches 32 degrees C either at point of placement or batch plant platform, or when ambient air temperature exceed 38 degrees C in the shade.

C. **Cold Weather:**
1. Paving may begin when base surface temperature is 2 degrees C in the shade and ascending.
2. Maintain the mix temperature at a minimum 16 degrees C.
3. Cease operations when the ambient temperature is 7 degrees C in the shade and decreasing.
4. Do not add chemical admixtures to prevent freezing.

5. Remove and replace concrete damaged by frost action at no additional cost to the DEPARTMENT.
6. Do not use material containing frost or lumps.
7. Do not heat water or aggregate to more than 66 degrees C.
8. Protect the concrete from freezing for 48 hours after placement.

D. **Night Operations:** Provide proper lighting from one-half hour after sunset to one-half hour before sunrise following Section 00555, paragraph: Limitation of Operations.

1.6 ACCEPTANCE - OVER LEAN OR UNTREATED BASE COURSE

A. Thickness acceptance will be determined by core lengths located randomly one core per 1100 m^2 area.

B. Core lengths:
1. ENGINEER will divide the pavement into consecutive areas not to exceed 1100 m^2.
2. Add a final area of less than 550 m^2 to the previous section to make one section.
3. A final area of greater than 550 m^2 will constitute a separate area.
4. Hand-placement areas will be considered separately. Take one core per placement area.

C. ENGINEER will take three measurements on each core and record to the nearest 1 mm. Use the average to determine the acceptability and pay factors for deficient thickness areas using Table 2 of Section 02752 of the Methods of Measurement, Basis of Payment in the Supplemental Specifications (Bid Book).

D. ENGINEER will take two additional cores for any deficient core (one on each side) where the thickness varies by 3 mm. Locate the new core between the deficient core and each of the adjacent cores.

E. Deficient areas of slab thickness will be defined by new cores plotted along with the original cores.

F. ENGINEER will graph the deficient areas with the following assumptions:
1. The graph represents the thickness of the pavement
2. The thickness varies linearly along the pavement's length from core depth to core depth
3. The pavement is a constant depth in the transverse direction.

1.7 ACCEPTANCE - OVER EXISTING SURFACES

A. Thickness acceptance of the finished pavement will be determined from the graph of the deviations from the profile grade established by the plans or ENGINEER.

B. ENGINEER will take elevations at 30 m intervals, and compare against the profile and graph to determine deficient thickness areas.

C. Price adjustments for pavement areas with deviations below thickness profile will be computed using Table 3 in Section 02752 of the Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).

D. The ENGINEER may accept pavement areas with deviations of more than 20 mm at 50 percent pay or require removal and replacement. Make all corrections, including removal and replacement, at no additional cost to the DEPARTMENT.

1.8 ACCEPTANCE - COMPRESSIVE STRENGTH (ACCEPTANCE/RETESTING)

A. Acceptance criteria for compressive strength are detailed in Table 1 of Section 02752 of the Methods of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).

B. Hand-placement areas will be considered separately.

C. The ENGINEER will notify the CONTRACTOR within three calendar days of determining the 28-day compression if any strength test is below specifications. The CONTRACTOR may request referee testing in writing within 35 calendar days after placing concrete.

1. An independent third party testing agency will conduct referee testing within 35 calendar days after placement at no additional cost to the DEPARTMENT.
2. All testing laboratories must:
   a. Be certified by the Cement and Concrete Reference Laboratory.
   b. Use ACI accredited level one or level two inspectors.
   c. Be acceptable to both the DEPARTMENT and the CONTRACTOR.
3. Obtain six pairs of cores at locations directed by the ENGINEER. Condition and wet test the cores as specified in AASHTO T 24.
4. ENGINEER will adjust the core strengths to a standard equivalent cylinder strength by dividing by a factor of 0.85. Each pair of adjusted core strengths will be averaged and considered as a single core test result.
5. Basis of acceptance of the lot will be as follows:
   a. If any of the adjusted referee core test results are less than 28.0 MPa, ENGINEER will use the lowest core test result or the original cylinder test value, whichever is lowest.
   b. If all the six adjusted referee core test results exceed 28.0 MPa and the average is below 32.4 MPa, ENGINEER will use the original cylinder test for the pay factor.
   c. If all the six adjusted core test results exceed 28.0 MPa and the average exceeds 32.4 MPa, DEPARTMENT will accept lot at full pay.

D. ENGINEER and CONTRACTOR will jointly determine alternate methods of acceptance for the lot represented by a specimen apparently damaged during the curing process or otherwise unacceptable.

E. Fill the core holes with concrete after coring making sure that the holes are cleaned and dry at the time they are filled.
   1. Coat the sides of the holes with an approved epoxy resin adhesive listed on the Qualified Products List maintained by the Materials and Research Section.
   2. Consolidate the concrete by rodding or vibrating.
   3. Strike off level with the pavement surface, texture, and treat with the specified curing-sealing compound.
   4. Protect concrete in core holes from any damage for a minimum of 48 hrs.

PART 2 PRODUCTS

2.1 CONCRETE

A. Use 3A(AE) concrete.

B. Refer to Section 03055: Portland Cement Concrete.

2.2 AGGREGATE

A. Refer to Section 03055 for coarse, fine, and combined aggregates.

B. Coarse aggregate sizes 50 mm to 4.75 mm and 37.5 mm to 4.75 mm shall be separated and stockpiled in two sizes with the separation being made on the 25 mm and 19 mm respectively.

C. The minus 75 Fm material shall be determined in accordance with AASHTO T 11 and T 27.

2.3 WATER

A. Water for washing aggregates, mixing concrete, and for use at the testing platform (when compared with distilled water) shall not change the setting time of Portland Cement more than 25 percent or reduce the compressive strength of mortar more than 10 percent.

B. The maximum concentration of sulfate as SO_4 shall be limited to 3000 ppm.

C. Potable water may be used without testing.

D. Conform to AASHTO T 26.

2.4 ADMIXTURES

A. Air-entraining Agents
   1. Select from the Qualified Products list maintained by the UDOT Materials & Research Division.
   2. When concrete is central-mixed and transported in non-agitating haul units, incorporate synthetic air entraining admixtures.
   3. When central-mixed with non-agitating haul units, incorporate non-vinsol resin.
   4. When central-mixed with agitating haul units or transit-mixed, conform to the material standard found in AASHTO M 154.
      a. Thoroughly mix all entraining agents before use.
      b. Constantly agitate any agent that settles during batching.

2.5 POZZOLAN

A. Refer to Section 03055.

B. Unless specified otherwise, replace 20 percent of the cement with Class F fly ash.

2.6 CONCRETE CURING COMPOUND

A. Refer to Section 03390, Part 2.

2.7 EXPANSION JOINT MATERIALS

A. Refer to Section 03152, Part 2.

2.8 JOINT SEALERS

A. Unless specified otherwise, provide pre-approved hot applied joint sealant for transverse-sawed, longitudinal-sawed, and all contact joint following Section 03152.

B. Select sealers and joint material from the qualified products list maintained by UDOT Materials and Research Division.

2.9 STEEL REINFORCEMENT

A. Tie Bar: Grade 60, deformed reinforcing steel epoxy-coated following Section 03211.

B. Dowel Bars: Grade 60, smooth steel rod, epoxy- coated, following Section 03211.

2.10 CONCRETE COLORANT FOR STATION MARKERS

A. Brick Red 160 or Tile Red A-28 surface, dry-shake type concrete colorant.

2.11 BATCH PLANT

A. Meet the requirements of the UDOT Quality Management Plan for Ready-Mix Concrete.

B. Equip batch plant with a numerical printout device that makes a continuous, permanent, and accurate record of:
   1. The weights of all individual ingredients including water and cement added after initial batching.
   2. The time of day for each batch shown in hours and minutes.
   3. Date and daily accumulated totals.
   4. Commercial batch plants that are not dedicated to the project are exempt from the daily accumulated total requirement.

C. Furnish the ENGINEER with a copy of the record at the end of each production day.

D. If the printout device malfunctions, finish the shift following the initial malfunction. Then stop operations until the device is fully operational.

E. Have the beams scales, and water meters on the batching plant checked, certified, and sealed by the Utah Department of Agriculture, Division of Weights and Measures annually and each time the plant or weighing device is moved.

2.12 TESTING PLATFORM

A. Provide a stable, 12 m x 12 m testing platform with a canopy when concrete is hauled in dump trucks.
   1. Provide a lockable 2.4 m x 3 m x 2.4 m storage room at one end.
   2. Locate the platform within 75 m of the batch plant.
   3. Platform height must equal the concrete haul truck bed height.
   4. Platform must meet the Department of Labor standards outlined in “Safety and Health Regulations for Construction.”
   5. Provide adequate railing, and stairs with a handrail.
   6. Provide 110 V electrical power and pressurized water.
   7. Maintain suitable lights and outlets and a communication system with the batch plant control room.

2.13 VEHICLES FOR HAULING

A. Haul vehicles are limited to the legal axle load.

B. Present certified scale axle weights for each unit in terms of meters to be hauled.

C. Permissible to use:

1. End dump trucks with essentially watertight beds and endgates, and rounded corners.
2. Agitator trucks with open tops.
3. Transit mixers that conform to the standard found in AASHTO M 157.

D. Do not use bottom or belly dump units.

2.14 CYLINDER STORAGE DEVICE

A. Use a device that maintains a temperature of 16 degrees C to 27 degrees C and is equipped with an automatic 7-day temperature recorder. The recorder's accuracy must be within 1 degree C. and have a permanent recording feature.

B. Use device or devices with the capacity to accommodate the required test cylinders and beams for a minimum of two day's operation. Shutdown placement of concrete if capacity is lacking.

C. Make the storage devices available on the job site at least 48 hours before placement.

D. Submit written procedures explaining operation and required monitoring or care of the device for approval.

E. A 24-hour test run may be required.

2.15 SLIP FORM PAVER

A. Self-propelled machine with no fluid leaks, equipped with automatic line and grade control capability.

B. Capable of:
1. Spreading the dumped concrete uniformly across the grade by an auger or a traveling strike-off device.
2. Vibrating, tamping, striking-off, and shaping the concrete to the desired line grade and thickness in one continuous pass.

C. Do not include a cleary rod or similar device.

D. Under normal operating conditions, do not place wheeled or tracked power equipment in front of the paver redistributing the concrete.

E. Vibrator minimum requirements:
1. Eccentric Diameter: 48 mm.
2. Frequency: 9500 vibrations per minute minimum.
3. Spacing: 450 mm maximum mounted longitudinally.

F. Operate the vibrators horizontally at the midpoint of the concrete slab and mounted so they maintain this position.

G. Run the vibrators parallel to the direction of the paving.

H. Check each vibrator for operation daily.
   1. Shutdown paving operations immediately if any indication of malfunction occurs.
   2. Resume operations only after repairing or replacing the vibrator.

I. Trailing forms: long enough to leave a smooth, straight, vertical edge.

J. The vibrating and tamping elements: stop when the forward movement of the paver stops.

2.16 FINISHING EQUIPMENT REQUIREMENTS

A. Machine float that may be attached to the paver.

B. Burlap drag.

C. Transverse tining machine (single use) and a comb equipped with steel tines randomly spaced (15 mm - 25 mm).

D. Curing-sealing compound application machine (single use) with a fully atomizing type power spray and a wind protection hood.

E. Dual-use tining and curing machine may be used when placement rate is 76.5 m^3/h or less.

2.17 PAVEMENT SURFACE ROUGHNESS TESTING DEVICE - PROFILOGRAPH

A. Refer to Section 01452.

PART 3 EXECUTION

3.1 PREPARATION

A. The profilograph must be on the project before beginning paving operations.

B. Aggregate Stockpiles
   1. Prepare site by clearing, grubbing, smoothing, and compacting.
   2. Stockpile platforms will be constructed in such a way as to prevent intrusion of subgrade materials into aggregates.

3. Provide adequate drainage for the stockpile site.
4. Construct stockpile platforms in such a way to prevent intrusion of subgrade materials into aggregates.
5. Provide adequate drainage for the stockpile site.
6. Construct either individual stockpiles containing materials for a single day of paving or elongated stockpiles (maximum 7.5 m in height, 9.0 m top width) with material identified.
    a. Build stockpiles a minimum of two working days before use.
    b. Acceptance of stockpiles will be in daily increments only and a maximum of 30 calendar days before use.
    c. May construct standby stockpiles to prevent or avoid delays. Cover until needed.
7. Construct by distributing over entire base in layers not to exceed 1.5 m.
    a. Do not dump or spill over sides.
    b. Equip conveyors with rock ladder or tremie.
    c. Maximum drop from rock ladder or tremie is 3 m.
8. Restrict conical piles to a 3 m maximum height before distribution.
9. Supply loader and operator to assist in sampling for testing.

3.2 APPLICATION - FORMED PAVING OPTION

A. Construct pavement between metal side form conforming to the guidelines in this Section.

B. Do not allow springing to occur under the weight of paving and finishing equipment.

C. Forms:
1. Keep free from warps, bends, kinks, and keep equal in depth to the specified pavement edge.
2. Maintain deviation of the forms within 3 mm from a plane in the top surface or within 6 mm from a plane surface on the inside face.
3. Set at a distance equal to a day's maximum run.
4. Firmly stake side forms using steel dowels placed on each side of every joint, and spaced not more than 1.5 m apart.
5. Tightly join form sections by an interlocking joint free of vertical and horizontal movement.
6. Cease paving operation if the side forms do not meet line and grade, or if side forms are loose.
7. Keep side forms in place for at least 12 hours after the concrete has been placed. Clean and oil forms after each use.
8. Remove the side forms without damage to the edge of the pavement. Immediately fill any honeycomb areas at once with mortar composed of 1 part portland cement, 2 parts sand, and sufficient water to form a thick paste.
9. Protect the edges of the pavement with curing-sealing compound after the form removal.

D. Vibrators:

1. Attach vibrators to the concrete finishing machine in front of the strikeoff auger and mount as transverse moving or longitudinal fixed at 450 mm maximum spacing to clear tie bars.
2. Vibrator minimum requirements:
   a. Eccentric Diameter: 48 mm.
   b. Frequency: 9500 vibrations per minute.
3. Use hand-operated vibrators on a regular pattern not to exceed 300 mm in each direction for irregular areas where required.

3.3 LINE AND GRADE CONTROL

A. Establish the necessary stakes for grade control over existing surfaces, and provide the elevation control benchmarks.

B. Use previously established stakes for grade control on the underlying course or courses of lean concrete or bituminous base course.

C. Equip machinery with a control system which automatically controls concrete placement to the specified longitudinal grades.

D. Control systems:

1. Must be automatically actuated from an independent line and grade control reference using a system of mechanical sensors or sensor-directed devices.
2. Use sensors that maintain the equipment at the proper transverse slope and elevation to obtain the required thickness and surface.
3. Furnish, place, and maintain supports, wire devices, and materials as required to provide continuous line and grade reference controls for the placing machine, etc.

3.4 BATCHING MATERIALS

A. As specified for weighing and batching materials. Conform to AASHTO M 157.

B. Batch mixer: Conform to the standard, and operate at the drum speed recommended by the manufacturer.

1. Do not lose bulk cement and fly ash when transporting into the mixer.
2. Introduce cement before fly ash.
3. Add admixtures to the mix water separately and at different times.
4. Conduct mixing efficiency tests at the beginning of placing concrete, and evaluate as specified in AASHTO M 157, Annex A-1.
5. Maintain a mixing time of 80 seconds at manufacturer recommended mixing speed after all materials are in the drum. If necessary, mixing time will be increased in 10 second increments until the mixer efficiency evaluation is passed.

6. Correct poor mixing efficiency at no additional cost to the DEPARTMENT.
7. Replace mixing blades when they are worn down 25 mm or more below the original height.
8. Do not allow buildup of cement or mortar on the mixer drums and blades.

C. Centrally mixed materials:
1. Mixing time will be based on the results of the mixer efficiency evaluation, and will be **not less than 80 seconds.**
2. Mix materials for a minimum of 30 seconds after the last addition of water or cement is made after initial batching.

D. Transit mixed materials:
1. Add a minimum of 30 revolutions at mixing speed when water is introduced after initial batching. Follow AASHTO M 157.
2. Do not add water to retemper the concrete.
3. Do not add water to the mix after acceptance testing.

3.5 PLACING CONCRETE

A. Keep the base surface moistened 150 m in front of the paver without allowing areas of standing water to occur.

B. Place material according to Section 01452, Part 3, paragraph: Testing Portland Cement Concrete Pavement; and Section 02752 of the Methods of Measurement, Basis of Payment, "Price Reductions for Deficient Thickness," in the Bid Book.

C. Place the concrete to the full width of the pavement in a single operation.

D. Vibrate, screed, and mechanically tamp the spread concrete.

E. Discharge and place the mixed concrete with a lay down machine within the time frame listed below after introducing the mixing water to the cement and aggregates. Reject concrete not placed within the following time period.
1. Non-agitating Haul Equipment: 35 minutes.
2. Agitating Haul Equipment: 75 minutes.

F. Deposit the concrete so rehandling is not required.

G. Thoroughly vibrate against and along the faces of the forms.

H. Use shovels or other approved tools for any necessary hand spreading. Do not use rakes.

I. Do not add water to the pavement surface behind the final screed on the paver.

J. Spray water directly on the final burlap drag only in the quantity necessary to keep the burlap wet.

K. Do not add water to the surface for finishing. If water is added, paving operations may be shut down or the concrete rejected.

L. Concrete may be placed in an adjoining longitudinal section three days after initial placement.

M. Provide protection for initial surface.

3.6 HANDLING AND PLACING REINFORCING STEEL

A. Properly store all steel received.

B. Keep tie bars clean, free from damage, and free from distortion.

C. Place tie bars in the middle third of the slab, as shown on the plans.
   1. Refer to Standard Drawings 450-1, 450-2, and 450-3.
   2. Place normal to direction of paving and parallel to the slab surface.
   3. Hold tie bars, as shown in the plans.
   4. Place by using automatic bar inserters, support on chairs, through forms, or drilled and epoxied in. Manual insertion is not permitted.

D. When load transfer dowel bars are required, place bars in the middle third of the slab depth, parallel to the centerline and surface of the slab. Deviations from parallel shall be limited to 6 mm in the length of the dowel bar.

3.7 FINISHING

A. Finish the surface smooth and true to grade by machine float immediately after placing concrete. Finish at a rate equal to the progress of the paving operation.

B. If preliminary finishing is delayed more than 30 minutes after initial screeding, shut down the mixing operation until the situation is resolved.

C. Texture the pavement by burlap drag and transverse tining.
   1. Use at least three plies of wet burlap and drag parallel to the centerline without tearing.
   2. Complete the drag finish with one pass.
   3. Form depressions in the plastic concrete surface with the tining comb:
      a. Randomly spaced (15 mm to 25 mm).
      b. 2 mm to 4 mm deep normal to centerline.
      c. Do not tear or remove excess mortar in the tining process.
   4. Do not tine Category 5 highways as defined in Table 3 in Section 01452.

D. Mark station numbers every 150 m and date of placement 7.5 m from start and finish of a day's placement on the outside edge of the concrete pavement:
   1. After texturing and before curing-sealing.
   2. Use a "brand" with changeable numbers a minimum of 75 mm in height.
   3. Smooth an area approximately 225 mm X 450 mm with a float, color with concrete colorant, and press the "brand" approximately 6.25 mm into the concrete to form the appropriate station number.

3.8 CURING

A. Refer to Section 03390, Part 3.

3.9 FIELD QUALITY CONTROL

A. ENGINEER will random sample all concrete.

B. Compliance with the mix design will be determined by inspecting the batching procedures.
   1. The DEPARTMENT will furnish the molds and machines for testing.
   2. Furnish material, internal vibrators and storage devices following paragraph 2.18: Cylinder Storage Device (3.5.4) for making and curing the test specimens as per AASHTO T 23.
   3. Maintain cylinders at a temperature range of 16 degrees C to 27 degrees C for the initial curing period of not less than 24 hours.
   4. Cure concrete cylinders and flexure beams in the field a minimum of 24 hours before moving.
   5. Maintain storage devices.

C. ENGINEER will sample materials centrally mixed with non-agitating haul units at the batch plant platform in accordance with AASHTO T 141.
   1. One set of strength tests represents 2200 m^2 of pavement.
   2. Hand-placed areas will be considered separately for strength and thickness.
   3. Run each truckload of concrete past the platform for inspection. The ENGINEER may test any or all truckloads.
   4. Perform correlation testing to determine the loss of entrained air from the platform to the finished in-place pavement.
      a. Perform air test on concrete at the platform, and again from the same load in the finished pavement. Record any change in the air content.
      b. Make necessary adjustments at the platform to ensure adequate air-entrainment in the finished pavement.
      c. Perform two tests, one in the morning and one in the afternoon, for each day of paving operations.

D. ENGINEER will sample and test materials centrally mixed with agitating haul units or transit mixed at placement location. One set of strength tests represents 600 m^2 of pavement or one day's placement whichever is smaller (a lot).

E. ENGINEER will test air and slump in accordance with AASHTO T 152, and T 119 on the first three loads at startup and after any shutdown of more than one hour.
   1. Slow the batching operation to allow completion of each air and slump test before the next batch is made. Communicate test results to the batch plant operator and make necessary corrections.
   2. ENGINEER will take random samples during the day. Any samples taken that differ from air or slump test requirements will require the testing and acceptance of three consecutive loads before full operation resumes.
   3. ENGINEER will verify samples that are out of specifications by conducting an additional test on the same load. When the second test is within specifications, ENGINEER will conduct a third test as the deciding factor.

F. Yield tests: ENGINEER will take in conjunction with an air test at least one per day in accordance with AASHTO T 121.

G. Compressive Strength: ENGINEER will conduct a strength test consisting of one set of three cylinders made at the platform or point of placement. Conform to AASHTO T 23.

H. Flexural Strength: ENGINEER will cast two beams for each day concrete is placed.
   1. Conform to AASHTO T 23 and T 97.
   2. Beams used to determine when a pavement can be opened for traffic shall be cured in the field at the site of the represented pavement.

3.10 PROTECTION

A. Protect pavement against all damage and marring.

B. Keep contractor hauling equipment and traffic off the pavement until at least ten days after concrete placement as per AASHTO T 97, or until 100 percent of the minimum strength has been achieved.
   1. Use barricades to prevent traffic from using the pavement.
   2. Construct crossings to bridge the concrete as approved by the ENGINEER when necessary at no additional cost to the DEPARTMENT.

C. Protect from rain and hail damage.
   1. Cease operation when rain is threatening.
   2. Remove, replace, or repair any pavement damaged by rain or hail as directed at no additional cost to the DEPARTMENT.

3.11 JOINTS

A. Construct contact joints, sawed joints, or transverse expansion joints as shown on the plans.

B. Keep the faces of all joints at right angles to the top surface of the pavement with all longitudinal joints parallel to the centerline and coinciding with the traffic lane lines.

C. Place fresh concrete against previously cured concrete at planned locations to form contact joints.
   1. When used, retain transverse contact joint forms in place until paving operations resume.
   2. Join concrete on both sides of all longitudinal and transverse contact joints with tie bars as shown in contract plans.
   3. Maintain the tie bars in their proper position during concrete placement.
   4. Saw and seal all contact joints to the dimensions shown on the plans.

D. Longitudinal contact joints:
   1. Construct with tie bars to the dimensions shown on the plans.
   2. Do not allow the finished surface across longitudinal contact joints to deviate from a straight line by more than 3 mm in 3 m when tested with a straight edge.
   3. Shut down operations until specified tolerances are achieved if the edge slump requirements are not satisfied within 60 m longitudinally of the start of a contact joint.
   4. If the edge slump exceeds the specified 3 mm in 3 m, repair the edge by the following procedures before placing adjacent concrete:
      a. Saw off the slumped edge to the full thickness with a diamond saw.
      b. Drill holes in the sawed edge and epoxy in new tie bars.
      c. Use 25 M --- 600 mm epoxy-coated tie bars. Place midpoint in the slab at 300 mm on center embedded 300 mm into the slab.
   5. Straighten bent tie bars and re-coat with epoxy paint at the bend point before placing concrete in the adjacent lane.

E. Use power driven saws to construct sawed joints. Maintain a minimum of two working power saws and one working standby power saw during concreting operations.
   1. Single cut all transverse and longitudinal joints (3 mm wide) to one third the depth of the design pavement thickness (T/3).
   2. Saw initial or “control” transverse contraction joints at 15 m intervals or less to control cracking.
      a. Begin sawing immediately after the concrete has sufficiently hardened and before uncontrolled cracking occurs.
      b. Conduct continuous sawing operations during both day and night regardless of weather conditions.
      c. Provide lighting during nighttime sawing.

3. Immediately flush all joints with water after sawing and wash cuttings from road surface.
4. Thoroughly clean joints of all loose debris, cement powder, etc., with a jet of water at 14 000 kPa minimum pressure.
5. Keep the transverse joints clean and dry before placing moisture resistant backer rod and/or sealant.
    a. Clean the joint with air at a minimum of 700 kPa just before placing the backer rod.
    b. Equip air compressors with operating oil and water traps.
6. Unless specified otherwise, install hot-pour joint sealant (ASTM D 3405) the full depth of the saw cut.
7. Fill the longitudinal joints evenly 3 mm ± below the pavement surface.
8. Do not permit hauling equipment or traffic on the pavement before all sawed joints are sealed.
9. Match joints in adjacent lanes to form a continuous line across the pavement width including the concrete shoulders.

F. Make night and transverse contact joints normal to the centerline without keyways on the vertical face.
1. Use 35 M --- 450 mm epoxy-coated tie bars placed midpoint in the slab at 300 mm on center and embedded 225 mm on each side.
2. Form joints with tie bars placed through the form or saw joints with tie bars drilled and epoxied, or as approved.

G. Form transverse expansion joints at structure approaches as shown on the plans by using a joint filler strip and joint sealer.
1. Firmly support the filler strip by metal holder and end supports which remain in place after completing the pavement.
2. Secure the metal holder and end supports to prevent movement of the filler strip away from the position indicated on the plans when placing and vibrating the concrete.
3. Extend the joint filler the full width of the concrete being placed less 5 mm on each end.
4. Remove any concrete which flows around the ends of the joint filler.

3.12 DEFECTIVE PAVEMENT PANELS

A. A panel is that area of pavement within the traffic lane bounded by two transverse joints.

B. ENGINEER will determine defective panels within 21 calendar days after placement.

C. Repair or replace defective pavement panels before acceptance for smoothness at no additional cost to the DEPARTMENT.

D. Remove and replace panels within the traffic lane when multiple full depth cracks separate the panel into three or more parts including the adjacent shoulder.

E. Remove and replace portions of panels within the traffic lane and the adjacent shoulder with any full depth transverse crack within 1.2 m or less of a transverse sawed joint. Use methods which do not disturb adjacent panels.

F. Drill and epoxy tie bars as well as dowel bars into existing pavement. Coat dowel bars with a release agent on the free end.

G. Groove to a 25 mm depth by 10 mm width and seal any random full depth cracks that open 0.5 mm or more at the surface in 21 calendar days after placement. Silicone sealant required.

H. Leave tight random cracks less than 0.5 mm wide undisturbed.

I. Any core taken for determining full-depth crack shall be at no additional cost to the DEPARTMENT when the core verifies full-depth cracking.

3.13 SMOOTHNESS TESTING

A. Determine pavement lane smoothness factors using a profilograph

B. Refer to Section 01452 for smoothness requirements.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

SECTION 02761

SCORED SHOULDER - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for scoring shoulder on the final asphalt surface.

PART 2 PRODUCTS

2.1 EQUIPMENT - ROLLER

A. Steel wheeled vibratory roller or combination steel wheel vibratory-rubber tire roller equipped as follows:

1. Rubber tires: Smooth and slick.
2. Water system: To moisten drums and tires sufficiently to prevent accumulation of asphalt material.
3. Weight: Five megagrams (minimum).
4. Alignment guide: Visible to the operator.
5. Steel roller modification:
   a. Use 37.5 mm diameter pipe (half-section) 0.6 m long welded onto the roller drum.
   b. Space pipes at 200 mm (minimum), 225 mm (maximum) centers.
   c. Pipes not to extend beyond drum edge.

PART 3 EXECUTION

3.1 INSTALLATION

A. At locations shown on the plans, and following Standard Drawing 460-1.

B. Not allowed at ramp openings.

C. Not allowed across bridges.

END OF SECTION

SECTION 02762

PLOWABLE PAVEMENT MARKER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing plowable pavement marker.

1.2 REFERENCES

A. ASTM A 536: Ductile Iron Castings.

1.3 SUBMITTALS

A. Provide a manufacturer's certificate of compliance for each housing, reflector, and epoxy.

PART 2 PRODUCTS

2.1 HOUSING

A. ASTM A 536.

B. Marker housing: Nodular iron, Grade 80-55-06, hardened to 52-54RC.

C. Rectangular housing: Not less than 250 mm long by 140 mm wide, including lugs, by 48 mm deep.

2.2 REFLECTOR

A. Acrylic prismatic reflector.

B. Reflective area not less than 1030 mm^2 per face.

C. Specific intensity of the reflector at 0.2 degrees observation angle.
   1. White:
      a. 3.00 at 0 degrees horizontal entrance angle.
      b. 1.20 at 20 degrees horizontal entrance angle.
   2. Yellow:
      a. 1.80 at 0 degrees horizontal entrance angle.
      b. 0.72 at 20 degrees horizontal entrance angle.

2.3 EPOXY

A. Rapid setting type with

1.	Pot life at 25 degrees C:	6 minutes to 11 minutes
2.	Bond strength 1 hour at 25 degrees C:	1240 kPa
3.	Bond strength 24 hour at 31 degrees C:	2760 kPa
4.	Property retention:	5 cycles
5.	-18 degrees C to 38 degrees C:	6 Months

PART 3 EXECUTION

3.1 RECTANGULAR MARKER

A. Placement:

1. Produce a hole and grooves in pavement parallel to the traffic. Depth and configuration to be consistent with housing.
2. Clean surface of the keel and web of oil, grease, or any contaminant that reduces the bond to the epoxy adhesive.
3. Partially fill the clean dry hole with epoxy cement.
4. Place reflector housing in epoxy filled grooves and apply sufficient foot pressure to seat the housing.
5. All four leveling lugs must contact the pavement surface.
6. Place reflector so that all leading edges are below or flush with the pavement surface.

B. Angle formed by the longitudinal axis of the marker and the adjacent pavement stripe not to exceed 5 degrees.

3.2 LIMITATIONS

A. Do not install when temperatures are below 10 degrees C.

END OF SECTION

SECTION 02765

PAVEMENT MARKING PAINT - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for applying marking paint to pavement.

B. Removing pavement markings.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

1.3 REFERENCES

A. Federal Standards 595B, 37875, 33538, 11105.

B. AASHTO M 247: Glass Beads Used in Traffic Paint.

C. ASTM D 476: Titanium Dioxide Pigments.

D. ASTM D 600: Liquid Paint Dryers.

E. ASTM D 603: Aluminum Silicate Pigments (Hydrous).

F. ASTM D 605: Magnesium Silicate Pigment (Talc).

G. ASTM D 711: No-Pick-Up Time of Traffic Paint.

H. ASTM D 740: Methyl Ethyl Ketone.

I. ASTM D 1199: Calcium Carbonate Pigments.

J. ASTM D 1214: Sieve Analysis of Glass Spheres.

K. ASTM D 2635: Methyl Isobutyl Carbinol.

L. TT-P-345: Federal Standard Color Number.

M. TT-P-410: Federal Standard Color Number.

N. TT-P-445.

PART 2 PRODUCTS

2.1 TRAFFIC STRIPING PAINT

A. Meet Federal Standards 595B, 37875, 33538, 11105.

B. Meet Cielab Requirements:

Table 1

CIELAB (L*a*b) D65/10E		
White	**Yellow**	**Red**
L * 91.9 to 95.6 a* -1.8 to -2.1 b* 3.8 to 2.2	L* 70.0 to 72.7 a* 22.5 to 24.8 b* 89.7 to 73.9	L* 31.4 to 33.4 a* 51.6 to 52.6 b* 34.1 to 35.1

C. Meet Composition Requirements:

Table 2

Standard Paint Kilograms per 100 Liters				
Composition	**900 White**	**901 Yellow**	**Red**	**Test**
Alkyd Resin 60 % solids (1)	17.37	17.97		
Styrene-Butadiane Resin			16.05	
Chlorinated Paraffin, 40%	3.0	3.0	5.87	
Chorwax “70" or equal			8.39	
Chlorinated Polyolefin, Cp 173	13.18	13.18		
Methol Ethol Ketone	28.76	28.16	40.14	ASTM D 740
Normal Butyl Acetate			12.1	
Solvent Aliphatic (2)	8.27	8.27		
Methyl Alcohol	0.6	0.6		ASTM D 2635
6% Cobalt Napthenate	0.12	7.31		ASTM D 600
24% Lead Napthenante	0.24	0.24		ASTM D 600
Anti-Settling Agents, max.			0.84	
Exkin No. 2 or Equal	0.36	0.36		
Bentone 38 or Equal	0.48	0.48		
Propolene Oxide	0.24	0.24		
Yellow Ochre 1209 or Equal (Richard Coulsion)		0.72		
Medium Chrome Yellow		9.58		
Titanium Dioxide, 80% min., 85% max.	17.97	3.0		TT-P-345, Type III ASTM D 476, Type III
Magnesium Silicate	20.97	23.0		ASTM D 605
Calcium Carbonate	28.16	31.4		ASTM D 1199
Toluidine Red			4.31	
Molybdate Orange, Dark			2.28	TT-P-445
Aluminum Silicate			17.61	TT-P-410
				ASTM D 603

D. Meet requirements for finished paint:

Table 3

	900 White	901 Yellow	Red	Test
Pigment, % by weight	45.3-49.3	46.0-50.0	21.5-23.5	
Total Nonvolatile, % by weight	64.5-71.5	65.0-69.5	50 min.	
Viscosity, KU @ 26 EC	72-82	72-82	60-75	
Fineness of Grind, Hegman	4 min.	4 min.	5 min.	
Wt. Per liter, kilogram	1.27-1.35	1.29-1.36	1.05-1.10	
Dry Time, ASTM D-711 minutes	10 max.	10 max.	25 max.	ASTM D 711
Nonvolatile Vehicle, % by weight, Total Paint	19 min.	19 min.		
Composition:				
Acrylic Copolymer, % by Weight of NVV.	47 min.	47 min.		
Titamium Dioxide Pigment, % by Weight of Pigment, 22 min.	26 min.	4.4 min.		
PbCrO4 % of Pigment	---	13. Min		

2.2 GLASS BEADS

A. Required gradation: ASTM D 1214.

Sieve Size Fm	Percent Passing
600	100
300	40-70
212	15-35
150	0-10

B. Minimum of 75 Percent (by weight) true spheres. ASTM D 1155.

C. Required characteristics:

1. Colorless.
2. Free of dark spots, milkiness, and air inclusions.
3. Silane coated.
4. Minimum index of refraction of 1.50 when tested by liquid immersion at 25 degrees C. AASHTO M 247.

2.3 PAVEMENT STRIPE MARKING EQUIPMENT

A. Use equipment manufactured specifically for applying paint, and only by workers experienced in operating such equipment.

B. Locate glass bead applicator directly behind and synchronized with marking applicator.
   1. Shield devices properly to avoid applying marking or losing beads outside designated area.

C. Equipment must be capable of:
   1. Applying three strips simultaneously, of the specified width ± 6.00 mm.
   2. Automatic skip control giving a 3 m long marked segment and a 9.0 m long gap within a linear tolerance of 150 mm over that cycle.

PART 3 EXECUTION

3.1 APPLICATION

A. Begin application no later than 24 hours after receiving written order from the ENGINEER.

B. Apply pavement paintings and markings only:
   1. When pavement surface is dry, clean, and free of oil.
   2. When pavement and air temperatures are at least 4 degrees C.
   3. During daylight hours.

C. Apply paint for lines at these rates:
   1. 100 mm solid line: From 25.0 to 27.4 linear m/L.
   2. 100 mm dashed line: From 96.6 to 106.3 linear m/L.
   3. 200 mm solid line: From 12.9 to 14.1 linear m/L.

D. Apply glass beads:
   1. At a minimum of 0.27 Kg/L of paint.
   2. The full length of the line.

E. Apply paint and glass beads for letters, arrows, railroad crossing markings, crosswalks, and stop bars:
   1. With well-defined outside edges and uniform thickness.
   2. Apply paint at 40.7 L per 100 m^2.
   3. Apply glass beads at 0.7 to 0.73 Kg/L of paint.

F. Operate equipment in the direction of the normal flow of traffic.

3.2 REMOVING PAVEMENT MARKINGS

A. Use one of these removal methods:
   1. Grinding.
   2. High pressure water spray.
   3. Sandblasting.
   4. Shot blasting.

B. Use equipment specifically designed for pavement marking removal.

END OF SECTION

SECTION 02768

PAVEMENT MARKING MATERIALS - See Supplemental

(Warranty Specification)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Methods and materials for installing pavement marking materials including Pavement Marking Tape, Solvent-Free and Lead-Free Epoxy, Acrylic Water-Based Paint, and Preformed Thermoplastic legends.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

1.3 REFERENCES

A. ASTM D 711: No-Pick-Up Time of Traffic Paint.

B. ASTM D 913: Evaluating Degree of Resistance to Wear of Traffic Paint.

C. ASTM D 2243: Freeze-Thaw Resistance of Water-Borne Coatings.

1.4 SUBMITTALS

A. Manufacturer Warranty:
   1. Provide a full warranty covering 100 percent of the installed price of the materials, including materials, equipment, and labor.
      a. Manufacturer is responsible for quality control of the materials, proper placement by the CONTRACTOR or subcontractor, and all other factors that affect the service life of the materials.
      b. In the event of a performance failure, replace 100 percent of the markings for all failed sections at no cost to DEPARTMENT.
      c. Failed sections are defined in this Section, Part 2 for each pavement marking material.

B. Warranty Bond:
   1. Provide a bond for the material from the manufacturer for the installed price of the material, or the following amount, whichever is greater.
      a. Pavement Marking Tape: $500,000.
      b. Solvent Free Epoxy: $200,000.
      c. Acrylic Water Based Paint: $100,000.
      d. Preformed Thermoplastic Legends: $100,000.

2. Warranty period covers the specified Service Life of the materials, and begins after all pavement markings are installed and accepted.
3. Submit proof of bond to the ENGINEER before placing the material.

C. Manufacturer's Quality Control (Epoxy):
1. Submit a plan detailing methods for maintaining a consistent production of the material.
2. List physical and chemical tests and tolerances used, including:
   a. Epoxide number
   b. Infrared spectrometer
   c. Tensile strength
   d. Gel time, dry time, no track time
   e. Shore D Hardness
   f. Wear index
   g. Amine number

3. Manufacturer's Certificate of Compliance with the physical and chemical testing as outlined in the manufacturer's Quality Control plan.
4. Test results from an independent laboratory that is nationally recognized by AASHTO and accredited in the required chemical test methods as outlined in the manufacturer's Quality Control plan.
5. Copy of Infrared spectra of each component on each lot number supplied.

D. Manufacturers Material Certification (Epoxy and Tape):
1. Submit for approval at least 14 days before placing the materials to:
   UDOT Central Materials Labs
   4501 South 2700 West
   Salt Lake City, UT 84119 (801) 965-4302
2. UDOT will not perform initial physical or chemical testing of the material for acceptance.
3. Tape: submit separate material certifications for each production lot that is shipped.

1.5 PREQUALIFIED MANUFACTURERS

A. Bids are limited to those listed, except as outlined in paragraph "New Brands, Products, or Manufacturers."

B. Inclusion on this list does not imply or guarantee UDOT's acceptance for performance of the products or the manufacturer's ability to meet the material and other requirements of this specification.

C. Prequalified Manufacturers:
1. Pavement Marking Tape for asphalt and concrete:
   a. 3M Stamark 380 Series Tape

2. Solvent-free and lead free Epoxy:
   a. Epoplex
   b. PolyCarb
   c. LDI
3. Acrylic Water-based Paint:
   a. Centerline
   b. Morton
   c. Pervo
4. Preformed Thermoplastic for Symbols and Legends:
   a. PREMARK 20/20 FLEX, Flint Trading Inc., phone 910-475-6600.
   b. HOTape, Stimsonite Corp., phone 1-800-327-5917.

1.6 DELIVERY, STORAGE, AND HANDLING

A. In accordance with manufacturer's recommendations.

B. Provide Material Safety Data Sheets (SMDS) upon delivery of material.

1.7 MANUFACTURER SERVICE REQUIREMENT

A. Provide technical support to the CONTRACTOR during the placement of the marking materials, including information about handling, storage, placement and other training that may preserve the quality of the installed markings.

1.8 NEW BRANDS, PRODUCTS AND MANUFACTURERS

A. Materials, products, and manufacturers not listed as prequalifed are considered experimental and are limited in size and scope, until added to the pre-qualified manufacturer's list See this Section, paragraph Prequalified Manufacturers.
   1. Pavement Marking Tape: Not more than $200,000 (installed price) per project, and no more than three projects per year.
   2. Epoxy: Not more than $200,000 (installed price) per project, and no more than two projects per year.
   3. Thermoplastic Pavement Markings: Not more than $20,000 (installed price) per project, and no more than three projects per year.

B. Manufacturers seeking to have their products considered as an experimental product must:
   1. Submit official request form R-52 to UDOT Research Division.
   2. Receive written approval to use the experimental product.

1.9 SERVICE LIFE TESTING (UDOT RESPONSIBILITY)

A. DEPARTMENT will perform service life testing.

B. Performance measures: Retro-reflectivity, color contrast and stability, and durability under all traffic volumes and wear conditions, unless stated otherwise.

C. Retro-reflectivity is measured using a Federally approved instrument (30 m geometry).

PART 2 PRODUCTS

2.1 PAVEMENT MARKING TAPE

A. Preformed adhesive tape with a raised profile.

B. Minimum service life for the following applications, under all traffic volumes and wear conditions:
   1. Longitudinal lines: 48 months.
   2. Legends and symbols: 18 months.
   3. Failure to maintain at least 90 percent of the markings in any 300 meter segment at the specified performance measures is considered a complete failure of that 300 meter segment. Replace under the warranty terms.

C. Performance Measures: Retro-reflectivity, Color Contrast/stability, and Durability.
   1. Minimum Retro-reflectivity:
      a. White Longitudinal Lines: 125 millicandelas.
      b. Yellow Longitudinal Lines: 100 millicandelas.
      c. Legends and Symbols: 100 millicandelas.
   2. Minimum Color Contrast and Stability: For white markings, provide a minimum yellowness index of 30 when measured with a portable colorimeter (XYZ C/2).
   3. Minimum Durability Level: 90 percent on any 300 meter segment.

2.2 SOLVENT-FREE EPOXY

A. 100 percent lead free, 2 component (resin and hardener) epoxy system for use on all pavement surfaces.

B. Minimum service life for the following applications, under all traffic volumes and wear conditions:
   1. Type 1 - Fast Dry:
      a. Longitudinal: Center, skip, and edge lines: 24 months.
      b. Legends and symbols: 12 months.
   2. Type 2 - Slow Dry
      a. Longitudinal: Center, skip, and edge lines: 48 months.
      b. Legends and symbols: 24 months.

3. Failure to maintain at least 90 percent of any one of the performance measures in any 300 m segment of the marking during the minimum service life constitutes a complete failure of the marking.

C. Performance Measures: Retro-reflectivity, Color Contrast/stability, and Durability.
   1. Minimum Retro-reflectivity:
      a. White Longitudinal Lines: 125 millicandelas.
      b. Yellow Longitudinal Lines: 100 millicandelas.
      c. Legends and Symbols: 100 millicandelas.
   2. Minimum Color Stability: Yellowness Index of White Paint on concrete or asphalt surfaces: 30 or less.
   3. Minimum Durability: 90 percent of the marking on any 300 m segment.

D. Retain a one pint sample from each lot or batch used.
   1. 24 months for Type I
   2. 48 months for Type II.

E. Use beads according to manufacturer's recommendations.

2.3 ACRYLIC WATER BASED PAINT

A. Minimum service life for the following applications, under all traffic volumes and wear conditions:
   1. Longitudinal lines: 12 months.
   2. Legends and Symbols: 10 months.
   3. Failure to maintain at least 90 percent of any one of the performance measures in any 300 m segment of the marking during the minimum service life constitutes a complete failure of the marking.

B. Performance Measures: Retro-reflectivity.
   1. Minimum retro-reflectivity:
      a. White markings: 125 millicandelas.
      b. Yellow markings: 100 millicandelas.
      c. Legends and Symbols : 100 millicandelas.

C. Meet the following properties in the material formulation:
   1. No-Track Time: no more than 5 minutes when tested according to ASTM D 711.
   2. Freeze-Thaw Stability: pass ASTM D 2243.
   3. Volatile Organic Compounds Content: Less than 150 mg/l.
   4. Heavy Metals Content: free of lead, chromium, or other regulated heavy metals.
   5. Use beads according to manufacturer's recommendations.

2.4 PREFORMED THERMOPLASTIC

A. Used for legends and symbols only.

B. Heat-fused and preformed.

C. Minimum Service Life for the following applications, under all traffic volumes and wear conditions:
   1. Minimum Service Life: 24 months.
   2. Failure to maintain at least 90 percent of the message in any of the performance measures during the Minimum Service Life is considered a complete failure of the message.

D. Performance Measures: Retro-reflectivity, and Durability, Skid Resistance, Thickness.
   1. Minimum Level of Retro-reflectivity: 100 millicandelas.
   2. Minimum Durability: 90 percent of the marking material for any segment.
   3. Minimum Skid Resistance: 35 BPN (British Portable Number).
   4. Minimum Thickness: 2.3 mm.
   5. Failure of one performance measure is considered a complete failure of the product on that message.

PART 3 EXECUTION

3.1 PREPARATION

A. Traffic Control: Submit Traffic Control Plan for approval. Refer to Section 01554.

B. Conduct other surface preparations in accordance with manufacturer's recommendations.

3.2 APPLICATION

A. Apply Pavement Marking Materials according to manufacturers's specifications.

END OF SECTION

SECTION 02771

CURBS, GUTTERS, DRIVEWAYS, DISABLED PEDESTRIAN RAMPS, AND PLOWABLE END SECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing curbs, gutter transitions, driveways, disabled pedestrian ramps, and plowable end sections.

1.2 RELATED SECTIONS

A. Section 02061: Select Aggregate.

B. Section 02324: Compaction.

C. Section 02330: Embankment.

D. Section 02721: Untreated Base Course.

E. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork.

F. Section 03055: Portland Cement Concrete.

G. Section 03152: Concrete Joint Control.

H. Section 03211: Reinforcing Steel and Welded Wire.

I. Section 03310: Structural Concrete.

J. Section 03390: Concrete Curing.

1.3 REFERENCES

A. AASHTO M 31M: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. AASHTO M 183: Structural Steel.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. Class AA(AE). Refer to Section 03055.

2.2 EXPANSION JOINT FILLER

A. Preformed material. Refer to Section 03152, Part 2, paragraph: Preformed Elastomeric Joint Sealants.

2.3 UNTREATED BASE COURSE

A. Refer to Section 02061.

2.4 STEEL

A. Reinforcing: Refer to Section 03211, Part 2, paragraph: Reinforcing Steel. Deformed billet-steel reinforcing bars as specified.

B. Structural: Refer to Section 05120. As specified or as indicated on the plans

PART 3 EXECUTION

3.1 PREPARATION

A. Construct subgrade to plan elevations following Section 02330.

B. Place and compact fill material and untreated base course. Follow Section 02324.

C. May use a slip form curb and gutter machine.

D. Dampen the untreated base course before placing concrete.

E. Curbs and Gutters: Refer to Standard Drawing 615-1A and 1B.

F. Disabled Pedestrian Access: Refer to Standard Drawing 715-2A.

G. Plowable End Section: Refer to Standard Drawing 815-5.

H. Forms: Refer to Section 02776, Part 3, paragraph: Preparation - Forms.

3.2 PLACING CONCRETE

A. Furnish materials and construct structural concrete following Section 03310, Part 3, paragraph: Placing Concrete.
   1. Do not use mechanical vibrators.
   2. Hand tamp forms to eliminate honeycomb.
   3. Deposit concrete continuously when using a slip form machine.
   4. Use dowels as shown on the plans when placing curb on existing pavement.

3.3 FINISHING CONCRETE

A. Round edges to a 13 mm radius.

B. Use a float to finish the top and front face of the curb and the top of the gutter.

C. Finish the traveled portion of the driveway with a broom finish.

D. Remove form marks or irregularities from finish surfaces.

E. Texture concrete on disabled pedestrian ramps as shown.

3.4 JOINTS

A. Place joints perpendicular to the subgrade and as shown.

B. Contraction joints:
   1. 3 mm to 5 mm thick steel plates.
   2. Space the joints every 3 m.
   3. Remove the templates as soon as the concrete takes an initial set.
   4. Cut joint 40 mm deep when using slip form method to place the concrete.

C. Expansion Joints:
   1. Place expansion joint every 10 m.
   2. Expansion joint not required when using slip form method to place concrete, except at adjacent pavement, curb radius, sidewalk, or structures.
   3. 13 mm thick premolded expansion joint filler.
   4. Place joint filler between the curb and gutter and sidewalk, or structures.

3.5 CONCRETE CURING AND PROTECTION

A. Cure the surface. Refer to Section 03390.
B. After curing, seal the surface. Refer to Section 03390.

END OF SECTION

SECTION 02773

ASPHALT CONCRETE CURB

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing asphalt concrete curb.

1.2 RELATED SECTIONS

A. Section 02745: Asphalt Material.

B. Section 02748: Prime Coat/Tack Coat

PART 2 PRODUCTS

2.1 ASPHALT CEMENT

A. Refer to Section 02745.

2.2 MINERAL AGGREGATE

A. As specified in AASHTO and the following gradation:

Mineral Aggregate Gradation	
Sieve Size	**Percent Passing (by weight)**
12.5 mm	100
4.75 mm	50-70
2.0 mm	30-50
75 Fm	5-10

2.3 TACK COAT

A. Refer to Section 02748.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean existing surface thoroughly.

B. Place tack coat at 0.25 L/m^2 residual asphalt or less.

3.2 PLACEMENT

A. Use an extrusion machine to place the curb.

B. Maintain the temperature of the hot mix asphalt as designated by the mix design. Refer to Section 02745.

C. Finish top and inside face of curb uniformly and free of irregularities.

END OF SECTION

SECTION 02776

CONCRETE SIDEWALK, MEDIAN FILLER, AND FLATWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing concrete sidewalk, median filler, and flatwork.

1.2 RELATED SECTIONS

A. Section 02324: Compaction.

B. Section 02330: Embankment.

C. Section 02721: Untreated Base Course.

D. Section 02776: Concrete Sidewalk and Median Filler.

E. Section 03055: Portland Cement Concrete.

F. Section 03152: Concrete Joint Control.

G. Section 03310: Structural Concrete.

H. Section 03390: Concrete Curing.

PART 2 PRODUCTS

2.1 PORTLAND CEMENT CONCRETE

A. Class AA(AE). Refer to Section 03055.

B. Substitute higher class of concrete if desired.

C. For flatwork: High purity, chemically-inert, unfading, and alkali-fast synthetic pigment coloring material.

2.2 EXPANSION JOINT FILLER

A. Preformed material. Refer to Section 03152.

2.3 UNTREATED BASE COURSE

A. Untreated Base Course. Refer to Section 02721.

2.4 EMBANKMENT MATERIAL

A. Refer to Section 02330.

PART 3 EXECUTION

3.1 PREPARATION

A. Construct subgrade to plan elevations and following Section 02330.

B. Place and compact fill material following Section 02324.

C. Concrete flatwork coloring:
   1. Conform to the samples provided by the ENGINEER.
   2. Provide a matching sample, 0.1 m square, for the ENGINEER's approval before placing concrete.
   3. Thoroughly mix color pigment in the concrete before placing.

D. Forms:
   1. Use approved concrete forms on all curves that transition smoothly from curves to straight section. Keep forms free of flat sections and sharp bends.
   2. Use wood, metal, reinforced fiberglass, or plastic forms free of warps or bends. Anchor securely in place.

3.2 PLACING AND FINISHING CONCRETE

A. Dampen the subgrade just before concrete placement.

B. Hand methods of strike-off and consolidation are permitted.

C. Finish the surface with a moist wooden float.

D. Round edges to a 13 mm radius.

E. Brush to a transverse broom finish.

3.3 EXPANSION AND CONTRACTION JOINTS

A. Place joints perpendicular to the subgrade and at right angles to the longitudinal axis of the sidewalk or median.

B. Contraction Joints:

1. 3 mm to 5 mm thick steel plates.
2. Space the joints 3 m apart.
3. Remove the steel plates as soon as the concrete takes an initial set.

C. Expansion Joints:

1. 13 mm thick premolded expansion joint filler. Refer to Section 03152, Part 2, paragraph: Preformed Elastomeric Joint Sealants.
2. Place expansion joint every 9 m.
3. Place joint filler between the sidewalk or median filler and the curb or adjacent pavement, sidewalk, driveway pavement, or structure.

3.4 CONCRETE CURING AND PROTECTION

A. Refer to Section 03390, Part 3, paragraph: Curing Structures.

END OF SECTION

SECTION 02785

SEAL COAT - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for applying liquid or emulsified asphalt on a cleaned surface.

B. Cover materials.

1.2 RELATED SECTIONS

A. Section 01558: Temporary Traffic Striping.

1.3 REFERENCES

A. AASHTO M 140: Emulsified Asphalt.

B. AASHTO M 208: Cationic Emulsified Asphalt.

C. AASHTO M 226: Viscosity Graded Asphalt Cement.

D. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

E. AASHTO T 19: Unit Weight and Voids in Aggregate.

F. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

G. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

H. AASHTO T 104: Soundness of Aggregates by Use of Sodium Sulfate or Magnesum Sulfate.

PART 2 PRODUCTS

2.1 ASPHALTIC CEMENT

A. As specified. Meet AASHTO M 226, Table 2 and as modified below:

1. Delete “Thin-Film Oven Test” requirement.
2. Change ductility requirements for AC 10 (PG 52-22) and AC 20 (PG 58-22) to Ductility, 4.0 degrees C, 15+ cm per minute.

2.2 ANIONIC EMULSIONS

A. As specified. Meet AASHTO M 140, and as modified below:
   1. Viscosity, Saybolt Fural at 50 degrees C 140 S. to 400 S.

2.3 CATIONIC EMULSIONS

A. As specified. Must meet AASHTO M-208, and as modified:
   1. Viscosity, Saybolt Fural at 50 degrees C 140 S. 400 S.

2.4 COVER MATERIAL

A. Crushed slag or crushed natural aggregates with a maximum dry unit weight of 1600 kg/m^3. Meet AASHTO T 19.

B. Grade with the following limits to meet the specified test standard in AASHTO T 27.

Table 1 - AASHTO T 11

Sieve Size	Percent Passing		
	Type A	**Type B**	**Type C**
12.5 mm	100		100
9.5 mm	85-100		70-90
4.75 mm	0-20	100	0-5
2.36 mm	0-5	85-100	0-3
1.18 mm		10-25	
300 Fm		0-5	
75 Fm	0-1	0-2	0-2

C. Wear: Maintain at less than 30 percent as per AASHTO T 96.

D. Weight loss: Maintain at less than 10 percent as per AASHTO T 104.

E. Round Aggregate: Do not use material that contains more than 20 percent by weight with all round faces. Must meet UDOT Materials Manual 8-929.

F. Stripping: More than 90 percent retention. Meet UDOT Materials Manual 8-945.

G. Polishing: Do not use polished aggregates unless the DEPARTMENT is supplied with test reports proving satisfactory friction values.

2.5 TEMPORARY PAVEMENT MARKERS

A. Refer to Section 01558, Part 2.

2.6 SOURCE QUALITY CONTROL - COVER MATERIAL

A. DEPARTMENT will sample and test stockpiles using Table 2.

Table 2

Stockpiles - Samples and Tests	
Lot Quantity (Megagram)	**Number of Samples**
Lot $ 2300	5
1400 < Lot < 2300	4
Lot # 1400	3

B. DEPARTMENT will accept stockpiles between 0 Mg and 2300 Mg when:
   1. The average gradation of the samples falls within the gradation band.
   2. Not more than one sample is outside the gradation band by more than 2 percentage points on any one sieve.

C. DEPARTMENT will accept stockpiles 2301 Mg or greater when:
   1. The average gradation falls within the band.
   2. Not more than 2 samples are outside the gradation band by more than 2 percentage points on any one sieve.

D. No tolerance will be allowed for the minus 75 Fm portion of cover material as per AASHTO T 11.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean the surface of all dirt, sand, dust, or other objectionable material.

B. Protect all structures from being spattered or marred including guardrail, guide posts, etc.

3.2 LIMITATIONS

A. Complete all work between May 15 and August 31.

B. Obtain written approval from the ENGINEER before placing seal coat before May 15 or after August 31.

C. Lay seal coat when the pavement surface temperature is:
   1. 20 degrees C and rising in the shade.
   2. Below 50 degrees C.

D. Do not place seal coat during rain, when the surface is wet, or during other adverse weather conditions.

3.3 COVER MATERIAL STOCKPILE

A. Construct either:
   1. Individual stockpiles containing material for a single day of application, or
   2. Elongated stockpiles, maximum 7.5 m in height, 9.0 m top width, with daily materials identified.

3.4 TEMPORARY PAVEMENT MARKER APPLICATION

A. Refer to Section 01558, Part 3.

B. Place Type “B” markers on center lines and Type “W” markers on lane lines at 12 m intervals before applying asphalt.

C. Place the reflective tape facing traffic when using Type “W” markers.

D. Remove covers immediately after the rolling is complete.

3.5 ASPHALT MATERIAL APPLICATION

A. Use a distributor equipped with a hydrostatic system and full circulating spray bar to apply the emulsion at the specified rate, maintaining a tolerance of ±0.14 L/m^2.

B. Maintain a distance of not more than 30 m between the distributor and the chip spreader.

3.6 COVER MATERIAL APPLICATION

A. Use a Flaherty Spread Master, or Etayre Spreader, or equipment of equal quality.

B. Spread aggregate at the specified rate, maintaining a tolerance of +0.5 km/m^2 to a -1.0 kg/m^2.

3.7 SURFACE ROLLING

A. Use pneumatic-tire rollers in a longitudinal direction to roll surface after the cover material has been satisfactorily spread.

B. Use equipment with at least 2 rollers in front and 1 roller in back. The last roller serves as a finish roller.

C. Seat the aggregate adequately.

3.8 TRAFFIC CONTROL

A. After spreading aggregate, provide a minimum of 4 hours of traffic control using pilot vehicles.

B. Sweep the surface before allowing uncontrolled traffic on the sealant.

END OF SECTION

SECTION 02786

PLANT MIX SEAL COAT (OPEN-GRADED) - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing plant mix seal coat or plant mix seal coat mix.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work.

B. Section 01452: Profilograph.

C. Section 02741: Hot Mix Asphalt.

D. Section 02745: Asphalt Material.

E. Section 02746: Hydrated Lime.

F. Section 02748: Prime Coat/Tack Coat.

1.3 REFERENCES

A. AASHTO T 11: Materials Finer Than 75Fm (No. 200) Sieve in Mineral Aggregates by Washing.

B. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

C. AASHTO T 30: Mechanical Analysis of Extracted Aggregate.

D. AASHTO T 40: Sampling Bituminous Materials.

E. AASHTO T 89: Determining the Liquid Limit of Soils.

F. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils.

G. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

H. AASHTO T 104: Soundness of Aggregate of Use of Sodium Sulfate of Magnesium Sulfate.

I. AASHTO T 112: Clay Lumps and Friable Particle is Aggregate.

J. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.

K. AASHTO T 209: Maximum Specific Gravity of Bituminous Paving Mixtures.

L. AASHTO T 242: Frictional Properties of Paved Surfaces Using a Full-Scale Tire.

M. AASHTO T 278: Surface Frictional Properties Using the British Pendulum Tester.

N. AASHTO T 279: Accelerated Polishing of Aggregates Using the British Wheel.

O. AASHTO T 304: Uncompacted Void Content of Fine Aggregate.

P. ASTM D 979: Sampling Bituminous Paving Mixtures.

Q. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

R. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

S. ASTM D 6307: Asphalt Content of Hot-Mix Asphalt by Ignition Method.

PART 2 PRODUCTS

2.1 ASPHALT MATERIAL

A. As specified, and following Section 02745.

B. Meet AASHTO T 40.

C. Refer to UDOT Materials Sampling and Testing Manual.

2.2 HYDRATED LIME

A. Refer to Section 02746.

2.3 AGGREGATE MATERIALS

A. Meet AASHTO T 11.

B. Clean, hard, fragments of 100 percent crushed virgin stone, gravel, or slag.
   1. Fine aggregate:
      a. Passing the 4.75 mm sieve
      b. Containing no more than 2 percent by mass of organic matter or other detrimental substances. AASHTO T 112.
      c. P. I. of zero. AASHTO T 89, and AASHTO T 90.

C. Coarse aggregate:
   a. Durable, sound fragments
   b. Free from organic matter or other detrimental substances.

D. Maximum mass loss of 30 percent for both Category 1 and Category 2 highways on L.A. Wear test. AASHTO T 96.

E. Meet AASHTO T 11, AASHTO T 27, AASHTO 30, and the following requirements:

Table 1

Aggregate Properties - Plant Mix Seal Coat			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	ASTM D 5821	95 percent min.	90 percent min.
Two Fractured Face	ASTM D 5821	90 percent min.	90 percent min.
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated (1 to 3 ratio)	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 % max.
Polish Test	AASHTO T 278 & T 279	31 min.	31 min.
Sand Equivalent	AASHTO T 176	60 min.	50 min.
Natural Fines	None	Not Allowed	10 % max.
Category 1: National Highway System and Truck Routes - Table 4 in Section 02741. Category 2: All Other Routes			

F. Meet the following requirements:

Table 2

Aggregate Gradation - Plant Mix Seal Coat (Percent Passing by Dry Mass of Aggregate)		
Control Sieve Size	**Category 1 12.5 mm**	**Category 2 12. 5 mm**
12.5 mm	100	100
9.5 mm	90 - 100	90 - 100
4.75 mm	34 - 45	35 - 45
2.36 mm	0 - 10	14 - 20
75 Fm	0 - 3	2 - 4

G. Determine the percent passing the 75 Fm sieve by washing with water. AASHTO T 11.

H. Maximum mass loss of 12 percent by weight when subjected to five cycles of sodium sulfate. AASHTO T 104.

I. Do not use aggregates consisting mainly of carbonate type rocks unless the DEPARTMENT is supplied with test results proving satisfactory long term friction values for comparable traffic volumes. AASHTO T 242.

2.4 JOB-MIX GRADATION

A. Obtain approval for job mix gradation:
   1. Submit written job mix at least 10 working days before beginning to pave.
   2. Show definite single values for the percentage of aggregate passing each sieve based on the dry mass of aggregate.
   3. Stay within the single value gradation limits of Table 2.
   4. Adding Hydrated Lime:
      a. Method A, Lime Slurry; or Method B, Lime Slurry Marination.
      b. Refer to Section 02746.
      c. Incorporate minimum hydrated lime by dry weight of aggregate into all mixtures. (1 percent for Method A; 1- 1/2 percent for Method B).

B. Changes in job mix gradation:
   1. Submit a written request for a change in a job-mix gradation.
   2. Give the ENGINEER 10 working days to review and approve the changes and to readjust the quantity of asphalt to be used.

PART 3 EXECUTION

3.1 STOCKPILES

A. Separate the aggregate into two or more stockpiles of different aggregates sizes for storage.

B. When placing the aggregate in storage or moving it from storage to the cold bins, do not use stockpiling methods that cause segregation, degradation, or a combination of materials of different sizes. Rescreen or waste segregated or degraded material.

C. Separate stockpiles are not required at commercial batch plants provided the specified gradation is obtained.

3.2 MIXING

A. Mix as specified in Section 02741, Part 3, paragraphs: Hot Mix Asphalt, and HMA Plants. The mineral aggregate coating will be considered satisfactory when all particles are coated.

3.3 SURFACE PLACEMENT

A. Apply the tack coat so the residual asphalt is uniform between 0.25 L/m^2 and 0.45 L/m^2. The ENGINEER will determine the exact amount.

B. Adjust the production of the mixing plant and the material delivery until a steady paver speed is maintained.

C. All passes shall be brought up even transversely at the end of each working day.

D. Locate longitudinal joints within 150 mm of lane lines.

E. Remove slick spots as directed by the ENGINEER.

3.4 LIMITATIONS

A. Place the plant mix seal coat between May 1 and September 15. The air temperature in the shade and the pavement surface temperature must be above 16 degrees C and rising.

B. Obtain written approval from the ENGINEER before placing plant mix seal coat after September 15.

C. Do not place plant mix seal coat during rain, when the surface is wet, or during other adverse weather conditions.

3.5 GRADATION TESTING

A. A lot equals the number of megagrams of mix placed during each production day.
   1. Add the lot to the next day's production if 4 random samples cannot be taken. Evaluate pay adjustment with the appropriate sample size.
   2. Add the lot to the previous day's production for the last day's production if four random samples cannot be taken. Evaluate with the appropriate sample size.

B. Take random samples as the mix is being placed. Generate from a random numbers table.

C. ENGINEER will take random samples from the truck at the plant.
   1. Representative of all material in the lot.
   2. Circular or square samples dimensions in the mat.

D. ENGINEER will conduct four aggregate gradations tests per lot on the residue of the burn-off oven test. For acceptance and pay adjustment for aggregate gradation, Refer to Table for Calculating Quality Index Values for Estimating Percent Within Limits in Section 02741 in the Methods of Measurement and Basis of Payment Section in the Supplemental Specifications (Bid Book).

3.6 THICKNESS TESTING

A. Verify the thickness with a depth probe as required by ENGINEER. Take corrective action as necessary.

3.7 SMOOTHNESS TESTING

A. Refer to Section 01452.

END OF SECTION

SECTION 02812

PRESSURIZED IRRIGATION SYSTEMS - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aboveground, underground, and drip irrigation systems complete with heads, valves, controls, and accessories.

1.2 RELATED SECTIONS

A. Section 02936: Vegetation Establishment Period.

B. Section 03055: Portland Cement Concrete.

1.3 REFERENCES

A. ASTM A 53: Pipe, Steel, Black, and Hot-Dipped, Zinc-coated, Welded and Seamless.

B. ASTM B 88: Copper Pipe.

C. ASTM B 687: Brass, Copper, and Chromium-Plated Pipe Nipples.

D. ASTM D 1784: Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated poly (Vinyl Chloride) (CPVC) Compounds.

E. ASTM D 1785: Poly(Vinyl Chloride) PVC Plastic Pipe, Schedules 40, 80, and 120.

F. ASTM D 2466 and D 2464: Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings; Schedules 40 and 80.

G. ASTM D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.

H. ASTM D 2672: Joints for IPS PVC Pipe Using Solvent Cement.

I. ASTM F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

J. ASSE 1013, 1015: Backflow Preventers, Pressure Reducers.

K. NEC: National Electric Code. (Latest edition)

L. Utah Plumbing Code: Section 1003.

1.4 PERFORMANCE REQUIREMENTS

A. Location of sprinkler heads: Design location is approximate.
   1. Adjust as necessary to avoid existing plants and other obstructions.
   2. At no time should the number of heads, valves, etc. be less than that indicated on the plans.

B. Water Coverage:
   1. Head to head coverage in turf and other planting areas (100 percent).
   2. Do not increase or decrease number of heads or size of pipe indicated unless approved by ENGINEER.

C. PVC Pipe: Must be stamped with certified NFS.

D. If work is to continue after November 1 or resume before April 15, drain the system at the end of each work day. Do not permit water to remain in pipe overnight.

E. Verify and have marked the location of all utilities and underground obstructions.

1.5 DEFINITIONS

A. Mainline: The system of pipes that carry water from the Point of Connection (POC) to the valves.

B. Lateral Lines: The system of pipes that carry water from the valves to the sprinkler heads and/or emitters.

1.6 SUBMITTALS

A. Product Data: Manufacturer's technical data and installation instructions.

B. Certificates of compliance to ENGINEER prior to installation.

C. As-Built Drawings: Red-lined plan layout and details illustrating mainline and lateral lines location, size, and assembly. Include type and coverage of heads, type of valves, controllers, fittings and accessories.

D. Operating and Maintenance Data:
   1. Instructions covering full operation, care, and maintenance of system (and controls) and manufacturers parts catalog. Include drain procedures, blow out features, etc.

2. Instruct maintenance personnel in proper adjustment of sprinkler heads and use of special tools for adjustments.

E. Keys:
1. Gate Valve Key.
2. Stop and Waste Valve Key: "T" handle, rigid steel, 1.5 m long minimum, key end to fit the stop and waste valve nut.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

A. Mainline: Solvent welded schedule 40 PVC through 38 mm, then Class 200 PVC. ASTM D 1784 and ASTM D 1785.

B. Lateral line: Solvent welded schedule 40 PVC through 38 mm, then Class 200 PVC. Meet ASTM 1784 and ASTM D 1785.

C. Fittings: Solvent welded schedule 40 PVC. Meet ASTM D 2466.

D. Risers: Threaded schedule 80 PVC. Meet ASTM D 2464.

E. Copper Pipe: Type K as specified in ASTM B 88.

F. Copper Fittings: Wrought or cast as specified in ASTM B 687.

2.2 VALVES

A. Automatic Control Valve:
1. Body made of high-strength, non-corrosive PVC material.
2. Pressure regulating (set at 350 MPa).
3. Slow and smooth opening and closing with a manual flow control and bleed screw.
4. Highly efficient, totally encapsulated 24 VAC solenoid.
5. High-strength rubber or synthetic rubber diaphragm.

B. Gate Valve: Threaded brass construction, 1400 MPa rated (minimum) and sized according to main line.

C. Manual Drain Valve: 19 mm bronze body, angle valve with replaceable seat disc and brass cross handle.

2.3 BACKFLOW PREVENTER

A. Body and caps constructed of bronze with wear and corrosion resistant internal parts complete with bronze quarter turn ball valves.

B. Reduced Pressure Principle Device (RP) as specified in ASSE 1013.

C. Double Check Valve (DCV) as specified in ASSE 1015.

D. Capable of being tested and serviced without removal of device from the line.

2.4 AUTOMATIC CONTROLLER

A. General: A commercial grade controller manufactured expressly for control of automatic valves and underground irrigation systems and equipped with the following minimum features.
   1. 12-hour duration for any or all stations.
   2. Four programs, with eight start times each.
   3. Two master valve terminals, one programmable by station.
   4. 365-day calendar with leap year intelligence.
   5. Event day off option.
   6. Programmable rain delay.
   7. Water budget by program with adjustments from 0 to 300 percent in 1 percent increments.
   8. Capable of having total run time split into usable cycles.
   9. Manual or automatic operation.
   10. Non-volatile.
   11. Battery backup.
   12. Heavy-duty electrical surge protection.
   13. UL listed; CSA, CE approved

B. Transformer: Capable of converting service voltage to control voltage in accordance with manufacturer's recommendations.

2.5 PEDESTAL

A. Free-standing unit with a weather resistant coating typically specified for the controller. Hardware included.

2.6 SPRINKLER HEADS

A. Fixed Riser
   1. 13 mm x 600 mm schedule 80 riser Male Pipe Threads (MPT).
   2. 13 mm shrub head adaptor Female Pipe Threads (FPT) x MPT.
   3. 13 mm FPT barbed swing pipe adapter.

B. Pop-up Spray Head
   1. Made of plastic and stainless steel materials.
   2. Pop-up risers of 100 mm, 150 mm and 300 mm.
   3. Stainless steel retraction spring.
   4. Ratcheting mechanism.
   5. Side and bottom inlets on 150 mm and 300 mm heads.

C. Rotary Head
   1. High-impact plastic construction with stainless steel ratcheting riser.
   2. Pop-up gear driven design.
   3. Integral rubber cover.
   4. Heavy-duty, stainless steel retraction spring.
   5. Heavy-duty, stainless steel riser with a minimum 100 mm pop-up.

D. Pop-up Impact Head
   1. High-impact plastic construction with plastic clapper.
   2. 100 mm pop-up design with internal wiper seals.
   3. Heavy-duty, stainless steel retraction spring.
   4. Built in check valve required when used with more than 1 meter of elevation change.
   5. Plastic Sprinkler Nozzles
      a. Interchangeable.
      b. Matched precipitation.
   6. 19 mm side or bottom inlet.

E. Above-ground Impact
   1. Brass construction with stainless steel clapper.
   2. Mounted above ground with no pop-up features.
   3. 99 mm riser mounted impact.
   4. 19 mm MPT inlet.
   5. Brass Sprinkler Nozzles.
      a. Interchangeable.
      b. Matched precipitation.

2.7 PLASTIC NOZZLES

A. Fixed Spray
   1. Radius patterns and L/min as shown on plans.
   2. Matched precipitation rates.
   3. Stainless steel adjustment screw.
   4. FPT to match 13 mm shrub head adapter.
   5. Pressure regulating: (Required when the MPa at the sprinkler does not fall within the range recommended for its use.) See manufacturer's specifications.
   6. Filter screen.

B. Bubbler
   1. Made of high-impact plastic.
   2. Pressure compensating with adjustable flow and radius as shown on plans.
   3. 13 mm FPT.
   4. Attach to fixed riser or pop-up spray.
   5. Filter screen.

2.8 DRIP TUBING

A. Self cleaning, pressure compensating, polyethylene dripperline.

B. Dripper discharge- 2.27 L/hr to 3.4 L/hr.

C. Pressure compensation range from 50 MPa to 350 MPa.

D. 17 mm outside diameter (±0.25); 14.5 mm inside diameter (±0.25).

2.9 LINE FLUSHING VALVE

A. Made of high impact plastic.

B. Maximum flow rate per flush valve - 56.7 L/min.

C. Automatic cleaning operation.

D. Can be disassembled allowing for winterization blow-out.

E. 13mm MPT threads.

2.10 AIR/VACUUM RELIEF VALVE

A. Installed at the highest points in the lateral drip piping network to eliminate negative pressure.

B. 13 mm MPT threads.

2.11 DISK FILTER

A. Corrosion resistant thermoplastic design.

B. Multiple disk filter design-120 mesh.

C. 25 mm MPT threads.

D. Shut-off valve.

E. Constructed of durable, non-corrosive components and equipped with O-ring seals.

2.12 "Y" FILTER

A. 25 mm threaded inlet and outlet.

B. 100 mesh polyester filter screen.

C. Constructed of durable, non-corrosive components and equipped with an O-ring seal.

D. Operating flow range of 3.7 L/min. to 57 L/min. with a pressure range of 140 MPa to 415 MPa.

E. Easy removable cap and screen.

2.13 SWING PIPE

A. Flexible Polyethylene Pipe: Maximum flow 22 L/min. Inside diameter of 12.45 mm (±0.25) with a wall thickness of 2.54 mm (±0.25) and 700 MPa rated.

B. Flexible Polyethylene Pipe: For flows exceeding 22 L/min. Inside diameter of 23.45 mm (±0.25) with a wall thickness of 2.54 mm (±0.25) and 700 MPa rated.

C. 13 mm Barbed Male Elbow: Plastic

D. 19 mm Barbed Male Elbow: Plastic

E. 25 mm Barbed Male Elbow: Plastic

2.14 VALVE BOX

A. Precast concrete or plastic with adequate hand room to operate small tools and provisions for locking cover to frame.

2.15 WIRE

A. Provide wire for connecting remote control valves to the automatic controllers that is Type "UF", 600 V, stranded or solid copper, single conductor wire with PVC insulation and bearing UL approval for direct underground burial feeder cable.
   1. Make all connections with UL approved type seal to make a waterproof connection.
   2. Where possible, bury wires in the same trench as the pipe.

B. Provide wire with 0.16 mm insulation, minimum covering of ICC-100 compound for positive weatherproofing protection.

1. For wire sizes 14, 12, 10, and 8 use a single conductor solid copper wire, and for sizes 6 and 4 use stranded copper wire.
2. Make control or "hot" wires red and all common or "ground" wires white.

2.16 QUICK COUPLER

A. Constructed of heavy duty brass with a 19 mm one-piece body design.

B. Operating flow range of 38 L/min. to 190 L/min with a pressure range of 35 MPa to 700 MPa.

C. 19 mm brass valve key.

D. 19 mm brass swivel hose ell.

E. Stainless steel spring.

2.17 WASHED AGGREGATE

A. 37.5 mm maximum with 100 percent retained on a 4.75 mm sieve.

2.18 JOINT PRIMER AND SOLVENT CEMENT

A. As specified in references. ASTM F 656, and ASTM D 2672.

2.19 ACCESS SLEEVE

A. 50 mm, Schedule 40 PVC with a yellow rubber cap.

2.20 TEFLON TAPE

A. For use on threaded joints. Quality grade, 0.09 mm thick (±0.025) and domestically made.

2.21 CLASS B CONCRETE

A. Refer to Section 03055.

PART 3 EXECUTION

3.1 EXCAVATION

A. Stake pipe and sprinkler locations for approval.

B. Excavate trenches for sprinkler system pipe to provide 400 mm of cover over main lines and 200 mm over lateral lines.

1. Where trenching is required in proximity to trees which are to remain, do not damage roots.

C. Barricade trenches within the clear zone and along pedestrian routes that are left open overnight.

3.2 INSTALLATION

A. General: Plans are diagrammatic. Proceed with installation in accordance with the following:

1. Install stop and waste valves, backflow preventors and other equipment required by local authorities according to Utah Laws and Regulations to make system complete.
2. Install main line, automatic control valves, lateral lines, fittings, and heads/drip line as per specifications.
3. Thoroughly flush main lines before installing automatic control valves, and laterals before installing sprinklers. Flush supply lines thoroughly before installing backflow preventers or other regulating devices.
4. After completion of grading, seeding or sodding, and rolling of grass areas, adjust heads to be flush with finished grades (flush is even with top of soil level or top of material level).

B. Piping: Assemble all mainline and lateral lines in accordance with manufacturer's recommendations with no cul-de-sacs.

1. At wall penetrations, pack the opening around the pipe with non-shrink grout. At exterior face, fill perimeter slot with backer rod and sealant. Repair below grade waterproofing and make penetration watertight.
2. Install PVC pipe in dry weather above 4 degrees C as specified by manufacturers recommendations. Allow joints to cure a minimum of 8 hours before testing.

C. Sleeving: Coordinate sleeving installation before placing pavement.

D. Control Valves:

1. Install at plan locations and according to detail. Use Schedule 80 PVC pipe for nipples on valve header, length as necessary. Install valves two per each standard, plastic valve box and provide 300 mm of expansion loop slack wire at all connections inside valve box.
2. Install valve boxes flush with finish grade and place them parallel or perpendicular to adjacent curbs, sidewalks, or driveways.
3. Place washed aggregate in sump as shown on plans.

4. Imprint a valve control number on each valve box cover that corresponds to the valve controller (clock). Print the valve box number 25 mm high (minimum) in a permanent and legible manner.

E. Manual Drains: Install at locations indicated on plans and according to detail.

F. Quick-Coupling Valves: Install using 19 mm Schedule 80 PVC nipples for risers and elbows. Locations as indicated as per plans.

G. Backflow Preventers:
1. Install assembly using the detail.
2. In below grade installations, provide washed aggregate drain sump.

H. Valve Access Boxes:
1. Install over all automatic control valves, manual control valves, or zone shutoff valves.
2. Install boxes on level finish grade.
3. Provide boxes with proper length and size extensions as per plan.

I. Automatic Controller:
1. Stake or mark controller location for approval.
2. Mount the panel enclosure so adjustments can be conveniently made by the operator.
3. Properly ground controller in accordance with Utah Laws and Regulations. Make all control wire connections to automatic controllers. Coordinate controller installation with electrical work.
4. If pedestal controller is used, pour the concrete pedestal base with inserted conduits and bolts.
5. Provide a laminated copy of the irrigation plan indicating valve station numbers and their field locations and attach it inside the controller.
6. Program the controller to provide the appropriate amount of water for each station.
7. Supply the ENGINEER with manufacturer's warranties and operating instructions for the controller.

J. Wire and Electrical Work:
1. Use electrical control and ground wire suitable for sprinkler control cable of size indicated on plans.
2. Tape control wires to underside of pipe at 5 meter intervals.

K. Spray Heads, Fixed Risers and Bubblers:
1. Install as per plans.
2. Adjust sprinkler nozzles to allow for adequate coverage and minimize overspray onto walks, roads, driveways, and buildings.

3.3 TESTING

A. Notify the ENGINEER 24 hours in advance of pressure testing the main line.

B. Before backfilling and after air pockets have been vented from the lines, subject all supply and pressure irrigation lines to a hydrostatic pressure test by maintaining full water pressure for 3 consecutive hours.

C. Test connections for leaks prior to backfilling and repair all leaks. Lateral lines may be tested in sections to expedite backfilling work.

3.4 BACKFILLING OPERATION

A. Bed all pipe 50 mm (minimum) surrounding the pipe with native material excavated from the trench and passing through a 13 mm sieve.

B. Prevent soil, rocks, or debris from entering pipes or sleeves.

C. Compact backfilled trenches thoroughly to prevent settling damage to grades or plant materials. Repair irrigation system and plants at no additional cost to DEPARTMENT.

3.5 IRRIGATION INSTALLATION INSPECTION

A. Notify the ENGINEER to schedule the inspection with the Region Landscape Architect after the irrigation system is completely installed and fully functional.

B. Make the required field adjustments and changes after the inspection.

3.6 ESTABLISHMENT PERIOD

A. If an irrigation system is installed to establish plant materials or turf, the following will be required:
   1. Refer to Section 02936.
   2. Repair or replace any component that does not allow the irrigation system to operate properly.
   3. Repair any erosion caused by leaking or broken irrigation equipment.
   4. Repair any settling occurring around valve boxes or trenches.
   5. If irrigation breaks or subsequent repairs damage installed plants, sod, or seeded areas, replace according to plan.
   6. Winterize the system in the fall by turning off the water and blowing out all supply, main, and lateral lines using an air compressor with a maximum 650 MPa, and following established procedures. Coordinate with the Region Landscape Architect.

7. Replace at CONTRACTOR's expense any line that breaks as a result of improper winterization.

3.7 DAMAGE

A. Repair breakage due to poor workmanship or negligence by the CONTRACTOR at no additional cost to the DEPARTMENT.

B. DEPARTMENT will pay for repairing damage due to acts of God, vandalism, or errant vehicles as force account work. Obtain approval before performing work.

END OF SECTION

SECTION 02821

CHAIN LINK FENCING AND GATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing chain link fencing and gates.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 181: Chain Link Fence.

C. AASHTO M 232: Zinc Coating (Hot Dip) on Iron and Steel Hardware.

D. AASHTO M 280: Zinc-Coated (Galvanized) Steel Barbed Wire.

E. AASHTO M 305: Aluminum Coated Steel Barbed Wire.

F. ASTM A 392: Zinc-Coated Steel Chain-Link Fence Fabric.

G. ASTM A 491: Aluminum-Coated Steel Chain-Link Fence Fabric.

H. ASTM F 1083: Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

PART 2 PRODUCTS

2.1 GENERAL

A. Class B Concrete. Refer to Section 03055.

2.2 POSTS, CAPS, RAILS, COUPLINGS

A. Pipe posts and rails:
   1. Schedule 40, hot-dip galvanized coated pipe. ASTM F 1083.

B. Fitting: malleable cast iron or pressed steel coated as specified. AASHTO M 232.

C. Caps: AASHTO M 232
   1. Equip all pipe posts with a galvanized steel or malleable iron weather-resistant cap, designed to fit securely over the posts and carry an apron around the outside of the post.
   2. Where top rail is used, provide cap to permit passage of top rail.

2.3 CHAIN LINK FABRIC

A. Provide either Type I zinc-coated steel or Type II aluminum-coated steel fence fabric as specified. AASHTO M 181.

B. Use 3.76 mm diameter wire for fence fabric 1.8 m or higher and 3.05 mm diameter wire for fabric less than 1.8 m high.

C. Provide 4.45 mm diameter spiral material for tension wires.

D. Tie fabric to supporting members of the same diameter as the fence fabric.

2.4 BARBED WIRE

A. Provide zinc-coated barbed wire when zinc-coated fence is used. AASHTO M 280.

B. Use 2.5 mm diameter barbed wire with 2.03 mm diameter 4-point barbs on 127 mm centers.

C. Provide aluminum-coated barbed wire when aluminum-coated fence is used. AASHTO M 305.

D. Support arm on the fence for barbed wire must support a 91 kg vertical load at the end of the arm without causing permanent deflection.

2.5 GATES

A. Construct gate posts and frames of the sizes following Standard Drawing 720-3.
   1. Fasten gate frame corners together with pressed steel or malleable iron corner ells, riveted or welded as shown.
   2. Galvanize welded steel gate frames after fabrication as specified. AASHTO M 111.
   3. Do not use closed cells that would prohibit dipping to galvanizing tanks.

B. Follow the same standards for chain link fence fabric for covering the gate frames as for other fence fabric.

C. Furnish each gate with the appropriate hinges, latch, and drop-bar locking device.

PART 3 EXECUTION

3.1 INSTALLING POSTS

A. Install following Standard Drawing 720-3.

B. Do not exceed the following spacing requirements when placing posts:

Radii of Curve	Maximum Post Spacing
Tangent or 150 m	3 m
60 - 150 m	2 m
30 - 60 m	1.8 m
0 - 30 m	1.5 m

C. Install brace posts at maximum 150 m intervals or at angle points of 30 degrees or more.

D. Set posts in concrete walls or masonry where required.
1. Set posts or post sockets in concrete walls to a minimum 450 mm depth.
2. Use 1.22 mm thick galvanized metal pipe sleeve socket with an inside diameter that allows post to fit loosely.
3. Coat the inside of the socket and the outside of the posts with bituminous paint.
4. Use sulfur caulk or other expansive grout to fasten the post in the socket.

E. Set posts in concrete bases.
1. Place concrete a minimum of 150 mm below each post.
2. Construct at least 300 mm diameter bases for end posts, pull posts, corner posts, gate posts, and line posts.

3.2 INSTALLING FENCE FABRIC

A. Place fence fabric on the roadway side of posts unless otherwise specified.
1. Place fabric approximately 25 mm above the ground.
2. Maintain a straight grade between posts by excavating high points of the ground.
3. Fill depression in the natural ground to within 25 mm of the bottom of fence.

B. Stretch the fabric taut and securely fasten to fence posts.
1. Use stretch bars and metal bands to fasten material to end, gate, corner, and pull posts.
2. Space metal bands at 0.3 m intervals along the post.

3. Cut the fabric at all pull and corner posts.
4. Fasten fabric to line posts with tie wires or metal bands at 350 mm intervals.
5. Attach the top edge of fabric to the top rail or tension cable with wire ties at approximately 600 mm intervals.
6. Attach bottom of fabric to bottom tension wire, and the bottom edge of the fabric to the bottom tension wire with wire ties spaced at 600 mm intervals.

3.3 INSTALLING GATES

A. Install single gate or double gate as specified. Install plumb, level, and secure for full opening without interference.

B. Install ground-set items in concrete for anchorage as shown in the Standard Drawing or as recommended by the fence manufacturer. Adjust hardware for smooth operation.

C. Set gate openings according to manufacturer's dimensions.

D. Fabric description numbers:
1. First number indicates height.
2. Section number indicates width of fabric opening.

END OF SECTION

SECTION 02822

RIGHT-OF-WAY FENCE AND GATE - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing right-of-way fences and gates.

1.2 REFERENCES

A. AASHTO M 111: Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 232: Determination of Lime Content in Lime-Treated Soils by Titration.

C. AASHTO M 279: Zinc Coated (Galvanized) Steel Woven Wire Fence Fabric.

D. AASHTO M 280: Zinc-Coated (Galvanized) Steel Barbed Wire.

E. ASTM A 641: Zinc-Coated (Galvanized) Carbon Steel Wire.

F. National Electric Safety Code, Section 9.

1.3 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 06055: Timber and Timber Treatment.

PART 2 PRODUCTS

2.1 WIRE MESH FENCING

A. As specified in AASHTO M 279.

B. Grade 60, nominal 2.51 mm farm grade wire mesh fencing with a 150 mm vertical wire spacing.

C. Class I zinc coating.

2.2 BARBED WIRE

A. Galvanized barbed wire as specified. AASHTO M 280.

B. Two strands of nominal 2.51 mm diameter wire twisted with a 4-point nominal 2.03 mm barbs no more than 127 mm on center.

2.3 UNTREATED WOOD POSTS FOR LINES, GATES, ENDS AND CORNERS

A. Native juniper or approved equal.

B. Line posts must have a minimum circumference of 250 mm.

C. Gate, brace, and corner posts much have a minimum circumference of 300 mm.

D. All posts must be sound, free of decay or defects, and structurally suitable.

2.4 TREATED WOOD POSTS AND WOOD BRACE RAILS

A. Sound Douglas fir, hemlock, or pine that is free from decay, splits, multiple cracks or any other defect, and structurally suitable.

B. Round or sawed rectangular post and braces.
   1. Round posts must have a minimum circumference of 250 mm.
   2. Gate brace and corner posts much have a minimum circumference of 300 mm.
   3. Rectangular posts must have a minimum normal cross section area of 7700 mm^2.
   4. Square members may be rough sawn or S4S.
   5. A line drawn between the centers of the butt and tip of each post and brace rail must be inside of the actual longitudinal centerline of the post or rail within 1.67 percent of its length.
   6. Taper (diameter differential) in round members must not exceed 50 mm in 3 m.
   7. Fabricate posts and brace rails before pressure treatment of the wood members.
   8. Field drill only after all exposed untreated surfaces of members are field treated with two coats of the same material as they were originally treated.
   9. Treat post and brace rail following Section 06055.
   10. Keep round posts free of bark, protruding knots, or other irregularities.

2.5 METAL POSTS AND BRACES (BRACE POSTS)

A. As Specified. ASTM A 702.

B. Coat fasteners as specified for Class 1 Coating. ASTM A 641.
   1. Omit anchor plate only if the post is set in a concrete footing with a minimum cross sectional dimension of 100 mm and a depth equal to full penetration of the post.
   2. Galvanized posts may be used in the place of painted posts if the galvanizing is a hot-dipped process that meets requirements as stated in AASHTO M 111.

2.6 TUBULAR-STEEL FRAME GATE WITH WIRE FABRIC

A. 25 diameter pipe gate frames as specified.

B. Place pipe braces vertically in each drive gate to provide uniform size panels.
   1. 3 m and 3.7 m gates must have 1 vertical support.
   2. 4.3 m and 4.9 m gates must have 2 vertical supports.

C. Dimension shown on the plans and in the specifications are the minimum clear openings between gate posts. The supplier must provide a gate with fittings to fill the opening.

D. Use galvanized woven fabric on the mesh wire fences of the same type and quality as specified for the fence and gates.
   1. Space horizontal wires corresponding to that of the fence.
   2. Provide an adjustable truss rod of 10 mm minimum diameter to prevent sagging on gates 3 m or more in length.

E. Supply hot-dipped galvanized steel fittings as specified. AASHTO M 232.

F. Pintles for 3 m and wider gates must be 16 mm in diameter or larger.

G. Frame and walk gates must be made of 25 mm galvanized steel tubing.

H. Fastener and single gates must be a 450 mm length of galvanized chain secured to the gate at one end and fitted with a snap fastener on the loose end.

I. All double drive gates must have a center latch in place of a chain fastener. A pin from the latch must fit in a socket embedded in concrete.

2.7 STAPLES

A. Galvanized No. 9 wire staples at least 38 mm in length.

2.8 ORNAMENTAL FENCE

A. Galvanized fabric for a Class 1 Coating as specified in AASHTO M 279.

B. Galvanized posts, frames and fittings as specified in AASHTO M 232.

C. Fabricate following Standard Drawings 720-1A and 1B.

2.9 CONCRETE

A. Class B(AE) concrete. Refer to Section 03055.

B. Contractor may substitute higher class of concrete.

PART 3 EXECUTION

3.1 PREPARATION

A. Clear and grade a minimum area to permit proper fence installation.

3.2 INSTALLATION

A. Install end-braced posts in existing cross fences when intersected by the new right-of-way fence.

B. Brace corner post in two directions.

C. Brace end and gate posts in one direction.

D. Compact backfill material around post.

E. Cut wood posts to the designated height and slant top at an approximate 30 degree angle.

F. Use a 10 mm diameter x 200 mm long galvanized steel dowels to connect wood braces to the adjacent posts.

G. Tension brace wires until installation is rigid.

H. Bolt or butt weld metal braces to the metal posts.

I. Support each timber brace with two No. 6 gauge galvanized iron wires fastened to the wood posts.

J. Remove all sags from wire mesh fabric without causing tension crimps to fail.
   1. Every alternate lateral wire in the mesh fabric.
   2. Each strand of barbed wire to the post.

K. Install grounds anywhere electric transmission, distribution, or secondary lines cross a wood post fence, conforming to industry standard. (National Electric Safety Code, Section 9).

L. Install fence fabric and barbed wire on the side of the post away from the roadway.

M. Install ornamental fence following Standard Drawings 720-1A and 1B.

END OF SECTION

SECTION 02825

CATTLE GUARD - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing cattle guard.

1.2 RELATED SECTIONS

A. Section 02316: Roadway Excavation.

B. Section 02056: Common Fill.

C. Section 02324: Compaction.

D. Section 03055: Portland Cement Concrete.

E. Section 03211: Reinforcing Steel and Welded Wire.

F. Section 05120: Structural Steel.

PART 2 PRODUCTS

2.1 CATTLE GUARD

A. Refer to Standard Drawing 760-1A, and 760-1B.

2.2 CONCRETE

A. Class AA(AE). Refer to Section 03055.

2.3 STEEL

A. Reinforcing: Refer to Section 03211.

B. Structural: Refer to Section 05120.

2.4 AGGREGATE

A. 25 mm or 19 mm granular backfill borrow gradation. Refer to Section 02056.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove and replace unacceptable material following Section 02316.

B. Compact existing materials to a minimum 0.3 m depth in compliance with Sections 02056 and 02324.

C. Cover prepared foundation with a 75 mm layer of untreated base course. Hand screed to the required grade utilizing properly placed screed rails.

END OF SECTION

SECTION 02841

TRAFFIC BARRIERS - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Beam guardrail, double beam guardrail, and guardrail transition elements.

B. Precast concrete barriers: standard, half, and terminal section.

C. Cast-in-place concrete barriers.

D. Traffic control cable.

1.2 RELATED SECTIONS

A. Section 02324: Compaction.

B. Section 02842: Delineators.

C. Section 03055: Portland Cement Concrete.

D. Section 03211: Reinforcing Steel and Welded Wire.

E. Section 03310: Structural Concrete.

F. Section 03390: Concrete Curing.

G. Section 03392: Penetrating Concrete Sealer.

H. Section 05120: Structural Steel.

I. Section 06055: Timber and Timber Treatment.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 180: Corrugated Sheet Steel Beams for Highway Guardrail.

C. AASHTO M 183: Structural Steel.

D. AASHTO M 270: Structural Steel for Bridges.

PART 2 PRODUCTS

2.1 BEAM GUARDRAIL

A. Galvanized beam guardrail elements including bolts in accordance with AASHTO M 180, Class A (2.625 mm thickness) Type 1.

B. Galvanized steel rub or bottom rail on double beam guardrail including bolts and fittings as specified in AASHTO M 183.

C. Galvanizing. AASHTO M 111.

2.2 GUARD RAIL POSTS AND OFFSET BLOCKS

A. Steel or timber as specified. Refer to Sections 05120 and 06055.

B. Treat wood guardrail posts and offset blocks following Section 06055.

2.3 CONCRETE

A. Class AA(AE). Refer to Section 03055.

2.4 REINFORCING STEEL AND WELDED WIRE FABRIC

A. As specified. Refer to Section 03211.

2.5 BARRIER SEAL (FOR PRECAST CONCRETE BARRIER)

A. Polyester polyurethane open-cell foam 100 percent impregnated with asphalt.

B. Foam unit weight requirements:
   1. Before impregnation: 40 kg/m^3 to 50 kg/m^3.
   2. After impregnation: 150 kg/m^3 to 160 kg/m^3.

C. Impregnated asphalt foam should return to 95 percent of its original volume when compressed to 25 percent of its volume and released.

D. Impregnated asphalt foam must remain stable at temperatures ranging from -40 degrees C to +65 degrees C.

2.6 TRAFFIC CONTROL CABLE

A. Wood posts: Refer to Section 06055.

B. Polyethylene Tube: Yellow, with outside diameter of 30 mm with a wall thickness of 1.5 mm. Material and color stabilized for ultraviolet light.

C. Cable: 6 mm galvanized aircraft cable (7 x 19) with a breaking strength of 31 100 N.

D. Clip: 6 mm galvanized wire rope.

2.7 CONCRETE BARRIERS

A. Use the specified reinforcing steel or welded wire fabric as the reinforcing component. Refer to Section 03211.

B. Refer to Section 03055 for hot and cold weather limitations.

2.8 PRE-CAST CONCRETE BARRIER

A. The fabricator will be pre-qualified as a supplier of pre-cast concrete products in accordance with the "Quality Management Plan: Precast-Prestressed Concrete Structures."

B. Permanently mark each barrier with date of casting and identification number supplied by the inspector. Stamp markings in fresh concrete on the underside of each barrier.

C. Prevent cracking or damage during handling and storage of precast units. Replace cracked or damaged precast units at no additional cost to the DEPARTMENT.

D. Accepted for shipment when:
   1. They meet the 28-day compressive strength.
   2. They meet 75 percent of the 28-day compressive strength within 7 days.
   3. They have been visually inspected and accepted by the ENGINEER.

2.9 BARRIER REFLECTOR

A. Sheeting: Refer to Section 02842.

B. Plastic Brackets:
   1. High impact thermoplastic, resistant to ultraviolet rays.
   2. Minimum thickness of 2 mm.
   3. At break: elongation not to exceed 15 percent, and minimum tensile strength 37 000 kPa.
   4. At yield: minimum tensile strength 27 500 kPa.

C. Steel bracket: Minimum thickness of 2 mm, galvanized steel. AASHTO M 111, and as specified.

D. Reflectors: As specified.

2.10 SURFACE SEALING MATERIAL (CAST-IN-PLACE CONSTANT SLOPE BARRIER)

A. Refer to Section 03392.

2.11 EXTRUSION AND SLIP FORM MACHINES FOR CAST-IN-PLACE CONSTANT SLOPE BARRIER

A. Capable of vertical adjustment to the grade line while in forward motion.

B. Equipment with an attached grade line gage or pointer to make a continual comparison with the barrier being place and the offset guide line.

PART 3 EXECUTION

3.1 PREPARATION

A. Site considerations: Protect work area when removing traffic barriers and end sections until the barriers and end sections are reconstructed or the hazard is mitigated.

B. For cast-in-place constant slope protection:
   1. Before applying curing compound, give the surface a final soft brush finish with strokes parallel to the line of barriers.
   2. Do not finish with a brush application of grout.
   3. Refer to Section 03392, Part 3, Preparation.

3.2 POSTS

A. Drive posts if satisfactory results are obtained without damaging the post. When posts are driven through asphalt, seal area around posts with asphalt or concrete.

B. Excavate post holes when not driven.
   1. If hole is overexcavated, compact approved backfill material into bottom of hole.
   2. Compact backfill material around post to a minimum of 96 percent of maximum laboratory density and dispose of excess material.

C. Traffic control cable:
   1. Set posts so that the top of the posts provides a uniform grade line with no noticeable deviations in elevation.
   2. Notches and saw cuts in the posts may be made before placement. If using the driving method, make the notches and saw cuts after post placement.
   3. Saw cut 0 to 75 mm above the ground line.

3.3 RAIL ELEMENTS

A. Punch or drill holes in rail element.

B. Curve rail elements before installation.

3.4 PRE-CAST CONCRETE BARRIERS

A. Installation includes moving, stockpiling, and placing all barriers.

B. Place seal between each barrier unit so that enough pressure is exerted on the sealing material to form and maintain a permanent bond.

3.5 CAST-IN-PLACE CONSTANT SLOPE BARRIER

A. Obtain approval from the ENGINEER before placing the material.

B. Conform to Standard Drawing 735-1H.

C. With fixed forms: Do not use precast mortar blocks to support the reinforcing steel.

D. Constant slope barrier placed by extrusion or slip form:
   1. Provide an offset guide line for the extrusion or slip form machine to maintain the predetermined grade.
   2. Feed concrete to the extrusion or slip form machine at a uniform rate.
   3. Operate machine, uniformly restraining forward motion.
      a. Produce well-compacted, dense concrete with consistency that maintains the shape of the barrier without support.
      b. Produce a well-compacted mass of concrete free from surface pits larger than 25 mm in diameter and requiring no further finishing.
   4. Saw or form joints before applying curing compound.

E. Curing: Refer to Section 03390.

F. Coating:
   1. Application rate based on resident content at a coverage rate of 0.0586 kg per square meter.

2. Apply according to the manufacturer's recommendation for horizontal, vertical and overhead surfaces.
3. Select a sealer with maximum drying time of 1-1/2 hours.

3.6 TRAFFIC CONTROL CABLE

A. Apply enough tension to eliminate sags greater than 75 mm in the cable.

3.7 BARRIER REFLECTORS

A. Attach L-shaped reflectors to concrete barriers as specified.

B. Attach straight reflectors to wood and steel posts as specified.

END OF SECTION

SECTION 02842

DELINEATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Delineators, Type I and Type II.

B. Culvert and maintenance markers.

1.2 RELATED SECTIONS

A. Section 02765: Pavement Marking Paint.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 268: Retroreflective Sheeting for Traffic Control.

C. ASTM A 570: Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

D. ASTM D 638: Tensile Properties of Plastics.

E. ASTM G 23: Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials.

F. Military Specification MIL-M 43719B

PART 2 PRODUCTS

2.1 STEEL POSTS

A. Supply and galvanize posts as specified. ASTM A 570, Grade C, and AASHTO M 111.

B. Use flanged, channel-shaped steel posts that weight 3 kg/m.

C. Make all cuts before galvanizing posts. Follow Standard Drawing 726-1.

2.2 FLEXIBLE POSTS

A. Free of burns, discoloration, contamination, and other defects.

B. Remains flexible at temperatures from -21 degrees C to +60 degrees C.

C. Capable of being driven into an earth shoulder with or without a pilot hole.

D. Tensile strength of 7500 kPa. ASTM D 638.

2.3 QUALITY CONTROL - FLEXIBLE POST TESTING

A. Meet Cold Bend Test:
   1. Subject 2 posts to a temperature of -23 degrees C ±3 degrees C for at least four hours.
   2. Immediately bend each post 4 times through a 90 degree angle around a 50 mm mandrel.
   3. Each post must return to its original straight configuration within a ±10 degree angle within 5 minutes at the end of the 4 bends.
   4. Any cracking or significant loss of rigidity are grounds for failure.

B. Meet Hot Bend Test:
   1. Subject 2 posts to a temperature of 38 degrees C ±3 degrees C for at least 4 hours.
   2. Satisfy all bending and physical requirements specified in the Cold Bend Test.

C. Meet Impact Resistance Test:
   1. Subject post to impacts by a typical sedan as follows:
      a. 3 hits - 0 degree angle at -18 degrees C.
      b. 3 hits - 0 degree angle at 38 degrees C.
      c. 10 hits - 0 degree angle at 60 km/h.
      d. 5 hits - 15 degree angle at 90 km/h.
   2. Acceptable results:
      a. Installed post remain intact, securely anchored and within ± 10 degrees of vertical orientation.
      b. Installed post shows minimal signs of cracking or loss of rigidity.
      c. Installed post retains at least 50 percent of its reflective sheeting.
      d. Impact vehicle suffers little or no damage during the impact test.

D. Exposure:
   1. Expose the specimens for 500 hours in a carbon arc-type apparatus following ASTM G 23, Method 1.

   2. Acceptable results:
      a. Exposure does not result in delamination, distress, or discoloration.

b. Sheeting is not removable from the specimens without damage.

c. Post is resistant to ultraviolet light, ozone, hydrocarbons, and other weathering.

2.4 SHEETING

A. Use approved sheeting. Refer to Product Acceptability Listing.

B. Reflective sheeting: Encapsulated lens sheeting or encapsulated lens (flexible) as specified. Standard Specifications for Construction of Road and Bridges on Federal Highway Projects, FP-92, Type III.

C. Non-reflective sheeting: As specified. Military Specification MIL-M 43719B, Type I, Class I.

2.5 PAINT

A. Refer to Section 02765.

PART 3 EXECUTION

3.1 INSTALLATION

A. Posts: visibly free of bends or twists both before and after installation.

END OF SECTION

SECTION 02843

ATTENUATION/END SECTION - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install attenuation or end section.

B. Remove and reinstall construction zone attenuator.

1.2 RELATED SECTIONS

A. Section 02841: Traffic Barriers.

1.3 SUBMITTALS

A. Installer Certification.
   1. Installer must be certified by manufacturer.
   2. Provide proof of certification prior to installation.

B. Provide a letter of certification for each device location, affirming that each device is installed according to manufacturer's specifications.

PART 2 PRODUCTS

2.1 ATTENUATOR/END SECTION

A. Selection:
   1. Meet Standard Drawing 735-1G in providing attenuator or end section markings.
   2. Select products from current product list in UDOT Guidelines for Attenuator/End Sections. The list is maintained by the UDOT Division of Traffic & Safety, and is also available through UDOT's Internet home page, accessed through Engineering Services "Specifications, Drawings, and Plans" Web page.

B. Types:
   1. Attenuator Type A - Fixed objects 1 m or more in width within 5 m of the traveled way.
   2. Attenuator Type B - Fixed objects 1 m or more in width outside of 5 m from traveled way.

3. Attenuator Type C - Fixed objects 1 m or less in width with limited longitudinal space.
4. Attenuator Type D - Fixed objects 1 m or less in width with unlimited space or double faced guardrail.
5. End Section Type F, Concrete Barrier or bridge abutment with limited longitudinal space.
6. End Section Type G, Single Face Guardrail, concrete barrier or bridge abutment with unlimited longitudinal space.
7. Attenuator Type CZ - Construction Zone with concrete barrier with speed higher than 70 km/h (45 MPH).
8. Attenuator Type CZL - Construction zone with concrete barrier with speed of 70 km/h (45 MPH) or less.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with:
   1. Manufacturers specifications and recommendations
   2. The DEPARTMENT's Guidelines for Attenuators/End Sections.
   3. Standard Drawing 735-1G.

B. A manufacturer certified installer must perform the installation.

C. Complete repair or replacement of any Attenuator/End Section damaged during construction within 24 hours of notification of damage.
   1. CONTRACTOR is responsible for the cost of any repair or replacements until completion of the project.

D. Grade approach to system to 1:10 or flatter, for a minimum of 15 m prior to front of system.
   1. Do not install system with curb and gutter. (Refer to UDOT Guidelines for Attenuators/End Sections detail guideline A or B).
   2. Meet manufacturer recommendations for all clear zones to the side and rear of device.

END OF SECTION

SECTION 02861

PRECAST RETAINING/NOISE WALLS - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing Precast Retaining/Noise Wall.

1.2 RELATED SECTIONS

A. Section 01571: Temporary Environmental Controls.

B. Section 02061: Select Aggregates.

C. Section 03055: Portland Cement Concrete.

D. Section 03152: Concrete Joint Control.

E. Section 03211: Reinforcing Steel and Welded Wire.

F. Section 03310: Structural Concrete.

G. Section 03390: Concrete Curing.

1.3 REFERENCES

A. AASHTO Standard Specifications for Highway Bridges.

1.4 SUBMITTALS

A. Lifting devices: Submit calculations and shop drawings for approval.

B. Precast Concrete Panels: Submit for approval samples of the exposed aggregate finish before casting the panels.

1.5 HANDLING, SHIPPING, AND STORAGE

A. Shipment Acceptance: Panels or posts may be accepted for shipment and marked with an orange UDOT sticker if:
   1. They meet the 28 day compression test, or
   2. They meet 75 percent of 28 day strength within 7 days.
   3. They are not cracked or damaged.

B. Do not ship any panel or post that does not satisfy strength requirements.

PART 2 PRODUCTS

2.1 MATERIALS FOR PRECAST NOISE WALLS AND RETAINING WALLS

A. Precast Wall Panels and Posts:
   1. Concrete Class AA(AE). Refer to Section 03055.
   2. Type II cement.
   3. Slump requirement need not be met.
   4. 28 day minimum compressive strength of 34 500 kPa.

B. Post Hole Concrete: Concrete Class B(AE). Refer to Section 03055.

C. Reinforcing Steel: Epoxy Coated Grade 400. Refer to Section 03211.

D. Welded Wire Fabric: Coated. Refer to Section 03211.

E. Curing Compound: Type I, Class A. Refer to Section 03390.

F. Gravel for Post Holes: Free Draining Granular Backfill Borrow. Follow Section 02061, Part 2.

G. Elastomeric Bearing Pad: 60 hardness. As specified in AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.2.

H. Backer Rod: Refer to Section 03152.

I. Construction Adhesive: Use an approved adhesive from the "Qualified Products Listing."

J. Wood Shims: Any grade fir.

2.2 ADDITIONAL MATERIALS FOR RETAINING WALLS

A. Composite Drainage Material: Two-layer composite, consisting of non-woven silt fence geotextile and matting surface which are heat bonded together.
   1. Polyester non-woven fabric. Follow Section 01571, Part 2, paragraph: Silt Fence.
   2. Compression resistant matting of three dimensional construction capable of multidirectional flow.

2.3 LIFTING DEVICES

A. Galvanized flush-type that do not project beyond the edge of the panels.

B. Capable of lifting the maximum size of panels (3.48 m x 2.13 m x 127 mm) and of tilting them from horizontal position to vertical position.

C. Shear factor of safety of 2.66:1 for lifting from a flat position and a tension factor of safety of 4:1 for lifting from a vertical position.

D. Designed for shear so that the panels can be lifted from either side.

E. Provide a sealing cover.

2.4 CONCRETE POSTS

A. Cast posts in metal forms.

B. Permanently mark each post with date of casting and post the identification number supplied by the inspector. Place markings in fresh concrete in the portion of the post which will be embedded in soil.

C. DEPARTMENT will accept posts if:
   1. They meet the 28 day compressive strength.
   2. They meet 75 percent of the 28 day compressive strength within 7 days.
   3. They have been visually inspected and accepted by the ENGINEER.
   4. The sides do not deviate from a straight line by more than 10 mm per post height.

D. Replace posts that are:
   1. Cracked or damaged.
   2. Not permanently marked.

2.5 PRECAST CONCRETE PANELS

A. Fabricator will be pre-qualified as a supplier of pre-cast concrete products in accordance with the “Quality Management Plan.”

B. Cast the panels to required tolerances regarding all dimensions.
   1. Cast in metal forms.
   2. Do not use coloring additives.
   3. Make panels match in contrast.

C. Permanently stamp panel identification number supplied by ENGINEER in the top surface of one lifting device prior to casting.

D. Expose the aggregate on both sides. Remove all residue from exposed surfaces.

E. DEPARTMENT will accept panels when:
1. They meet the 28 day compressive strength.
2. They meet 75 percent of the 28 day compressive strength within 7 days.
3. They have been visually inspected and accepted by the ENGINEER.
4. The sides do not deviate from a straight line by more than 3 mm.

F. Replace panels that:
1. Are cracked or damaged.
2. Do not match in contrast.
3. Are not permanently marked.

PART 3 EXECUTION

3.1 LIMITATIONS

A. Refer to Section 03055 for hot and cold weather limitations.

3.2 CURING

A. Refer to Section 03390.

3.3 POST HOLES

A. Refer to plans for post spacing.

B. Place edge of post holes no nearer than 0.6 m from any underground utility.

3.4 LIFTING DEVICES

A. Place waterproof caps in the lifting devices after the panels are permanently placed.

3.5 CONCRETE POSTS

A. Set true to line and grade. Reject and replace posts more than 13 mm out of plumb in exposed length.

B. Replace posts that do not adequately support or accept insertion of the precast panels.

C. Replace cracked or damaged posts.

D. Glue elastomeric bearing pads to the concrete post following the manufacturer's recommendations.

3.6 PRECAST CONCRETE PANEL PLACEMENT

A. Set elevations in the field for ENGINEER's acceptance. Stake elevations to the bottom of the bottom panel. Align as shown on the plans.

B. Place the panels in the posts with the form side facing the highway.

3.7 RETAINING WALLS

A. Follow Standard Drawing 546-1, 2.

B. Composite drainage material:
   1. Place behind the wall panels at each weep hole location.
   2. Place the fabric side of the material against the fill. Extend the length of the material from the bottom of the wall panel to the top of the fill.

C. Filter Fabric: Place around the back side of the posts as shown in the plans. Extend the material from the bottom of the wall panel to the top of the fill.

D. Free Draining Granular Backfill Borrow: Place and tamp down behind the wall panels, between the posts to the fill height and length, and at the locations shown on the plans.

END OF SECTION

SECTION 02891

TRAFFIC SIGNS - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing traffic signs.

1.2 RELATED SECTIONS

A. Section 02317: Structural Excavation.

B. Section 03055: Portland Cement Concrete.

C. Section 03211: Reinforcing Steel and Welded Wire.

D. Section 05120: Structural Steel.

E. Section 06055: Timber and Timber Treatment.

1.3 REFERENCES

A. APA: American Plywood Association Product Standard.

B. ASTM A 314: Stainless Steel Billets and Bars for Forging.

C. ASTM B 209: Aluminum and Aluminum-Alloy Sheet and Plate.

1.4 TRAFFIC SIGN COMPONENTS

A. Substrate: The base material, usually plywood or aluminum, upon which the background sheeting is attached.

B. Panel: Assembly of substrate and attached sheeting. Several panels may be necessary to complete one sign. Panel types are:
   1. Type A: Reflective sheeting on sheet aluminum.
   2. Type P: Reflective sheeting on plywood.
   3. Legend:
      a. -1 With non-reflective legend, symbols, and borders.
      b. -2 With reflective legend, symbols, and borders.

C. Sheeting: The reflective or non-reflective material that comprises the background legend, border, and symbols.

D. Sign: A complete assembly comprised of post, frame, and panel.

E. Auxiliary Sign: A sign including frame, if required, attached and supplemental to a complete sign assembly.

F. Panel replacement: Removing the existing panel and attaching a new panel to the frame.

G. Panel Overlay: Attaching new panels to all or part of an existing panel.

H. Size: Horizontal x vertical

1.5 SIGN CODES

A. New Sign: N

B. Auxiliary Sign: Aux

C. Relocation: R

D. Removal: X

E. Panel Replacement: PR

F. Panel Overlay: PO

1.6 SUBMITTALS

A. Submit 3 sets of drawings for overhead structures for prefabrication approval. Allow 14 calendar days for approval.

PART 2 PRODUCTS

2.1 MATERIALS

A. Fabricate sign and posts as specified per Standard Drawings 745-50A, 745-50B, 745-50C, or 745-60.

B. Substrate: 2 mm thick. ASTM B 209 alloy 6061-T6, or 5052-H38.

C. Plywood as specified below and which meets the American Plywood Association product standard 1 PSI-83, Group 1, 16mm thick.
   1. 90/90, high density BB exterior (Douglas Fir) B Grade.
   2. Plugged-core (Douglas Fir) with 13 mm maximum gaps.
   3. Use acrylic laminate that is compatible with the reflective sheeting adhesive, and that does not require the removal of the release agents before applying the sheeting.

D. Posts:
   1. Steel: Follow Section 05120
   2. Wood: Follow Section 06055.

E. Reflective Sheeting:
   1. Encapsulated lens sheeting or encapsulated lens (flexible) as specified.
   2. Meet Standard Specifications for Construction of Roads and Bridges on Federal Highway Projects FP-92, Type III.

F. Nonreflective Sheeting: As specified. Meet Military Specification MIL-M 4371B, Type I, Class I.

G. Fasteners: As specified. Meet ASTM A 314, Class 304, 18-8, Stainless Steel.

H. Foundation
   1. Concrete: Class A (AE). Refer to Section 03055.
   2. Reinforcing steel: Refer to Section 03211.
   3. Anchor bolts: Refer to Section 05120.

I. Structural Steel: Structural Steel frame. Refer to Section 05120.

J. Temporary covering: Opaque material.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate utility location.

B. Excavate following Section 02317 requirements.

C. Install traffic control devices before work activities begin.

3.2 INSTALLATION - GENERAL

A. Furnish a daily record of the number and location of all traffic control devices in use.

B. Do not reverse screen sign larger than 0.7 m^2 per color.

C. Do not remove a sign which is being replaced until the new sign is placed and uncovered.

D. Compact backfill to a density equal to surrounding materials.

E. Establish proper elevation and orientation of all signs, structures, and determine proper sign post lengths as dictated by construction slopes.

F. Cover signs which require temporary covering an opaque material. Secure at the rear of the sign so that the sign is not damaged. Maintain covering until removed.

G. Construct sign post foundations with concrete conforming to indicated dimensions.

3.3 RELOCATING EXISTING SIGN

A. Retrofit as required to meet current standards.

B. Provide new posts and accessories as required.

C. Remove foundations to a minimum of 150 mm below the ground line, and backfill.

3.4 REMOVING EXISTING SIGN

A. Remove foundations to a minimum of 150 mm below the ground line and backfill.

END OF SECTION

SECTION 02892

TRAFFIC SIGNAL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing traffic signals.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02748: Prime Coat/Tack Coat.

C. Section 03055: Portland Cement Concrete.

D. Section 03211: Reinforcing Steel and Welded Wire.

E. Section 03310: Structural Concrete.

F. Section 03575: Flowable Fill.

G. Section 16135: Electrical Junction Boxes.

H. Section 16525: Highway Lighting.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AISI, Type 201.

C. ANSI/UL 467:

D. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

E. ASTM A 325: Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

F. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

G. ASTM A 570: Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.

H. ASTM B 85: Aluminum-Alloy Die Castings.

I. ASTM B 117: Operating Salt Spray (Fog) Apparatus.

J. ASTM B 766: Electrodeposited Coatings of Cadmium.

K. ASTM D 638: Tensile Properties of Plastic.

L. ASTM D 2240: Rubber Property-Durometer Hardness.

M. ASTM D 3005: Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape.

N. International Municipal Signal Association (IMSA): 20-1, 50-2, 51-1, 51-3, 51-5, 51-7, 60-6.

O. Institute of Traffic Engineers (ITE), Technical Report No. 1, and 4.

P. Military Spec. Mil-C-5541, and TTE-529.

Q. NEC 250-1: National Electric Code.

R. NEMA TC-2, TC-3, UL Listed.

S. REA (Rural Electrical Association) Bulletin 17551-100.

T. UL 6.

U. UL 510.

V. UL E-50076.

W. 3M - 8982/Gel.

1.4 SUBMITTALS

A. Certified test report of wire compliance as specified. IMSA 20-1, 50-2, 51-1, 51-3, 51-5, 51-7, 60-6.

B. Submit samples of materials for approval when requested.

C. Submit two copies of the following within 15 days after receiving a Notice to Proceed:
   1. List of equipment and materials (name of manufacturer, size, and identification number).
   2. Detailed shop drawing, wiring diagrams, and certifications.

3. Manufacturers' warranties, guarantees, instruction sheets, and parts lists.

1.5 ACCEPTANCE TESTING

A. Detector Loop Circuit: Conduct the following acceptance tests before and after backfill for approval by the ENGINEER.

1. Loop Resistance Formula: $R_t = R_l + R_d$

   R_t= Resistance of loop as measured at pull box.

   R_l= Resistance of loop lead in wire (from the loop to junction box per meter) equals 0.0213 ohms, measured from loop to pull box splice.

   R_d= Resistance of loop = $P.T.R_d$ (See Loop Resistance Table below)

   P = Perimeter of loop in meters.

   T= Number of turns in the loop.

   R_c= Resistance of #14 AWG copper wire per meter equals 0.0107 ohms.

Table 1

Loop Resistance			
Loop Type			**R_d Loop Resistance (ohms)**
Width	**Length**	**Turns**	
1.5	1.8	4	.29
1.5	3	4	.39
1.8	1.8	4	.31
1.8	3	4	.41
1.8	3.6	4	.47
1.8	4.2	3	.39
1.8	4.8	3	.43

2. A minimum reading between the conductor and ground of 100 MÙ when tested with a 500 V megger meter.
3. An inductance between 65 FH and 1000 FH.
4. Signal Power Circuits:
   a. Continuity of grounding conductors to maintain a 1000 W load at each pole to maintain less than 2 V drop.
   b. Insulations resistance of supply conductors to ground shall be no less than 40 MÙ (500 V megger meter).

PART 2 PRODUCTS

2.1 MATERIALS

A. Use electrical components as listed and defined by the National Electric Code (NEC).

2.2 SIGNAL POLE AND TRAFFIC SIGNAL LIGHT SUPPORT ARM

A. Post mounted Tapered Signals Pole: Standard Drawing 745-55D.
   1. Steel, as specified. ASTM A 570, Grade 33.
      Allowable stresses: F_b = 150.17 MPa (0.66F_y)
      F_V = 75.08 MPa (0.33 F_y)
   2. Galvanized as specified. AASHTO M 111.
   3. Wind load: 130 km/hr wind with 170 km/hr gusts.

B. Foundation:
   1. Concrete: Class AA(AE) Concrete. Refer to Section 03055.
   2. Reinforcing steel: Coated steel. Refer to Section 03211.

2.3 BOLTS AND NUTS

A. Anchor bolts and nuts: Follow Standard Drawing 745-55 D.
   1. Steel as specified. ASTM A 307.
   2. Zinc-plated or galvanized, as specified.
      a. Zinc-plated as specified. ASTM B 766.
      b. Galvanized steel: ASTM A 123.
   3. Nuts; free running, by hand, for total thread length.

B. Slip Bolts as specified.
   1. Zinc plated: ASTM B 766.
   2. Steel: ASTM A 325.

2.4 WIRE

A. Copper, as specified. International Municipal Signal Association (IMSA).

B. Size as specified. American Wire Gauge (AWG).

C. Service Cable:
   1. Single-conductor, as specified. Type THWN, THW, THHW.

D. Interconnect cable:
   1. Twisted pair filled shielded cable, as specified.
   2. IMSA 60-6.

E. Signal Cable:
   1. Multi-colored cables, as specified.
   2. IMSA 20-1

F. Ground Wire:
   1. Solid, bare, soft-drawn, copper wire, as specified.
   2. NEC 250-1.

G. Splice Sealing: Rural Electrical Association (REA) Bulletin 17551-100.
   1. Rigid body re-enterable gel-filled enclosure. Meet 3M-8982/gel, or equivalent.
   2. Mastic rubber pads and overwrap with vinyl electric tape.
   3. ASTM D 3005, Type I or II. UL 510.

H. Color Coding Tape:
   1. Vinyl electric tape, as specified.
   2. UL 510.

2.5 TRAFFIC SIGNAL HEAD

A. Use Standard Drawing 745-55 G.

B. 300 mm vehicular signal heads:
   1. With tunnel hoods and mounting brackets, square doors,
   2. Capable of adjusting a full 360 degrees around a vertical axis in one direction.

C. Assembly:
   1. Designed to use standard 75 mm Light Center Length (LCL) traffic signal lamps, 1950 lm/150 W lamps.
   2. Sections:
      a. Separate, interchangeable, and expandable without tie rods.
      b. Stainless steel bolts, screws hinge pins, and door-locking devices in any exposed sections.
   3. Die-cast aluminum parts, including the doors, as specified: ASTM B 85. Clean, smooth parts free from flaws, cracks, blow holes, or other imperfections.
   4. Moisture and dust resistant.
   5. All surfaces inside and out of signal housing, door, and outside of visor painted with electrostatically-applied, fused-polyester paint in Highway Yellow. Paint inside of visor flat black.
   6. Integrally round serrated boss openings in the top and bottom of each section that receives 38 mm supporting pipe frame.
   7. Rain-tight top opening and an ornamental cap for closing the bottom opening.
   8. Visor securely mounted at a minimum of four points.

D. Optical Unit: Watertight and dust resistant, mounted so various parts swing open for easy access.

1. Glass lens: Meet current applicable specification for traffic signals. Institute of Traffic Engineers (ITE) Report No. 1.
2. Reflector:
   a. One-piece parabolic, alzak finished specular aluminum as specified. ITE Technical Report No. 1.
   b. Designed to minimize "sun phantom" false illumination.
3. Lampholder:
   a. Positively positioned and easily rotated without tools.
   b. Vibration resistant, weatherproof, molded construction.
   c. Lamp filament positioned at the focal center of the reflector.
   d. Use stranded, No. 18 AWG, 105 degrees C. minimum, 600 V wire leads.
4. Traffic Signal Lamps: ITE R-4
   a. 75 mm LCL, Incandescent
   b. 136 watt, 122.5 V.
   c. 10,000 hour rated life, 1750 lm.

E. Louvered back plate

1. Constructed from minimum 1.25 mm aluminum.
2. Both sides primed and painted flat black.
3. Designed to be attached to the signal head used.

2.6 PEDESTRIAN SIGNAL HEAD

A. Follow Standard Drawing 745-55J.

B. Includes a housing, swing down door assembly, parabolic reflector, message lens, sunshield, two signal lamps and two sockets.

1. Housing:
   a. Dustproof and weatherproof.
   b. Die cast, single piece aluminum allot.
   c. 38 mm top and bottom openings with integrally-cast shurlock boss when used with pipe mount brackets.
   d. Use stainless steel screws springs, and assembly hardware.
2. Swing down door assembly:
   a. Capable of being opened without tools.
   b. Made of a single piece aluminum alloy, die cast with two hinge lugs at the bottom and two latch slots at the top of the door.
3. Reflectors:
   a. Single-piece of polycarbonate plastic sheet, double-parabolic, vacuum-formed, 6 mm minimum thickness, textured.
   b. Lamp side texture comforms to C-64 or C-66 pattern or equivalent for light uniformity.

c. Aluminum-coat lamp side by vacuum deposition.

4. Message lens: 5 mm thick tempered glass lens.

5. Sunshield:

a. Eggcrate-type with 15 vertical and 26 horizontal members.

b. Two anti-vandal, integral locking strips.

c. Minimum thickness of 0.75 mm.

d. Finish: 100 percent impregnated black, polycarbonate plastic, with a flat finish on both sides.

6. Electrostatically apply a synthetic enamel as specified.

a. Gloss black case and door frame.

b. Flat black sunshield.

c. Oven-cure finish for a minimum of 20 minutes at 177 degrees C.

7. Signal lamps: Meet ITE R-4.

a. 62 mm LCL, incandescent, 69 W.

b. 8000 hour rated-life.

c. 690 lm, 122.5 V.

8. Sockets: high temperature ceramic lamp socket with brass screw shell.

C. All components compatible with 116 W lamps.

D. Symbol messages blank out under ambient light conditions when the pedestrian signal is not energized.

E. Optical unit does not allow erroneous messages from lamp failure of light spill over.

2.7 ELECTRICAL CONDUIT

A. Conduit and fittings:

1. Schedule 40 PVC rated at 90 degrees C. as specified. NEMA TC-2, TC-3. UL Listed.

2. Rigid steel as specified. UL 6.

3. Galvanized as specified. ANSI C80.1.

B. Casing: Smooth steel with a minimum 6 mm wall thickness as specified.

2.8 DETECTOR CIRCUIT

A. Wire:

1. Detector Lead-In Wire (feeder): as specified. IMSA 50-2.

2. PVC Sensor Loop Wire - No. 14, single-conductor, stranded wire as specified. IMSA 51-3.

3. Saw Cut Sensor Loop Wire.

4. No. 14, single-conductor, stranded wire encased in a polyethylene tube as specified. IMSA 51-7.

B. Traffic loop embedding sealant:
   1. Isophthalic, acid-based, unsaturated, polyester resin.
   2. With sufficient adhesion, strength, and flexibility to:
      a. Withstand normal movement in asphaltic and concrete pavements, and
      b. Protect the loop wire from moisture penetration, fracture and shear.
   3. Cured sealant resistant to motor oils, gasoline, anti-freeze solution, brake fluid, and de-icing chemicals.
   4. Meet the physical property requirements in Table 2.

Table 2

Traffic Loop Embedding Sealant		
Physical Properties	**Test**	
Shore D Hardness	ASTM D 2240	74
Specific Gravity		1.13 - 1.20
Styrene Monomer, percent		28 - 32
Viscosity: Pa·s	Brookfield Model LVF #3 Spindle @ 60 rpm	0.7-0.9
Gel Time	MEK Peroxide 46-709	11 - 15 minutes
Tensile Elongation, % @ Break	ASTM D 638	50
Pot life, minimum		5 minutes
Tensile Strength	ASTM D 638	13 800 kPa

2.9 LUMINAIRE

A. Housing:
   1. Die-cast aluminum
   2. Reflectors, sockets, mounting cradles, and clamps fitted to the upper housing.

B. Integral ballast: Pre-wired with quick disconnect plugs mounted on a removable, hinged power door.

C. Power Door: Ballast assembly interchangeable with all luminaires, regardless of wattage.

D. Optical assembly: Formed aluminum reflectors with a chemically bonded, non-breakable, glass finish on both the inside and outside surfaces.

E. Mogul base sockets:
   1. Adjustable with split-shell, tempered-brass lamp grips.
   2. Free-floating, spring loaded center contacts.
   3. Heat- and impact-resistant glass prismatic refractors.

F. Mounting adjustment:
   1. 10 degrees above horizontal for the reflector and refractor.
   2. 5 degrees adjustment from vertical on the bracket arm.

G. Weight: no more than 34 kg;

H. Projected area: no more than 0.3 m^2.

I. Ballast: high pressure sodium type that will:
   1. Maintain a minimum power factor of 90 percent.
   2. Maintain lamp wattage of not more than 5 percent for nominal line and lamp voltage.
   3. Maintain regulation of not more than 35 percent for a 10 percent line voltage variation.
   4. Start and operate the lamp at ambient temperatures down to -40 degrees C.
   5. Sustain lamp operation for a minimum of 4 seconds at a voltage dip of 35 percent.

J. Lamp: high pressure sodium lamp that uses clear bulbs and has:
   1. Apparent color temperature of 2100 K.
   2. CIE chromaticity of X = 0.512, Y = 0.420.
   3. Rated-life of not less than 24 000 hours per 10 hour start.

2.10 GROUND ROD

A. Copper-coated steel as specified.

B. ANSI/UL 467.

2.11 MESSENGER

A. 10 mm diameter galvanized, stranded steel cable.

B. Minimum breaking strength of 48 000 N, as specified.

C. ASTM A 123.

2.12 MOUNTING BANDS AND BUCKLES

A. As specified.

B. American Iron and Steel Institute, (AISI) Type 201.

2.13 POWER SOURCE

A. Pole Mount: Standard Drawing 745-55E.
   1. Service disconnect:
      a. Single pole 40 amp 120 volt AC metered for signal.
      b. Double pole 20 amp 240 volt un-metered for lighting.
   2. Provide a manual EUSERC approved circuit closing link by-pass release meter socket.
   3. Unmetered street lighting circuit.

B. Underground Service Pedestal: As specified. ASTM B 117, and ASTM A 123 (Cabinet). UL E 50076
   1. Enclosure: 3 mm galvanized steel or anodized aluminum.
      a. 2 mm galvanized steel or anodized aluminum covers.
      b. Finished surface with an environmental green, baked enamel over zinc-chromate primer as specified, or anodized aluminum. ASTM B 117.
      c. Bottom access opening.
      d. Electrical Utility Service Equipment Requirements Committee (EUSERC) approved circuit-closing by-pass release meter socket.
      e. Baffled ventilation louvers.

C. Circuit Breaker: Main Breaker
   1. Six space metered.
   2. Six space unmetered bus.

D. Detachable, pad-mount base.

2.14 FLOWABLE FILL

A. Refer to Section 03575.

2.15 HOT MIX ASPHALT

A. 13 mm maximum. Refer to Section 02741.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform to the National Electrical Code (NEC).

B. Pick up State-furnished materials at the DEPARTMENT's Division of Safety Warehouse, 4501 South 2700 West, Salt Lake City, UT.

C. Saw cut concrete or other improved surfaces to be removed in the sidewalk area, and replace with in-kind materials to match the existing grade.

D. Attach brackets with a banding machine with stainless steel bands. Do not drill holes in poles except as shown on the plans. Follow Standard Drawings 745-50J, and 745-55A2.

E. Do not disconnect or remove an existing signal system until the replacement system is functioning.

F. Contact power company at least 30 days before the connection date, and verify the exact location, voltage, procedure, and materials required by the power company.

3.2 CONSTRUCT POLE FOUNDATION

A. Follow Standard Drawings 745-55C and 745-55K.

B. Concrete: AA(AE) required. Refer to Section 03055.

C. Structural Concrete: Refer to Section 03310.

D. Reinforcing Steel and Welded Wire: Refer to Section 03211.

E. Do not weld reinforcing steel, anchor bolts, or conduit.
   1. Use tie wire to secure conduit.
   2. Use template to align and secure anchor bolts.

F. Place the concrete directly into the excavation, and use minimum forming above ground.

3.3 TRENCH FOR CONDUIT

A. Paved Surface (asphalt concrete):
   1. Do not use backhoe.
   2. Make the trench 150 mm wide or less.
   3. Use flowable fill to within 75 mm of the existing roadway surface.
   4. Evenly apply tack coat before final backfill.
   5. Match the composition, density, and elevation (± 5 mm) of the existing surface in the final 75 mm of backfill.

B. Unpaved Surface:
   1. Use backfill that matches the composition, density, and elevation (± 5 mm) of the existing surface.

2. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by jacking, drilling, or pushing. Entirely replace any damaged section at no additional cost to DEPARTMENT.
3. Dispose of surplus material daily.

C. Trenching under Railroad (Subject to agreement with railroad):
1. Install smooth steel casing a minimum depth of 1.2 m under railroad track to house conduit.
2. 150 mm diameter casing with a minimum 6 mm wall thickness, and a minimum yield strength of 241 MPa.

D. Minimum cover of conduit:
1. Minimum cover for all roadway crossings: 610 mm.
2. Minimum cover off roadway without concrete encasement or capping: 460 mm.
3. Minimum cover off roadway with concrete encasement or capping with minimum thickness of 50 mm: 300 mm.

3.4 INSTALL CONDUIT

A. Place all conduits in the same trench before surfacing.

B. Above ground use galvanized rigid steel; under ground use PVC.

C. Seal uncapped conduit ends inside junction box with at least 50 mm of duct caulking.

D. In future-use conduit, install No. 14 single conductor copper, type THHN pull wire.
1. On each end of conduit install cap with 6 mm hole for pull wire.
2. Leave 0.5 m of wire outside of the cap, fastened securely.
3. Place future-use conduit in top portion of trench for easier access later.

E. Secure conduit on structures with standard galvanized iron conduit clamps using at least 8 mm diameter concrete expansion anchors at maximum 1.5 m spacing.

F. Use conduit expansion fittings at structure expansion joint crossings.

3.5 INSTALL WIRING

A. Conductors:
1. Clean and dry the inside of the conduit before installing conductors.
2. Install grounding conductor in all power circuit conduits.
3. Use powered soapstone, talc or other approved lubricants when pulling conductors in conduit.
4. Tape the ends of unused conductors and label them as spares.

5. Use conductors that are color coded as specified. Meet IMSA 20-1.

B. Ground wire:
   1. In all non-metallic conduit, a ground wire must run continuously and be grounded at each junction box, except in those conduits used solely for interconnect and detector circuits.
   2. Bond the ground wire to the ground rod in each junction box except in circuits with less than 50 V.

C. Neatly arrange wiring within cabinets, junction boxes, fixtures, etc.

D. Terminate all terminal connections by a mechanical (spade) connector.

E. Wire splicing:
   1. Splice wires only in detection circuits where the wire type changes in the junction boxes.
   2. Mechanically secure or solder, individually insulate, and water seal all splices. Encapsulate in a rigid body re-enterable gel filled enclosure, or cover with mastic rubber pads and overwrap with vinyl electric tape.

F. Mark cabinet cables with vinyl electrical color coding tape as specified according to Table 3. Meet UL 510.

Table 3

Cables Marked with Colored Tape				
	Northbound P2	**Southbound P3**	**Eastbound P4**	**Westbound P1**
Signal Circuit	Blue	Red	Yellow	Orange
Detector Circuit	Blue	Red	Yellow	Orange
	Circuit Coding One band, Through, 2 bands, Left Turn, 3 bands, “Q’s”, Four bands, Dilemma			
Pedestrian	Blue & Green	Red & Green	Yellow & Green	Orange & Green
Pedestrian Button Circuit (3)	Blue & White	Red & White	Yellow & White	Orange & White

G. Connect conductors according to Table 4.

Table 4

Color-Coded Conductors		
	North-South	**East-West**
Seven-Conductor Pedestrian Circuit	Red - Don't Walk Green -Walk White - Neutral	Black - Spare Orange - Don't Walk Blue - Walk White with Black Tracer - Neutral
Three-Conductor Pedestrian Head Circuit	Red - Pedestrian Call White - Common	Black - Pedestrian Call White - Common
Seven-Conductor Signal Circuit	White - Neutral Red - Red Through Orange - Yellow Through Green - Green Through Blue - Green Arrow White with Black Tracer - Yellow Left Black - Left red or spare	

3.6 INSTALL DETECTOR LOOPS

A. Follow Standard Drawing 745-55L.

B. One turn is once around the perimeter of the loop with the same conductor.
   1. Use number of turns as specified in Table 1 (Loop Resistance Table).
   2. Do not allow twists in the loop.

C. Loop lead-in from loop to junction box:
   1. Minimum of 3 twists per meter in saw cut.
   2. Minimum of 10 twists per meter for conduit.
   3. Do not interweave with other loop lead-ins.
   4. Each lead-in requires a separate conduit.

D. For Detector Lead-in (feeder) from the junction box to controller cabinet, carry shield across all splices.

E. Saw cut loop:
   1. Round the corners with a minimum of 50 mm drill.
   2. Remove all loose material and wash and dry all saw cuts.
   3. All loop wire shall be in a 6 mm polyethylene tube.
   4. Seat the conductor with no damage at the bottom of the slot.
   5. Fill the saw cut with embedding sealant, surround the polyethylene tube to the level of the existing roadway surface ±6 mm. Remove any excess embedding sealant.

F. PVC loop:

1. Trench 50 mm maximum width and 100 mm minimum to 150 mm maximum cover.
2. Anchor sensor loops to prevent movement or floating.
3. Apply a tack coat to the sides and the bottom of the remaining 75 mm of trench and backfill with hot mix asphalt. Refer to Sections 02741 and 02748.
4. Loops in new pavement preformed and placed 40 mm below the surface of the base course and backfill with surrounding material.

3.7 INSTALL POWER SOURCE

A. Verify the exact location, voltage, procedure, and materials required by the power company.

B. Follow Standard Drawing 745-55E.

3.8 INSTALL LUMINAIRE

A. As specified.

B. Follow Standard Drawing 745-55A1.

3.9 INSTALL SIGNAL HEAD

A. Do not install signal heads at the intersection until ready for operation.

B. If turn on is not immediate, completely cover the signal heads with non-transparent, non-paper material tied securely around head.

C. Install directed and veiled optically-programmed signals following the manufacturer's instructions. Mask each section of the signal with prescribed materials.

D. Use louvered back plates on all signal heads except Type V & VI. Use a minimum of four 3 mm stainless steel screws per section to mount the back plates, or according to manufacturer's instructions.

3.10 REMOVE AND SALVAGE EXISTING EQUIPMENT

A. Light poles, signal poles, messenger cable, signal and pedestrian heads, controller cabinets, other items as specified on the plans remain the property of the DEPARTMENT.

B. Transport items to the specified location.

C. Remove foundations to a depth of at least 150 mm below the existing surface.

D. Backfill all holes with local material and compact to the density of the surrounding area.

END OF SECTION

SECTION 02896

BOUNDARY SURVEY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide boundary survey, and plat.

B. Furnish and set right-of-way markers.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

1.3 REFERENCES

A. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

PART 2 PRODUCTS

2.1 RIGHT-OF-WAY MARKERS

A. Pipe: As shown in Standard Drawing 724-1. Meet ASTM A 53, Schedule 40, Galvanized.

B. Cast bronze cap: Free from defects and constructed as shown in Standard Drawing 724-1.

2.2 CONCRETE

A. Class B concrete per Section 03055.

B. May substitute higher class of concrete.

PART 3 EXECUTION

3.1 RIGHT-OF-WAY MARKERS

A. Place Right-of-Way Markers in accordance with Standard Drawing 724-1, including stamping onto each Right-of-Way Marker:
   1. Control Line station.
   2. Elevation.
   3. Professional Land Surveyor's License Number.
   4. Year onto each right-of-way marker.

B. Tightly rivet cap to the pipe.

3.2 BOUNDARY SURVEY

A. Provide boundary survey by Utah licensed surveyor.

B. Prepare survey plat and narrative.

C. File mylar copy of plat with county surveyor, region, and Central Right-of Way offices of DEPARTMENT.

D. Accuracy: Third Order, and Class I (1/10,000).

3.3 PLAT COMPLIANCE REQUIREMENTS

A. Utah Code 17-23-17.

B. DEPARTMENT procedure "Design Process."

C. Show on the survey plat:
   1. Survey coordinates accurate to 5 decimal places and elevations accurate to 3 decimal places on all right-of way markers.
   2. Right-of-Way markers.
   3. Adjacent quarter corners and section corners.
   4. Original highway control points.
   5. Local city or county monuments.

D. Compute and draw plat, stationing, and coordinates to the same units as the project drawings.

E. Show both metric and English units for centerline control and control line references, with the English unit in parenthesis following the metric unit.

F. Deliver a copy of the survey plat to ENGINEER on a 3-1/2 inch disk in MicroStation format.

G. Correction Factor: Show state plane to ground correction factor.

END OF SECTION

SECTION 02911

MULCH

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Types of mulch.

B. Application requirements

1.2 REFERENCES

A. TxDOT/TTI Hydraulics and Erosion Control Laboratory Field Performance Testing of Selected Erosion Control Products - Final Performance Analysis - Current Evaluation Cycle.

B. Utah Water Research Laboratory (UWRL) at Utah State University. Ongoing evaluation of cellulose fiber mulches under simulated rain and sunlight.

1.3 SUBMITTALS

A. The manufacturer's specifications and recommended installation requirements.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in original wrapping showing the name of the manufacturer and product description.

PART 2 PRODUCTS

2.1 CELLULOSE FIBER MULCHES

A. Contact Region Landscape Architect for Approved List of Cellulose Fiber Mulches.

B. Approved products are evaluated based on testing results from TxDOT/TTE and UWRL.

2.2 STRAW MULCH

A. Clean, cereal straw from a field certified by the Utah Department of Agriculture as weed-free and noxious weed-free.

B. Air dried with a maximum moisture content of 18 percent.

2.3 TACKIFIER

A. A dry powder mixture of three hydrocolloids from natural plant sources, which has been combined with a crosslinking agent.

B. Will hydrate when incorporated in a water slurry, and resist rewetting when dry on the soil surface, but allow moisture penetration into the soil.

C. Viability of 6 to 9 months.

D. Biodegradable and nontoxic to animal and plant life.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete all required grading and seeding before applying mulch.

B. Apply the mulch within 24 hours after seeding or before precipitation falls. If the mulch is not installed and a precipitation event occurs creating soil erosion, replace eroded material, rework the soil, and reseed before applying the mulch.

3.2 APPLYING MULCH

A. Cellulose Fiber Mulch

1. Apply cellulose fiber mulch, tackifier, and water at the following rates per hectare:
   a. Mulch: 2250 kg
   b. Tackifier: 45 kg
   c. Water: 46 700 L

2. Mix water, tackifier and cellulose fiber mulch in a hydroseeder, following manufacturer's directions.
3. Apply mulch to form an even cover over the seeded areas.
4. On cut slopes, extend the mulch over the top of the slope to cover all disturbed areas.

B. Straw Mulch

1. Apply 3000 kg of straw (having moisture content less than 18 percent) per hectare.
2. Apply straw uniformly using a blower-type mulching machine.
3. Begin application at the top of the slope working in a downward direction.

4. On cut slopes, extend straw mulch over the top of the slope and tie in to existing vegetation.

C. Straw Anchoring

1. On accessible slopes, crimp the straw into the soil using a sheep's foot roller, a dull edged disk-type roller or other approved equipment that will anchor the straw into the soil without slicing the straw.
2. On slopes inaccessible to crimping equipment, inject a tacking agent into the straw as it leaves the machine or apply it evenly using a hydromulcher after straw is placed. Mix 50 kg of tackifier, 14 000 L of water and 225 kg of cellulose fiber mulch per hectare.

END OF SECTION

SECTION 02912

TOPSOIL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and spread topsoil on prepared areas.

B. Strip topsoil from on-site locations and place in stockpile.

C. Spread stockpiled topsoil on prepared areas.

1.2 RELATED WORK

A. Section 02922: Seed, Turf Seed, and Turf Sod.

B. Section 02932: Trees, Shrubs, and Groundcovers.

1.3 REFERENCES

A. AASHTO T 88: Particle Size Analysis of Soils.

B. AASHTO T 194: Determination of Organic Matter in Soils by Wet Combustion.

C. Textural Triangle National Soils Handbook, Part 603-5.

1.4 SUBMITTALS

A. For CONTRACTOR-furnished topsoil: Submit to the ENGINEER a minimum of 7 working days before delivery of soil, the laboratory test results from each topsoil source to be used.

PART 2 PRODUCTS

2.1 CONTRACTOR FURNISHED TOPSOIL

A. Meet the following:
1. **PH**: 6.0 to 8.0
2. **EC**: (Electrical Conductivity): less than 4 ds/m
3. **SAR**: (Sodium Adsorption Ratio): less than 10.

4. **Organic matter**: 1 to 20 percent. Determined by the release upon combustion, Walkley-Black or modified Walkley-Black testing method.
5. **Noxious Weed Seed Content:** Less than 5 percent of total weed seed germination test or obtain written approval from ENGINEER.
6. **Textural classification**: Loam, sandy loam, silt loam or sandy clay loam not exceeding the following percentiles:

Soil component	Percentile Range
Sand	20-70
Silt	20-70
Clay	10-30

7. Particle size analysis to be determined by the hydrometer testing method. AASHTO T 88.

B. Topsoil free of:
1. Subsoils (no B or C horizon soils)
2. Coarse sand and gravel
3. Stiff clay, hard clods or hard pan soils
4. Rock larger than 75 mm in any dimension
5. Trash, litter or refuse

C. Topsoil may contain a maximum of 5 percent rock smaller than 75 mm.

2.2 SOURCE QUALITY CONTROL - CONTRACTOR FURNISHED MATERIAL

A. Obtaining Soil Samples:
1. Obtain soil samples while the ENGINEER is present. Provide no less than .25 kilograms per soil sample.
2. Provide additional soil samples for verification if requested by the ENGINEER.
3. Obtain samples from a thin slice of soil cut from the side of a freshly dug hole or by using a soil auger or sampling tube.
4. Label each sample with the location and date of sampling.
5. Mix several small samples taken from various places around the source together to produce a composite sample.
6. More than one composite sample may be required if the topsoil horizon changes significantly across the source.
7. Store samples in a clean container at room temperature and out of direct sunlight.

B. Soil Testing:

1. Submit soil samples to an approved independent soil testing laboratory capable of performing the tests listed in this Section, paragraph: Contractor Furnished Topsoil. A partial list of acceptable testing laboratories includes:

Brigham Young University
Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
(801) 378-2760

USU Extension - Soil Lab
University Hill
Logan, Utah 84322-4820
(435) 797-2233

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Place topsoil just before seeding following Section 02922 only if it can be seeded within the upcoming fall seeding window.

B. Do not strip or handle topsoil when it is wet or frozen.

C. Work topsoil only when it can be left in a friable, loose and crumbly state.

D. On steep cut slopes requiring the placement of topsoil, it may be necessary to place the topsoil as the slope is constructed.

3.2 CONTRACTOR FURNISHED TOPSOIL

A. Place and spread the topsoil from the tested and approved source on the prepared areas at the plan depth.

3.3 DEPARTMENT FURNISHED TOPSOIL

A. Strip the topsoil only from areas identified on the plans or approved by ENGINEER.

B. Remove and dispose of any roots larger than 50 mm in diameter or 300 mm in length.

C. Stockpile stripped topsoil at locations acceptable to the ENGINEER and so that placement or activity around the stockpile does not damage any existing trees or shrubs.

D. Grade to minimize erosion on and around the stockpiles.

3.4 SPREAD STOCKPILED TOPSOIL

A. Clear area to receive topsoil of all trash, debris, weeds, and rock 75 mm or larger, and dispose of objectionable material in an approved manner.

B. Place and spread the stockpiled topsoil over the prepared slopes to the plan depths.

C. Disc or harrow the prepared areas following topsoil placement. When discing or harrowing slopes, follow the contour to help prevent erosion.

D. Provide a crumbly soil texture.

END OF SECTION

SECTION 02922

SEED, TURF SEED, AND TURF SOD - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seed, turf seed, and turf sod requirements.

B. Surface preparation.

1.2 RELATED SECTIONS

A. Section 02912: Topsoil.

1.3 REFERENCES

A. Utah Seed Law: Utah Code - Title 4, Chapter 16.

1.4 SUBMITTALS

A. Copy of the purchase order to the ENGINEER documenting that all seeds, including substitutions, have been acquired before the seeding window begins.
   1. For seeding schedule, refer to this Section, paragraph: Scheduling.
   2. The purchase order should list the common and botanical name for each seed species.

B. Certification that turf sod is nursery grown and contains a minimum of 3 varieties of Kentucky Blue Grass.

C. Certification indicating the date and time sod was cut at the nursery.

D. Furnish fertilizer labels to ENGINEER.

E. Through the ENGINEER, supply legible copy of Seed Certification Reports to Region Landscape Architect.

F. Seed certification: Include the following on seed certification reports and labels:
   1. Botanical name (include variety if applicable).
   2. Common name.
   3. Name of seed testing laboratory.
   4. Lot number and address of the seed company.
   5. Weed seed (percent).

6. Other crop seed (percent).
7. Inert matter (percent).
8. Pure live seed (percent).
9. Noxious weed seed (name and rate of occurrence).
10. Date tested (month and year).
11. Germination(percent).
12. Hard seed (percent).
13. Net weight (do not include container weight).
14. Pure live seed weight.
15. Collection locations for native shrub and tree species (state, county, elevation).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Mixing Seed:
1. Notify ENGINEER 7 calendar days prior to seed mixing.
2. ENGINEER will verify that the seed certification report or label represents the seed lot from which the seed is furnished.
3. Mix the different seed varieties to provide an even blend.
4. Bag the mixed seed, seal the container, and attach a signed UDOT label to the exterior.

B. Deliver seed or turf seed to job site in original containers showing analysis of seed mixture, net weight, and date and location of packaging. Damaged packages are not acceptable.

C. Strip turf sod from nursery no more than 24 hours before laying.

D. Deliver fertilizer in containers showing weight, chemical analysis, and name of manufacturer. Store fertilizer in a weatherproof location.

1.6 SCHEDULING

A. Pre-measure the area to be seeded before ordering seed from supplier. The ENGINEER must approve the measuring technique and determined quantity.

B. Seeding Window: Complete all general roadside seeding within the appropriate seeding window.
1. If the seeding is not completed within the given window, postpone seeding until the following year.
2. Under certain conditions, an exception to this window may be obtained through the Region Landscape Architect. The exception must be approved by the ENGINEER.

Elevation	Seeding Window
Below 1200 m	Oct. 1 to Dec. 15

1200 - 1800 m	Sept. 15 to Dec 1
Above 1800 m	Sept. 1 to Nov 15

C. Turf seed and turf sod can be placed only after irrigation system is installed and operational.

D. Topsoil: Refer to Section 02912.
   1. Place topsoil just before seeding to eliminate competition from weeds.
   2. Coordinate topsoil placement with the above seeding window.

PART 2 PRODUCTS

2.1 SEED AND TURF SEED

A. Meet the Utah Seed Law.

B. Supply seed on a pure live seed (PLS) basis.

C. Obtain seed from lots that have been tested by a state certified seed testing laboratory.
   1. Seed germination tests older than 18 months for grass seed, and 9 months for forb, shrub, or tree seed are not acceptable.
   2. Based on the amount or type of seed required on a project, UDOT may require additional testing by the Utah Department of Agriculture (UDA).

D. Do not use wet, moldy or otherwise damaged seed.

E. Seed Substitutions
   1. Before requesting a seed substitution, contact the major seed brokers in the state to verify that the seed is unavailable.
   2. Have the ENGINEER contact the Region Landscape Architect to verify the seed is unavailable and to recommend a seed substitution.
   3. Replacement seed shall be of equal or greater cost to the originally specified seed.

2.2 TURF SOD

A. Healthy and well-rooted nursery grown Kentucky Blue Grass sod comprised of a minimum of 3 varieties and free of weeds.

B. Machine cut in straight, uniform strips not exceeding one square meter. Limit depth of cut to between 15 mm and 25 mm.

2.3 FERTILIZER (For turf sod and turf seed areas only)

A. Uniform in composition, dry and free flowing.

1. For turf seed or turf sod: Elemental nitrogen in granular form. Phosphorus, and potassium are optional and may be applied with nitrogen in granules. A minimum of 50 percent of nitrogen shall be in a slow release form such as sulfur coated urea or urea formaldehyde.
2.. If hydroseeding method is used, apply elemental nitrogen with a concentration ranging from 21-34 percent.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete all final grading, trench settling, topsoil placement, surface preparation, and irrigation work before seeding begins.

B. Prepare General Seedbed (for all seeded and sodded areas).

1. Before any seed or sod work begins, properly prepare the topsoil surface and have it approved by the ENGINEER. Refer to Section 02912.
2. Do not work topsoil or seed when the soil is saturated or frozen.

C. Prepare Turf Seedbed:

1. Review finish grade to confirm that topsoil is 25 mm below the top of all walk, curbs, mow strips and other had surfaces.
2. Apply fertilizer at the rate of 1 kg/100 m^2 and mix thoroughly into upper 50 mm of topsoil.
3. Do not apply fertilizer and seed at the same time in the same machine.

D. Prepare Turf Sod Surface:

1. Review finish grade to confirm that topsoil is 40 mm blow the top of all walks, curbs, mow strips and other hard surfaces.
2. Apply fertilizer at the rate of 1 kg/100 m2 and mix thoroughly into upper 50 mm of topsoil.
3. Level and roll seeded areas using an 80 L water-filled hand roller containing 30 L to 40 L of water.
4. Just before laying the sod, lightly rake and dampen with water the top 5 mm to 15 mm of soil.

3.2 SEEDING

A. Notify the ENGINEER 7 working days before seeding.

B. Apply seed at the rate indicated in the Seed Schedule shown in the plans.

3.3 DRILL METHOD

A. Use the drill method of seeding on accessible slopes 1:3 and flatter.

B. Use a rangeland type drill for non-turf areas or a Brillion type drill for turf areas equipped with the following:
   1. Depth band
   2. Seed box agitator
   3. Seed metering device
   4. Furrow opener
   5. Packer wheels or drag chains

C. Provide the ENGINEER a copy of the manufacturer's directions on drill calibration 2 working days before seeding.

D. Calibrate the drill in the presence of the ENGINEER.

E. Demonstrate the accuracy of the drill equipment calibration by using the manufacturer's directions or the following method:
   1. Area Calibration:
      a. Obtain the quantity of seed mixed at the specified rate to cover 2500 square meters (1/4 Hectare).
      b. Apply the seed with a one meter drill seeder in one pass in a straight line 833 meters wide.
      c. While drilling the seed, keep watch to see when the seed box is empty.
      d. If the seed is dispersed before completing the 833 meter pass, calibrate the seeder to apply less. If there is excess after completing the pass, calibrate to apply more.
      e. Repeat calibration until the seed supply intended to cover 2500 square meters is distributed when the seeder reaches the 833 meter mark ± 10 meters.

F. Space drill rows a minimum of 150 mm and a maximum of 200 mm.

G. Fill the seed box/boxes no more than half full when drilling on a slope.

H. Set depth bands to drill seeds to a 10 mm to 15 mm depth.

I. Drill along the contour.

J. Maintain the drill at the calibrated setting throughout the seeding operation.

K. Allow the furrows that are created by the drill to remain.

3.4 BROADCAST METHOD

A. Use the broadcast method of seeding under the following conditions:
   1. Slopes steeper than 1:3.
   2. Slopes 1:3 and flatter where the area to be seeded is inaccessible to drill.
   3. Where the area to be seeded is not large enough to justify using a drill.
   4. Where rocky surface conditions would damage a drill.

B. Obtain approval of the broadcast method by demonstrating the procedure on a 100 m^2 area.

C. Broadcast the seed and rice hull carrier (if needed)
   1. Evenly in one direction with a cyclone seeder or other approved mechanical seeder.
   2. Or, using a hydroseeder, apply seed, water and 500 kg of cellulose fiber mulch (tracer) per hectare.

D. Do not seed during windy weather or when soil is saturated.

E. Incorporate the seed into the soil by one of three methods:
   1. Cat-tracking, running the dozer up and down the slope, creating continuous cleat tracks that run parallel with the contours.
   2. Hand raking the seed in 5 mm to 15 mm deep and along the contours of the slope.
   3. Slope chaining by pulling the chain along the contour until the seed is covered.

3.5 TURF SEEDING

A. Apply turf seed. Refer to this Section, paragraph: Drill Method, and paragraph: Broadcast Method, item C.2.

B. Roll seeded areas using an 80 L water-filled hand roller with 30 L to 40 L of water. Rolling is not necessary if a Brillion type seeder is used.

C. Lightly water and program the irrigation system to maintain a moist seed bed.

D. Along walkways, rope-off newly seeded areas using bright plastic ribbon tape attached to stakes.

3.6 LAYING SOD

A. Refer to this Section, paragraph: Scheduling, item C for timing.

B. Place sod with all edges and joints tightly butted.
   1. Do not stretch or overlap sod.

2. Keep length seams in a straight line.

C. Lay turf sod with staggered joints and trim off excess material along the edges.

D. Roll sod immediately after placing using an 80 L hand-roller containing 30 L to 40 L of water.

1. Re-roll if depressions still remain.
2. Thoroughly water with a fine spray to a depth sufficient that the underside of the new sod and soil immediately below the sod are thoroughly wet.

END OF SECTION

SECTION 02931

POLE PLANTINGS/WILLOW CUTTINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Collecting and installing pole plantings and/or willow cuttings.

1.2 RELATED SECTIONS

A. Section 02938: Tree Pruning.

1.3 REFERENCES

A. ANSI A-300: Pruning Standards.

B. International Society of Arboriculture: Current standards for pruning.

1.4 SCHEDULING

A. Install poles and cuttings in the fall after October 15 and before the ground becomes frozen or in the spring after the ground thaws and before April 15.

PART 2 PRODUCTS

2.1 POLES AND CUTTINGS

A. Collect poles and cuttings from live native stands of the species listed from October 15 to February 15.

B. Obtain poles and cuttings from live trees and shrubs that will be destroyed due to highway construction, from areas adjacent to the project or from locations that are ecologically matched in climate and elevation.

C. Before collecting poles and cuttings outside the right-of-way, obtain necessary permits from appropriate regulatory agency or permission from land owner.

D. When collecting poles and cuttings from trees or shrubs that will remain, prune branches using current standards from the International Society of Arboriculture.

E. When obtaining poles and cuttings from vegetation that will remain within the right-of-way, remove no more than 1/3 of the branches from any tree or shrub.

F. Size of poles and cuttings, as determined by the ENGINEER:
   1. Pole: Cut branches at a 45 degree angle, 1.8 m long and 25 mm to 75 mm in diameter from one to three-year-old growth.
   2. Willow Cutting: Cut stems at a 45 degree angle, 1 m long and 10 mm to 20 mm in diameter from one to two-year-old growth.

PART 3 EXECUTION

3.1 STORING

A. If dormant poles and cuttings are acquired but not planted in the fall, store until the ground thaws.

B. Store in plastic bags at temperatures between 0 degrees C to 5 degrees C, or outside in snow-filled plastic bags.

C. Do not allow the poles or cuttings to dry out or break bud while being stored.

3.2 INSTALLING

A. Stake poles and cuttings at plan locations for approval or as directed.

B. Dig a hole to accommodate the pole or cutting and leave 50 mm to 100 mm of the cutting sticking out of the ground.

C. Just before planting, remove 25 mm from the basal end of the pole or cutting.

D. Place the pole or cutting in the hole (basal end first).

E. Backfill and compact around the pole or cutting to eliminate air pockets.

F. Water the pole or cutting and add more backfill if settling occurs.

END OF SECTION

SECTION 02932

TREES, SHRUBS, AND GROUNDCOVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installing plant material.

1.2 RELATED SECTIONS

A. Section 02912: Topsoil

B. Section 02936: Vegetation Establishment Period.

1.3 REFERENCES

A. ANSI Z60.1: American Standard for Nursery Stock

1.4 SUBMITTALS

A. A copy of the plant purchase order indicating plant names, sizes, quantities, and unit prices. Submit within 90 calendar days from the Notice to Proceed.

B. Plant substitutions:
   1. Obtain a signed statement from 3 wholesale nurseries, noted for stocking the specified plant(s), indicating that the plant(s) is unavailable.
   2. Submit to the ENGINEER the signed statements and a written request indicating the size and species of the unavailable plants and their suggested replacements.

C. All necessary inspection certificates for each shipment of plants as required by Utah Laws and Regulations.

1.5 QUALITY ASSURANCE

A. Plants not meeting ANSI specifications will be rejected.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Secure required plants at a nursery within 60 calendar days from the Notice to Proceed.

B. Before site delivery, grow plants under full exposure to climatic conditions for a minimum of 60 calendar days.

C. Notify the ENGINEER at least 14 calendar days before delivering the plants to the site.

D. Deliver plant materials to the work site in covered vehicles just before placement.

E. Maintain delivered plants in a healthy condition.
   1. Wilted, windburned or stressed plants will not be accepted and shall be replaced at no additional cost to the DEPARTMENT.
   2. Protect balled and burlapped rootballs from sun and wind by covering with soil or other suitable material if not planted immediately upon delivery.

1.7 PLANT INSPECTION AND ACCEPTANCE

A. Replace unacceptable plant material within 14 days after notification from the ENGINEER.

B. The plant inspection will only occur after all plant materials have been installed.

C. The ENGINEER will schedule the inspection date.

D. Make the required field adjustments and changes following the inspection.

1.8 SCHEDULING

A. Install irrigated plants using the following schedule:

Elevation (meters)	**Planting Season**
Below 1200 m*	March 1 - December 1
1200-1800 m	April 15 - October 15
Above 1800 m	May 1 - July 1

* No planting in July or August.

B. Install non-irrigated plants in the fall after the plant is dormant and before the ground freezes.

PART 2 PRODUCTS

2.1 PLANTS

A. Supply healthy plants that are of the species and size specified, true to form, free from disfiguring knots, sunscald, frost cracks, abrasions of the bark, and all forms of infestation and disease.

B. Provide legible labels attached to all plants, flats, bundles, or other containers indicating botanical genus, species, and size.

C. Supply trees with straight central leaders capable of standing upright without the support of stakes or guys.

D. Container supplied plants must be fully established in the container.

E. Balled and burlapped plants will not be accepted if the ball of earth surrounding roots has been cracked or broken or if the burlap is not secure.

F. Bare-root plant material is not acceptable unless approved by the ENGINEER.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify that area prepared to receive plants is graded properly as per plan, all work is completed in the area, and that topsoil has been placed. Follow Section 02912.

B. Have the irrigation system installed and fully operational before installing plants.

C. Stake or delineate locations of plants for approval before installation.

3.2 INSTALLATION

A. General
1. Install plants so that the top of the rootball is flush with the surrounding finished grade.
2. Within one hour of installation, water the plants to saturate the rootball to a minimum of 100 mm below and around the plant hole. Add more backfill if settling occurs.

B. Containerized Plants
1. Excavate plant holes to twice the diameter and the same depth of the rootball.

2. Carefully remove the plant from its container, scarify the sides and bottom of the rootball if needed and place it in the prepared hole.
3. Place excavated soil in 100 mm lifts around the rootball and eliminate voids by tamping the soil between each lift.

C. Balled and Burlapped Plants
1. Excavate plant holes to twice the diameter and the same depth of the rootball.
2. With burlap securely intact, gently place the plant in the prepared hole.
3. Remove any burlap to 150 mm below the surface without disturbing the root ball.
4. If applicable, cut the wire or plastic basket and remove the top half down to 150 mm below the soil surface.

D. Tubeling Plants
1. Prepare a hole the same size as the tube.
2. Immediately following excavation of the hole, gently place watered tubeling in the prepared plant pit so that the roots are not tangled, compacted, or curled up at the ends.
3. Compress the soil at the base of the tubeling to eliminate voids between the rootball and existing soil.

3.3 CLEANING AND MAINTENANCE

A. Remove from site foreign materials such as containers, burlap, twine, etc., collected during installation.

B. Remove any tags, labels, or other items attached to the plant material after final plant inspection.

C. Maintain the plants in a healthy condition until the final plant inspection. Refer to Section 02936 for vegetation establishment period.

END OF SECTION

SECTION 02936

VEGETATION ESTABLISHMENT PERIOD

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Establish and care for plantings requiring watering.

1.2 RELATED SECTIONS

A. Section 02812: Pressurized Irrigation Systems.

B. Section 02911: Mulch.

C. Section 02922: Seed, Turf Seed, and Turf Sod.

D. Section 02932: Trees, Shrubs, and Groundcovers.

1.3 ESTABLISHMENT PERIOD

A. A length of time during which the CONTRACTOR is responsible for caring for and establishing plant material installed on the project.

B. The establishment period begins after the irrigation system and plant installation inspections and acceptances have been completed and continues for one calendar year.

1.4 QUALITY ASSURANCE

A. The DEPARTMENT will conduct three inspections to determine if the CONTRACTOR is satisfactorily performing work under the Establishment Period. The inspections will occur at the ENGINEER's discretion.

B. Replace in kind any dead or unacceptable plant or sod within four weeks of notification at no additional cost to the DEPARTMENT.

PART 2 PRODUCTS Not Used.

PART 3 EXECUTION

3.1 INSTALLATION

A. Establish healthy trees, shrubs groundcovers, and turf installed on the project.

B. Replace any plant or sod that dies or is unacceptable during the establishment period with an identical plant at no additional cost to the DEPARTMENT.

C. CONTRACTOR will not be held responsible for plants damaged due to acts of God, vandalism, or errant vehicles. Immediately notify the ENGINEER if such an event occurs.

3.2 PLANT CARE

A. Watering:
   1. Pressurized irrigation system: When a pressurized irrigation system has been installed to establish plant material or turf, set the controller to apply the appropriate amount of water and make seasonal adjustments as necessary.
   2. Hand watering: If a pressurized irrigation system is not included in the project, then hand-water the plant to provide healthy plant material through the establishment period.

B. Maintain weed-free plant basins or areas where mulch has been placed.

C. Prune broken, dead or diseased branches to the next lead.

D. Repair any non-functional water basins.

3.3 LAWN CARE

A. Apply a 16-0-0 (NPK ratio) fertilizer once in the fall following manufacturer's recommendation.

B. Control broadleaf weeds using a selective herbicide as required.

C. Repair and reseed or resod areas showing rodent, or erosion damage.

3.4 LAWN MOWING AND TRIMMING

A. When turf has established, begin mowing lawn a minimum of one time per week during the morning (7:00 a.m. to 11:00 a.m.) or evening (5:00 p.m. to 8:00 p.m.)

B. Set mower to cut the grass at a 75 mm height. Keep mower blades sharp.

C. Bag all grass clippings unless a mulching mower is used.

D. After mowing, trim along sidewalks, curbs and mow strips. Trim to the same height as the mower cuts (75 mm).

3.5 PRESSURIZED IRRIGATION SYSTEM

A. Refer to Section 02812, Part 3, paragraph: Establishment Period, and paragraph: Damage.

END OF SECTION

SECTION 02938

TREE PRUNING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selectively remove and dispose of tree limbs.

1.2 RELATED SECTIONS

A. Section 02231: Site Clearing and Grubbing.

1.3 REFERENCES

A. ANSI A 300: Tree Care Operation- Tree, Shrub, and Other Woody Plants.

B. ANSI Z 133.1: Pruning, Trimming, Repairing, Maintaining, and Removing Trees, and Cutting Brush- Safety Requirements.

C. Current standards for pruning - International Society of Arboriculture. (ISA).

1.4 SUBMITTALS

A. Obtain necessary permits from the municipality and/or city forester in which the work is performed, and submit a copy of the permits to the ENGINEER seven calendar days before beginning work.

B. A copy of the arborist's certificate from I.S.A.

1.5 QUALITY ASSURANCE

A. Contractor must provide an I.S.A. certified arborist to supervise tree pruning.

PART 2 PRODUCTS

2.1 DISINFECTANT

A. Chlorine based.

PART 3 EXECUTION

3.1 TREE PRUNING

A. Conform to ANSI A 133.1.

B. Prune trees following listed references.

C. Remove tree branches extending over the roadway to provide a clear height of 4.6 m above the paved surface and 3 m above sidewalks.

D. Spray pruning equipment with disinfectant after coming in contact with diseased plant material.

E. Use the “Natural Target” or “Drop Crotch” pruning method when removing limbs.

F. Do not top, pollard, stub or dehorn any tree.

G. Make all pruning cuts sufficiently close to the trunk or parent limbs without cutting into or removing the “branch collar” or the “branch bark ridge”.

H. Prune trees to make them shapely, symmetrical, and typical of the natural form of the species being pruned.

I. Do not remove branches that would deform the appearance of the tree.

3.2 BRANCH DISPOSAL

A. Shred removed branches into wood chips 150 mm or smaller.

B. Remove all wood chips larger than 150 mm.

C. Where practicable and where placement will not be detrimental to vegetation growth, broadcast shredded branches over and around the site where trees are being pruned or removed. Refer to Section 02231.

END OF SECTION

SECTION 02961

ROTOMILLING - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Equipment and procedures for rotomilling existing asphalt pavement.

1.2 RELATED SECTIONS

A. Section 01355: Environmental Protection.

PART 2 PRODUCTS

2.1 MILLING MACHINE OR GRINDER

A. Self-propelled and capable of removing a minimum 3.0 m wide pass to the depth indicated on the plans.

B. Automatic system for controlling depth of cut and cross slope within plus or minus 3.0 mm.

C. Maximum 16.0 mm cutting teeth spacing on mandrel to create a diamond pattern.

D. Integral reclaiming and loading equipment to remove and discharge cuttings into a truck in one operation.

PART 3 EXECUTION

3.1 CONSTRUCTION

A. Work with the ENGINEER in re-establishing cross slope or crown.

B. Remove all cuttings and clean the surface daily.

C. Rotomill the area directly surrounding a manhole, catch basin, water meters, water valves or any other permanent fixture to the specified depth using a small, portable milling machine.

D. Control dust created by cutting action.

E. Do not damage materials outside limits designated for removal. If damage occurs, repair or replace at CONTRACTOR's expense.

F. Unless otherwise specified, rotomill cuttings become the property of the CONTRACTOR. Refer to Section 01355.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

SECTION 02966

RECYCLED SURFACE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for recycling the existing surface by heating, scarifying, screeding, and compacting the existing surface.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02745: Asphalt Material.

1.3 REFERENCES

A. AASHTO T 48: Flash and Fire Points by Cleveland Open Cup.

B. AASHTO T 59: Testing Emulsified Asphalt.

C. AASHTO T 201: Kinematic Viscosity of Asphalts.

D. AASHTO T 240: Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test).

E. ASTM D 244: Emulsified Asphalts.

F. ASTM D 2006-71: Rostler Test Method.

G. ASTM D 2007: Characteristics Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method.

PART 2 PRODUCTS

2.1 HEATER/SCARIFYING EQUIPMENT

A. Heating unit
   1. Enclosed combustion area.
   2. No open flame to come in direct contact with asphalt surface.
   3. Burn only clean burning buels (propane, butane, etc.).

4. Units which use liquified natural gas shall be inspected and approved at least annually by the Utah State Fire Marshall.
5. Use equipment meeting the requirements of the Utah State Liquified Petroleum Gas Board.

B. Safety Shut-off Switch for the Heat Exchanger
1. Clearly marked and easily operated.
2. Controlled from both the ground and the operator's station.
3. Instantaneously turn off the heat exchanger and the fuel supply.

C. Scarifier Unit
1. Have at least two rows of spring equalized scarifier rakes (hydraulic or pneumatic leveling).
2. Removable teeth in the rakes.
3. Spring release for manhole and valve protection.

D. Screed
1. Heated to maintain specified surface temperature.
2. Have reversible augers to move material left or right.
3. Vibratory or oscillating screed.

2.2 ASPHALT REJUVENATING AGENT

A. Petroleum resin oil base emulsified with water and conforming to the requirements in Table 1.

B. Asphalt Materials: Refer to Section 02745.

Table 1

Asphalt Rejuvinating Agent				
Test on Emulsion	**ASTM**	**AASHTO**	**Min.**	**Max.**
Viscosity at 25 EC, SFS		T 59	15	85
Residue, percent		T 59	60	
Cement Mixing Test, percent		T 59		2.0
Sieve Test, percent		T 59[2]		0.1
Particle Charge Test		T-59	Pos.	Pos.
Test on Residue Oil				
Original				
Viscosity at 60 EC cst		T 201	80	500
Flash point, COC, EC		T 48	400	
Saturates, percent	D 2007			3.0
Asphaltenes, percent	D 2007			1.0
PC/S Ratio[4]	D 2007			1.5
Maltenes Distribution[4]	D 2006-71		0.5	
Ratio[4]	D 2006-71		0.2	1.0
$(PC + A_1)(A + A_2)$				
Test on Residue From RTFO				
Oven Test at 163 EC		T 240		
Viscosity Ratio[5]		T 201		3.0
RTFO Oven Weight Change		T 240		6.5

[1]ASTM D-244 Modified Evaporation Test of percent residue is made by heating a 50 g sample to 140 degrees C until foaming ceases, then cool immediately and calculate results.
[2]Test procedures identical with ASTM D 244 except that distilled water will be used in place of two percent sodium oleate solution.
[3]ASTM D 2006-71 can be used for the determination of saturates.
[4]In the Maltenes Distribution Ratio Test by ASTM Method D 2006-71.

PC = Polar Compounds A_1 = First Acidaffins
A_2 = Second Acidaffins S_1 = Saturates

[5]Viscosity Ratio = $\frac{\text{RTF O Viscosity of Residue at 60 EC, Cst}}{\text{Original Viscosity at 60 EC, Cst}}$

PART 3 EXECUTION

3.1 PREPARATION

A. Broom all loose material off the pavement surface before starting heater/scarifying operations.

3.2 HEATER/SCARIFYING OPERATIONS

A. Temperature Control
   1. Regulate burners to produce the required scarification without charring the asphalt surface or breaking aggregate particles.
   2. Keep the temperature of the scarified material behind the screed between 110 degrees C and 155 degrees C.

B. Width and Depth
   1. Heat the surface to be recycled 150 mm to 300 mm wider than the width to be processed.
   2. Scarify to a sufficient depth to yield at least 45 kg/m^2.
   3. When a subsequent pass is made adjacent to a previously recycled surface, the longitudinal joint shall extend at least 50 mm into the previously recycled surface.

3.3 DISTRIBUTION OF MATERIAL

A. Uniformly distribute materials across the width being processed.

B. Level to produce a smooth surface and uniform cross section.

3.4 COMPACTION

A. Use at least two rollers.
   1. One double drum steel vibratory for breakdown rolling.
   2. One pneumatic (12 Mg or more) for finishing rolling.

B. Complete rolling before temperature of material drops below 85 degrees C.

C. Conform to Section 02741, Part 1, Acceptance for density, and Section 02741 in Methods of Measurement and Basis of Payment in the Supplementary Specifications (Bid Book), except that it will be based on the Marshall Method.

3.5 APPLYING REJUVENATING AGENT

A. During scarifying:
   1. Mount applicator on the scarifier.

2. Synchronize with the scarifier's forward speed so that the application rate is within ± 5 percent of the rate specified.

B. After rolling:
1. Apply before the surface temperature drops below 65 degrees C.
2. Apply with a distributor truck equipped with a metering device.
3. Maintain application rate ± 5 percent of that specified.

3.6 FIELD QUALITY CONTROL

A. Sampling and testing: ENGINEER will make at least one weight and one temperature determination randomly within each 20-minute interval during scarifying operations.

B. Corrective action:
1. Reprocess the surface from the last acceptable test, when a test yields less then 45 kg/m^2.
2. A failing test will be cause for suspension of work.
3. Corrective action includes one or more of the following:
   a. Increase the number of heater/scarifiers.
   b. Reduce the speed of travel.
   c. Adjust the burner(s).

END OF SECTION

SECTION 02967

SURFACE REPAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Soften, scarify, rejuvenate, mix and level reclaimed material.

B. Furnish and place new surfacing material.

C. Place and compact reclaimed and new material in one operation to produce a monolithic pavement.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02745: Asphalt Material.

C. Section 02786: Plant Mix Seal Coat (Open-graded).

D. Section 02966: Recycled Surface.

1.3 REFERENCES

A. AASHTO T 48: Flash and Fire Points by Cleveland Open Cup.

B. AASHTO T 59: Testing Emulsified Asphalt.

C. AASHTO T 201: Kinematic Viscosity of Asphalts (Bitumens).

D. AASHTO T 227: Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.

E. AASHTO T 228: Specific Gravity of Semi-Solid Bituminous Materials.

F. AASHTO T 240: Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin Film Oven Test).

G. ASTM D 2006-71: Rostler Test Method.

1.4 SUBMITTALS

A. Written sequence of operations. Submit at least two weeks prior to start of operations for approval by the ENGINEER.

PART 2 PRODUCTS

2.1 ASPHALT CONCRETE PAVEMENT

A. Refer to Section 02741.

2.2 PLANT MIX SEAL COAT

A. Refer to Section 02786.

2.3 ASPHALT CEMENT

A. Refer to Section 02745.

2.4 EQUIPMENT

A. Indicate at the Preconstruction Meeting the type of repaving equipment to be used.

B. Use equipment capable of processing hot mix asphalt or plant mix seal coat.

C. Have the equipment on the project in operating condition prior to beginning work and with sufficient time for the ENGINEER to evaluate.

2.5 HEATING UNIT

A. May or may not be an integral part of the scarification unit.

B. Adequate in number and type to heat the pavement.

C. For specific requirements, refer to Section 02966, Part 2, paragraph: Heater/Scarifier Equipment.

2.6 RECYCLING UNIT

A. Single piece of equipment.

B. Self-contained, self-propelled, automated unit capable of scarifying to the depth required.

C. Capable of automatically applying a rejuvenating agent when required to within ± 5 percent of the rate specified.

D. Capable of mixing, redistributing to a uniform depth over the width being processed, and leveling the reclaimed material in one pass.

E. Capable of applying a new asphalt concrete pavement immediately on the reclaimed material.

F. Incorporate a spring release for manhole and valve box protection.

G. Screed to have automatic controls to produce a surface of uniform slope, grade, and texture.

2.7 ASPHALT REJUVENATING AGENT

A. Composed of a petroleum base resin oil uniformly emulsified with water or non-emulsified agent and conforming to Table 1.

Table 1

Asphalt Rejuvenating Agent			
Non-Emulsified Agent	**AASHTO**	**Min.**	**Max.**
Viscosity at 60 EC, CST	T 201	50	150
Flash point, COC, C	T 48	425	--
Saturates, Wt., percent	Rostler method	--	25
Test on Residue from RFTO, 163 EC	T 240	--	--
Viscosity Ratio [2]	T 240	--	3
Wt. Change, ±, percent	T 240		4
Specific Gravity	T 228, T 227	Report	Report
Emulsified Agent	**AASHTO**	**Min.**	**Max.**
Viscosity at 25 EC, SFS	T 59	15	85
Residue, percent	T 59	60	--
Cement Mixing Test, percent	T 59	--	2.0
Sieve Test, percent	T 59	Pos.	Pos.
Particle Charge Test	T 59	Pos.	Pos.
BASE OIL [1, 2]			
Recovered From Emulsified Agent	**AASHTO**	**Min.**	**Max.**
Viscosity 60 EC, CST	T 201	50	150
Flash Point, COC, C	T 48	425	--
Saturates, Wt., percent	Rostler Method	--	25
Test on Resident from RFTO, 163 EC	R 240		
Viscosity Ratio [2]	T 240	--	3
Wt. Change, ±, percent	T 240	--	4
Specific Gravity	T 228, T 227	Report	Report
1 Values obtained on the emulsion's residue may vary from the emulsified rejuvenating agent.			
2 Viscosity Ratio = $\frac{\text{Viscosity of Residue RTFO, 60 EC, CST}}{\text{Original Viscosity 60 EC, CST}}$			

2.8 QUALITY CONTROL - SCARIFIER TEST

A. Adding rejuvenating agent, mixing, and leveling of reclaimed material or placing of new surfacing will not be required during the test as only the depth of scarification is being tested.

B. Unlimited testing and retesting will not be allowed.
   1. Make necessary adjustment if after two successive control section tests, the results are inconclusive or not in specification.
   2. The ENGINEER will conduct one additional test. If the results of this test are inconclusive or out of specification, do not use the equipment or processes.

C. Demonstrate the ability to heat and scarify to the required depth in a 150 m control section at no additional cost to the DEPARTMENT.
   1. Divide control section into four sublots.
   2. The ENGINEER will determine the depth of scarification (by differential leveling) at one (at least) location (randomly selected) in each sublot.
   3. Operate heaters and scarifiers at the same speed and in the same manner during the test as during actual paving operations.
   4. Record the following data during the test:
      a. Air temperature (in the shade).
      b. Pavement temperature.
      c. Wind speed.
      d. Cloud cover.
      e. Speed of equipment (meters/minute).
      f. Spacing of equipment.
      g. Number of burners operating.
      h. Pressure on scarifier.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean the pavement of all loose dirt, leaves, and other materials.

B. Protect from head damage the area on and adjacent to the work.

C. Not more than 24 hours before the start of operations, have all appropriate utility companies and city or county service functions (including but not limited to gas and sanitary sewer) check all valve boxes, manholes, and other service openings for dangerous concentrations of flammable or explosive gases or liquids to determine if they are within safe limits.

D. Obtain approval for equipment, processes, operating conditions, and methods of construction before operations begin.

3.2 REPAVING OPERATION

A. Sequence of Operations: Process ramps, cross reads, and secondary routes before the primary route.

B. With a single piece of equipment, scarify, add rejuvenating agent when required, mix, level, and place new surfacing.

C. Repave the surface at the same or slower speed, spacing of equipment, and manner of operation as used during the successful test.

D. Cut back the edge of the previous, adjacent pass a minimum of 50 mm during the subsequent pass.

E. Place the new surface on top of the recycled mix when the temperature of the recycled mix is between 95 degrees C and 120 degrees C.

F. Complete compaction of the surfacing before the temperature of the mix drops below 95 degrees C.

3.3 FIELD QUALITY CONTROL

A. ENGINEER will sample and test gradation, asphalt content, density, and smoothness of the new material under Section 02741, or Section 02786.
   1. ENGINEER will obtain samples from laydown hopper or screed auger.

B. Thickness of the new surfacing or Plant Mix Seal coat will be determined for each sublot as described in Section 02741, paragraph: Thickness Testing, by calculating the paver yield for two consecutive truck loads of paving mixture.
   1. The combined yield for two consecutive trucks will constitute a single test.
   2. A tolerance of ±15 percent of the designated thickness will be allowed.
   3. The calculations, results, station, location and respective weigh ticket numbers will be documented for each sublot.

END OF SECTION

SECTION 02968

OPTIONAL USE OF RECLAIMED ASPHALT PAVEMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Option to incorporate Reclaimed Asphalt Pavement (RAP) materials into hot mix asphalt.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02745: Asphalt Material.

C. Section 02746: Hydrated Lime.

1.3 SUBMITTALS

A. Quality plan:
   1. Submit for ENGINEER's approval.
   2. Provide for independent extraction and gradation testing of the reclaimed material and the total mixture.

1.4 QUALITY CONTROL

A. Provide independent testing on commercial sources at no additional cost to the DEPARTMENT.

B. For project specific sites, the DEPARTMENT will participate in the design.

PART 2 PRODUCTS

2.1 MIX DESIGN

A. Provide separately for each reclaimed, virgin, and combined portions:
   1. Gradation
   2. Viscosity 60 degrees C
   3. Penetration 25 degrees C
   4. Asphalt content

B. Recovered asphalt cement from combined mix must be the same as the grade specified for the hot mix asphalt. A recycling agent may be used.

C. Meet all requirements of Sections 02741 and 02745 for combined virgin and RAP.

D. Specify the percent by weight of reclaimed material to be used in the combined mix.

E. May use up to 25 percent RAP by total weight in the hot mix asphalt.

F. May use up to 60 percent RAP only under special conditions and upon written approval.

PART 3 EXECUTION

3.1 RECLAIMED MATERIAL

A. Crush or screen the reclaimed material to pass a 37.5 mm sieve and to be retained on a 4.75 mm sieve.

B. Do not use material retained on the 37.5 mm sieve or passing the 4.75 mm sieve.

C. If 15 percent or less RAP is used, material passing the 4.75 mm sieve may be used as long as all other requirements are met.

D. The screened reclaimed material must be free of organic materials, soil, or other foreign substances.

3.2 LOTTMAN TEST

A. ENGINEER will perform a Lottman test on the proposed job mix following UDOT Materials Manual, Procedure 8-957.

B. ENGINEER will determine percentage of lime to be used. Refer to Section 02746.

END OF SECTION

SECTION 02969

OPTIONAL USE OF RECLAIMED ASPHALT PAVEMENT (PG GRADE PROJECTS ONLY)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Option to incorporate Reclaimed Asphalt Pavement (RAP) materials into hot mix asphalt pavement, dense-graded material only.

1.2 RELATED SECTIONS

A. Section 02741: Hot Mix Asphalt.

B. Section 02745: Asphalt Materials.

C. Section 02746: Hydrated Lime.

D. Section 02961: Rotomilling.

1.3 SUBMITTALS

A. Quality plan.
   1. Submit for ENGINEER approval.
   2. Provide for independent testing of the reclaimed material and the total mixture at no additional cost to the DEPARTMENT.

PART 2 PRODUCTS

2.1 PG BINDER

A. Meet the cold end requirements of the design grade for a virgin mix.

B. The hot end of the PG grade may be one grade above the grade specified.

C. Reduction in the RAP content may be required if the low end of the PG grade for the binder does not meet the original grade specified. If a standard PG binder can not meet the cold end requirement, then RAP will not be allowed.

D. A 5 percent or greater change in either the RAP or virgin materials requires a new mix design. ENGINEER will approve changes in mix proportions.

E. Combined virgin and RAP material must meet all requirements of Sections 02741, and 02745 with the exception of the mix design which must meet SHRP requirements. RAP material does not have to be 100 percent crushed as outlined in the above sections.

F. May use up to 25 percent RAP by total weight in the hot mix asphalt. RAP may only be used if approved by the ENGINEER.

2.2 MIX DESIGN

A. Complete the mix design including the RAP material using a Materials Division approved independent laboratory following SHRP volumetric mix design procedures.

B. Provide separately the following for reclaimed portion and virgin portion:
1. Gradation
2. PG Grade
3. Asphalt content

C. Provide the following for the combined portion:
1. Gradation
2. PG Grade
3. Asphalt content
4. RAP content

PART 3 EXECUTION

3.1 RECLAIMED MATERIAL

A. Remove the existing surface as outlined in Section 02961.

B. Only material rotomilled from 50 mm below the existing surface will be allowed to be recycled into the dense-graded asphalt concrete material.

C. Crush or screen the reclaimed material to be used for recycle to pass a 37.5 mm sieve.

D. Screen and separate the RAP to be used for recycle into two stockpiles.
1. Stockpile: Material passing the 37.5 mm sieve and retained on the 4.75 mm sieve.
2. Stockpile: Material passing the 4.75 mm sieve.
3. Material retained on the 4.75 mm sieve will have no more than 10 percent override of the material passing the 4.75 mm sieve during the screening process.
4. Use separate cold feed bins for each stockpile.

E. Use screened reclaimed material free of organic materials, soil, or other foreign substances.

3.2 LOTTMAN TEST

A. ENGINEER will verify a Lottman Test on the proposed job mix to determine the percentage of lime required.

1. Complete and have approved the Lottman Test before the project paving begins.
2. 80 percent retained tensile strength is required.
3. Lime slurry or marination of one or more stockpiles may be necessary to meet the strength requirement. Refer to Section 02746 and UDOT Materials Manual, procedure 8-957.

END OF SECTION

DIVISION 3 - CONCRETE

SECTION 03055

PORTLAND CEMENT CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for producing Portland Cement Concrete.

1.2 REFERENCES

A. AASHTO M 6: Fine Aggregate for Portland Cement Concrete.

B. AASHTO M 80: Coarse Aggregate for Portland Cement Concrete.

C. AASHTO M 92: Wire-Cloth Sieves for Testing Purposes.

D. AASHTO M 154: Air-Entraining Admixtures for Concrete.

E. AASHTO M 157: Ready Mixed Concrete.

F. AASHTO T 22: Compressive Strength of Cylindrical Concrete Specimens.

G. AASHTO T 23: Making and Curing Concrete Test Specimens in the Field.

H. AASHTO T 26: Quality of Water to be Used in Concrete.

I. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

J. AASHTO T 119 Slump of Portland Cement Concrete.

K. AASHTO T 121: Mass per Cubic Meter, Yield and Air Content (Gravimetric) of Concrete.

L. AASHTO T 141: Sampling Fresh Concrete.

M. AASHTO T 152 Air Content of Freshly Mixed Concrete by the Pressure Method.

N. AASHTO M 194: Chemical Admixtures for Concrete.

O. ACI 301.

P. ASTM C 150: Portland Cement.

Q. ASTM C 595M: Blended Hydraulic Cement (Metric).

R. ASTM C 618: Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

S. ASTM C 1157: Blended Hydraulic Cement.

T. ASTM C 1240: Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.

U. ASTM C 1260: Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).

PART 2 PRODUCTS

2.1 CEMENT

A. Use Type II Portland Cement, or Blended Portland Cement, unless otherwise specified.

B. Portland Cement, Type II.
   1. Follow Tables 1 and 3 in ASTM C 150.
   2. Follow the requirements of Table 2 of ASTM C 150 for low-alkali cement.

C. Blended Portland Cement.
   1. Type IP blended cement may be substituted for Type I cement. Conform to ASTM C 595M.
   2. Type IP (MS) blended cement may be substituted for Type II cement.
   3. Type (HS) blended cement may be substituted for Type V cement, as specified in ASTM C 1157. Conform to requirements of ASTM 595M.
   4. When blended cement is used in conjunction with reactive aggregate, use **Option R** as specified in ASTM C 1157. Conform to requirements of ASTM 595M.
   5. Pretest the cement aggregate mixture and meet the specified design criteria at no additional cost to the DEPARTMENT.
   6. Do not use fly ash as a replacement for any blended cement.

D. Do not use cement that contains lumps or is partially set.

E. Use cement from the list of UDOT pre-qualified sources maintained by the UDOT Materials Quality Assurance Section.

F. Do not mix cement originating from different sources.

G. Do not use air-entrained cement.

H. Cement may be sampled and tested for compliance at any time.

2.2 COARSE AGGREGATE

A. As specified in AASHTO M 80, and as modified, using one of the gradations found in Table 1.

Table 1

Aggregate Gradations - Percent Passing (by weight)								
Aggregate Size (mm)	**63 mm**	**50 mm**	**37.5 mm**	**25 mm**	**19.0 mm**	**12.5 mm**	**9.50 mm**	**4.75 mm**
50 to 4.75	100	95-100		35-70		10-30		0-5
37.5 to 4.75		100	95-100		35-70		10-30	0-5
25 to 4.75			100	95-100		25-60		0-10
19.0 to 4.75				100	90-100		20-55	0-10

B. Use sieve screens with square openings as specified. Meet AASHTO M 92.

C. Do not exceed percentages of deleterious substances as shown in AASHTO M 80, Table 1, for Class A aggregates.

D. Determine the suitability of coarse aggregate sources using the requirements for soundness, percentage of wear and potential reactivity as specified in AASHTO M 80.

2.3 FINE AGGREGATE

A. As specified using one of the gradations shown in Table 2. Meet AASHTO M 6.

Table 2

Sieve Size	Percent Passing (by weight)
9.50 mm	100
4.75 mm	95 to 100
1.18 mm	45 to 80
300 Fm	10 to 30
150 Fm	2 to 10

B. Do not exceed percentages of deleterious substances as outlined in AASHTO M 6 for class A aggregates.

C. Soundness: As specified to determine suitability of fine aggregate. Meet AASHTO M 6.

2.4 COMBINED AGGREGATE

A. Do not allow the material passing the 75 Fm sieve to exceed 1.75 percent by weight of the combined fine and coarse aggregates.

2.5 CONTRACTOR FURNISHED AGGREGATE

A. ENGINEER will evaluate aggregate from a non-state specified source.
   1. Proportion mix designs accordingly to mitigate any potential performance problems inherent to the aggregate source.
   2. Pay additional costs incurred from using a CONTRACTOR furnished source.

2.6 WATER

A. Potable, or water that meets the specified test standard in AASHTO T 26.

B. Screen out extraneous material when pumping water from streams, ponds, lakes, etc.

2.7 ADMIXTURES

A. Air Entrainment: as specified. Meet AASHTO M 154, including Section 5.

B. Water Reducing Agents: as specified. Meet AASHTO M 194.
   1. The chlorides content (as ClG) not exceeding 1 percent by weight of the admixtures.

C. Do not use calcium chloride.

D. Protect all admixtures from freezing.

2.8 POZZOLAN

A. Fly Ash:
   1. Class F, as specified.
      a. Conform to ASTM C 618, Class F.
      b. Loss on Ignition (LOI): not to exceed 3 percent.
      c. Maximum allowable CaO content: not to exceed 15 percent.
   2. Allowed as a portland cement replacement under the following conditions:
      a. If used, replace 15 to 20 percent of the portland cement by weight.

b. Use the minimum cement content in the design formulas before replacement is made.
c. Use fly ash from the list of UDOT pre-qualifed sources maintained by the UDOT Materials Quality Assurance.
d. Label the storage silo for fly ash to distinguish it from cement.
e. Use different size unloading hoses and fittings for cement and fly ash.

3. Fly ash may be sampled and tested for compliance at any time.

B. Natural Pozzolan (Class N)

1. Conform to ASTM C 618.
2. May use instead of fly ash provided that the 14 day expansion test (ASTM C 1260) with job aggregates and job cement does not exceed that for the same aggregates and cement with a UDOT approved Class F fly ash.

C. Silica Fume: Conform to ASTM C 1240.

2.9 MIX DESIGN

A. Furnish a mix design to the ENGINEER for each class of concrete to be used.

1. Do not change the mix design without written approval.
2. Base concrete mix designs for Class AA(AE), Class A(AE), and Class A on trial batch test results or on past history (same materials used in previous mix designs within the past year).
3. Use the same components in the trial batches that are to be used in the project including coarse and fine aggregate, water, source and type of cement, air-entraining agent, fly ash, etc.
4. The DEPARTMENT or its representative will witness the trial batch.
5. Mix concrete (trial batches) as specified.

PART 3 EXECUTION

3.1 PREPARATION

A. Aggregate stockpiles:

1. Clear, grub, smooth, and compact the site.
2. Stockpile platforms will be constructed in such a way as to prevent intrusion of subgrade materials into aggregates.
3. Building stockpiles at least two days before use.
4. Provide an operator and front end loader to help the ENGINEER take aggregate samples.
5. Acceptance will be made in daily increments, but not more than 30 days before use.
6. Provide separate stockpiles for coarse and fine aggregate.

7. Construct stockpiles in thin layers (1.5 m maximum) that have uniform thickness and a regular form.
    a. Do not build high, cone-shaped piles above the maximum height of 3 m before distribution.
    b. Do not dump or spill aggregate over the sides of the stockpile.
    c. Minimize segregation of aggregate.
8. Allow washed aggregates to drain to a uniform moisture content before use (12 hours minimum).
9. Move conveyor continuously across the stockpile as aggregate is discharged.
10. Do not drop material more than 3 m from conveyor.

B. Heating Aggregate and Water
1. Provide and operate heating devices at no additional cost to the DEPARTMENT when heated aggregates are required.
2. Aggregates must be free of ice.
3. Heat aggregates uniformly, when required. Avoid overheating or developing hot spots.
4. Meet temperature control requirements found in this Section, paragraph: Limitations, item C.
5. Meet cold weather limitations found in this Section 03310.
6. Use either steam or dry heat.
7. Do not allow the products of fuel combustion to contact the aggregate.
8. Heat the mixing water to between 21 degrees C and 82 degrees C when introduced into the mixer.

3.2 CONCRETE CLASSES AND MIX REQUIREMENTS

A. Meet the requirements in Table 3.

Table 3

Concrete Classes and Mix Requirements							
Class	**Coarse Aggregate Size (mm)**	**Max. Water/ Cement Ratio**	**Min. Cement Content (kg/m^3)**	**Slump (mm)**	**Air Content Percent (%)**	**Mix Design Compress f'_{cr} (MPa)**	**28 Day Minimum Compress f'_c (MPa)**
7A(AE)	**	**	**	**	**	71.8	55.2
6A(AE)	**	**	**	**	**	62.8	48.3
5A(AE)	**	**	**	**	**	53.8	41.4
4A(AE)	**	**	**	**	**	44.8	34.5
3A(AE)	50 to 4.75 37.5 to 4.75 25 to 4.75 19 to 4.75	0.44 0.44 0.44 0.44	362 362 390 390	15 - 88 15 - 88 15 - 88 15 - 88	4.0 - 7.0 4.5 - 7.5 5.0 - 7.5 5.0 - 7.5	36.0 36.0 36.0 36.0	27.5 27.5 27.5 27.5
AA(AE)	50 to 4.75 37.5 to 4.75 25 to 4.75 19 to 4.75	0.44 0.44 0.44 0.44	335 335 362 362	25-88 25-88 25-88 25-88	4.0 - 7.0 4.5 - 7.5 5.0 - 7.5 5.0 - 7.5	32.8 32.8 32.8 32.8	25.2 25.2 25.2 25.2
A(AE)	37.5 to 4.75 25 to 4.75 19 to 4.75	0.53 0.53 0.48	279 279 293	25-88 25-88 25-88	4.5-7.5 4.5-7.5 4.5-7.5	27.0 27.0 27.0	21.1 21.1 21.1
B or B(AE)		0 62	223	50-125	-- 3.0-6.0	22.5	17.0
C or C(AE)		0.70	223	50-125	-- 3.0-6.0	18.0	14.0

** Design and proportion mixes according to ACI 301 and project specific criteria.

B. Minimum strength is based on a coefficient of variation of 10 percent, and one test below the minimum strength per 100 tests.

C. Maximum size of coarse aggregate:

1. Not larger than 1/5 of the narrowest dimension between sides of forms.

2. Not larger than 1/3 the depth of slabs.
3. Not larger than 3/4 of the minimum clear distance between reinforcing bars or between bars and forms, whichever is least.

D. Do not exceed water/cement ratio.

E. When a pozzolan is used in the mix, calculate the water/cement ratio (w/c) according to the following formula:

$$\frac{W}{C} = \frac{Water}{Cement\ \ pozzolan}$$

F. When concrete is deposited in water, use 56 kg more cement per cubic meter than the design requires for concrete placed above water.

G. When not using water reducing admixtures, use Table 4 to determine the slump requirements.
1. Slump requirements when using low range water reducers: 25 to 125 mm for all classes of concrete.
2. Slump requirements when using high high range water reducers: 100 mm to 230 mm for all classes of concrete.

3.3 ADDITIONAL REQUIREMENTS FOR USING HIGH RANGE WATER REDUCERS (SUPER PLASTICIZERS)

A. Establish the effective life of the High Range Water Reducer (HRWR) by trial batch.
1. Trial batch will approximate field conditions including time of placement (see this Section, paragraph: Limitations General - timing), and concrete temperature.
2. ENGINEER will witness the trial batch.
3. Slowly agitate the mix throughout the test period.
4. Record and plot slump and mix temperature at 15 minimum intervals.
5. Maintain the required slump (100 mm to 230 mm) throughout the time allowed for placement. Re-dose if necessary.
6. If re-dosing is required, record the time of re-dose and the amount of admixture added.
7. Do not exceed any manufacturers recommendations for the use of the HRWR.
8. Submit results of the trial batch to the ENGINEER.

B. High Range Water Reducer (HRWR) may be added at the job site.
1. Record on the batch ticket, the time at which the HRWR was added.
2. Maintain the mixing period for truck mixers between 70 and 100 revolutions at mixing speed.

3. ENGINEER will perform a standard slump test before adding the HRWR to a transit mixer. Meet the requirements of Table 6.
4. ENGINEER will take additional slump tests at the job site after adding the HRWR.

C. If the HRWR is added to a central mixer, no preliminary slump test is required.

D. Show on batch tickets the amount of admixture used.

E. Do not exceed the requirements established by the trial batch.

F. CONTRACTOR is responsible for changes in placement and finishing operations due to the addition of admixtures.

3.4 ADDITIONAL REQUIREMENTS FOR USING SET RETARDING ADMIXTURES

A. If set retarding admixtures are specified due to haul times exceeding the time limitations in this Section, paragraph: Limitations - Timing, establish the effective life of the set retarding admixture by trial batch.
1. The trial batch will approximate field conditions including concrete mix temperature.
2. ENGINEER will witness the trial batch.
3. Slowly agitate the mix throughout the test period.
4. Record and plot slump and mix temperature at 15 minute intervals.
5. Do not exceed any manufacturers recommendations for the use of the set retarding admixture.
6. Do not re-dose the concrete with additional set retarding admixture.
7. Submit results of the trial batch to the ENGINEER.

B. Add set retarding admixture at the batch plant at the time of initial batching operations, or immediately after.

C. Show on batch tickets the amount of admixture used.

D. Time of placement will be established by the trial batch and will supersede the requirements in this Section, paragraph: Limitations - Timing.

E. Do not exceed the requirements established by the trial batch.

F. CONTRACTOR is responsible for changes in placement and finishing operations due to the addition of admixtures.

3.5 BATCHING MATERIALS

A. Meet AASHTO M 157.

B. Meet the requirements of the *UDOT Quality Management Plan for Ready-Mix Concrete*.

C. Operate the batch mixer at the manufacturer's recommended drum speed.

D. Keep drums and blades free from excessive cement and mortar buildup.

E. Add the admixtures separately to the mix water.

F. Do not use any process which will cause “flash set” of the mix.

G. At central mix plants, mix all materials for at least **80 seconds** at recommended drum speed.
   1. When adding more water or cement, mix 30 additional seconds.
   2. Introduce the cement into the batcher before the fly ash.

H. Conduct mixing efficiency tests as specified.
   1. AASHTO M 157, Annex A-1.
   2. ENGINEER may order mixing efficiency tests at the beginning of concrete operations, or anytime deemed necessary.

I. Maintain the mixing period for truck mixers between 70 and 100 revolutions at mixing speed.
   1. Maintain a minimum of 90 revolutions for front end discharge trucks.
   2. Complete concrete mixing before the truck leaves the batch plant yard.

J. Hand Mixing:
   1. Only Class B and C concrete may be hand mixed.
   2. Hand-mixed batches cannot exceed 0.4 m^3 in volume.
   3. Hand mix on a watertight platform.
   4. Spread the aggregate evenly on the platform, and thoroughly mix in the dry cement until the mixture becomes uniform in color.

3.6 TRANSPORTING

A. Transport ready-mixed concrete in transit mixers or agitator trucks.
   1. Do not load trucks in excess of their rated mixing capacity, or 63 percent of the drum gross volume, or less than 1.5 m^3.
   2. The truck rating plate must be readable.

B. Equip transit mixers or agitator trucks with a visible water meter and revolution counter (electronic or mechanical). Use the water meter to measure all water discharged from the truck's tank.

C. Obtain approval to add water after the transit mixer or agitator truck leaves the batch plant.
   1. Add water within the specified time limits.
   2. Do not add more water than the batch ticket indicates.
   3. Do not add water after more than 0.4 m^3 of concrete has been discharged from the drum and do not exceed the water/cement ratio.
   4. When adding water, rotate the drum at least 30 revolutions at the mixing speed recommended by the manufacturer.

3.7 LIMITATIONS - GENERAL

A. Timing. Reject concrete if:
   1. It is not placed within 90 minutes when the air temperature is below 27 degrees C.
   2. It is not placed within 75 minutes when the air temperature is between 27 and 29 degrees C.
   3. It is not placed within 60 minutes when the mix temperature is between 30 and 32 degrees C.
   4. Initial set has developed.

B. Do not temper concrete by adding water or by any other means after initial set or false set has taken place.

C. Concrete Temperature:
   1. Place concrete in the forms when the concrete temperature is between 10 and 32 degrees C.
   2. Do not place concrete when the mix temperature exceed 32 degrees C.
   3. Cold and Hot Weather Limitations: Refer to this Section.

D. Pumping and Conveying Equipment
   1. Do not use equipment, or a combination of equipment and the configuration of that equipment, that causes a loss of entrained air content that exceeds one half of the range of air content allowed by specification.
   2. At the direction of the ENGINEER, CONTRACTOR is responsible for verification and/or monitoring of air loss.

3.8 LIMITATIONS - COLD WEATHER

A. Cold weather limitations apply when the temperature is likely to fall below 4 degrees C within 14 days of placement.

B. Comply with the following regulations for placing concrete in cold weather:

1. Submit a written plan for approval 14 calendar days before concrete placement.
2. Do not use chemical additives in the concrete to prevent freezing.
3. Provide all necessary cold weather protection for in-place concrete (cover, insulation, heat, etc.).
4. Do not place concrete in contact with frozen surfaces.
5. Produce concrete with a temperature between 16 degrees C and 32 degrees C at the time of placing.
6. Adequately vent combustion-type heaters that produce carbon monoxide.
7. Maintain the concrete temperature above 10 degrees C for the first 14 days after placing.
8. Protect the concrete from freezing until a compressive strength of at least 24 MPa has been achieved.
9. Maintain moist conditions for exposed concrete not in contact with forms; avoid loss of moisture from the concrete due to heat applied.
10. Limit the drop in temperature next to the concrete surfaces when removing heat to 11 degrees C during any 12-hour period until the surface temperature of the concrete reaches that of the atmosphere.
11. Determine the concrete temperature with a surface thermometer insulated from surrounding air.

C. **Paving:**

1. Paving may begin when base surface temperature is 2 degrees C in the shade and ascending.
2. Maintain the mix temperature at a minimum 16 degrees C.
3. Cease operations when the ambient temperature is 7 degrees C in the shade and decreasing.
4. Do not add chemical admixtures to prevent freezing.
5. Remove and replace concrete damaged by frost action at no additional cost to the DEPARTMENT.
6. Do not use material containing frost or lumps.
7. Do not heat water or aggregate to more than 66 degrees C.
8. Protect the concrete from freezing until a compressive strength of at least 24 MPa has been achieved.

3.9 LIMITATIONS - HOT WEATHER

A. Begin batching operations when the ambient air temperature in the shade is 29 degrees C and declining.

B. Discontinue placing when the ambient air temperature reaches 27 degrees C in the shade and is increasing.

C. Paving: Discontinue paving when mix temperature reaches 32 degrees C either at point of placement or batch plant platform, or when ambient air temperature exceeds 38 degrees C in the shade.

3.10 FIELD QUALITY CONTROL - SAMPLING

A. ENGINEER will conduct sampling and testing.
   1. When testing concrete from a concrete pump, ENGINEER will take the samples from the hose after all of the priming grout has been wasted.
   2. When testing concrete used on bridge decks, CONTRACTOR will place a small pile of concrete in front of the deck screed and provide suitable access for the ENGINEER to obtain samples.

B. Provide and maintain cylinder storage devices to control the temperature within the specified range.
   1. Maintain cylinders at a temperature range of 10 degrees C to 27 degrees C for the initial 16-hour curing period.
   2. Do not move the cylinders during this period.
   3. Equip the storage device with an automatic 24-hour temperature recorder with an accuracy of ±1 degree C.
   4. Have the storage devices available at the point of placement at least 24 hours before placement.
   5. ENGINEER will stop placement of concrete if the storage device cannot accommodate the required number of test cylinders.
   6. Use water containing hydrated lime if water is to be in contact with cylinders.
   7. A 24-hour test run may be required.

C. Do not place concrete without approval.

D. Cure cylinders representing steam-cured concrete as specified. Leave the cylinders with the product while steam is applied and then standard cured for the remaining 28 days. AASHTO T 23.

END OF SECTION

SECTION 03152

CONCRETE JOINT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Joint Filler and Joint Sealer.

B. Waterstops.

1.2 REFERENCES

A. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete.

B. AASHTO M 153: Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

C. AASHTO M 213: Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

D. AASHTO T 132: Tensile Strength of Hydraulic Cement Mortars.

E. AASHTO Standard Specifications for Highway Bridges.

F. ASTM C 509: Elastomeric Cellular Preformed Gasket and Sealing Material.

G. ASTM C 719: Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).

H. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

I. ASTM D 794: Determining Permanent Effect of Heat on Plastics.

J. ASTM D 1084: Viscosity of Adhesives.

K. ASTM D 1621: Compressive Properties of Rigid Cellular Plastics.

L. ASTM D 1622: Apparent Density of Rigid Cellular Plastics.

M. ASTM D 1623: Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

N. ASTM D 2240: Rubber Property-Durometer Hardness.

O. ASTM D 2628: Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements.

P. ASTM D 3405: Joint Sealant, Hot-Applied, for Concrete and Asphalt Pavements.

Q. ASTM D 3407: Joint Sealants, Hot-Poured, for Concrete and Asphalt Pavements.

R. Federal Specification TT-S-00230.

S. Military Specification 8802.

1.3 SUBMITTALS

A. For Silicone Joint Sealer: Furnish manufacturer's certified test results of each lot of the joint sealant material to ENGINEER, except for the bond to cement mortar test. Certificate must show use of primers, where applicable.

PART 2 PRODUCTS

2.1 PREFORMED ELASTOMERIC JOINT SEALANTS

A. Preformed elastomeric joint seal material made of vulcanized elastomeric compound using polymerized chloroprene as the only basic elastomer.

B. ENGINEER will approve the shape of any joint sealer prior to submission of the individual production lot.

C. DEPARTMENT evaluation requirements for any joint seal geometry are:
1. Overall width of sealer: 11 mm minimum.
2. Overall depth of sealer: maximum of 25 mm when compressed to 5.5 mm.
3. Materials Physical Property: Conform to ASTM D 2628.
4. Maintain the force-deflection requirements in Table 1.

Table 1

Deflection Condition	Force Requirement
Seal compressed to 9.0 mm width	350 N/m minimum
Seal compressed to 5.5 mm width	2100 N/m maximum

5. Heat-age the specimens used for determining the original force-deflection relationship in an oven for 70 hours at 100 degrees C. under 50 percent deflection.
6. Subject the specimens to another force-deflection test after heat-aging and comply with the requirements in Table 2.

Table 2

Deflection Condition	Force Requirement
Seal compressed to 9.0 mm width	175 N/m minimum
Seal compressed to 5.5 mm width	2100 N/m maximum

D. Use a one-component, polycholorprene, lubricant adhesive containing only soluble phenolic resins blended with anti-oxidants and acid acceptors in an aromatic hydrocarbon solvent mixture with the following properties:
1. Average net weight 0.93 kg/L ± 5 percent.
2. Solids content by weight of 11.3 kg ± 3 percent. Meet ASTM D 1084.
3. Suitable viscosity for use with installation equipment.
4. Film strength of 15 800 kPa minimum tensile strength and 750 minimum percent elongation before breaking. Meet ASTM D 412.
5. Manufactured within 9 months of use.
6. Deliver in containers plainly marked with the manufacturer's name or trade mark, lot number, date of manufacture. Send manufacturer's certification of specification compliance.

E. DEPARTMENT may sample and test materials after delivery to the project site.

2.2 HOT-POURED JOINT SEALANT

A. As specified for general requirements, physical properties, packing, marking, and sampling. Meet ASTM D 3405.

B. Test physical requirements as specified in ASTM D 3407.

2.3 PREMOLDED JOINT FILLERS

A. As specified.

B. Meet AASHTO M 153 and AASHTO M 213.

2.4 SILICONE JOINT SEALER

A. Select and use a prequalifed sealant from the Approved Products List, available from the DEPARTMENT.

B. Silicone joint sealer and special category for self-leveling: both made of low-modulus silicone specifically formulated to seal Portland Cement Concrete Pavement joints.

C. Furnish in a one-part, non-acid curing formulation.

D. Meet the following physical requirements:
   1. Refer to the plan details.
   2. Backer rod compatible with the sealant and all components of the joint sealant system. Meet the requirements for Backer Rod.
   3. Prevent any bond or adverse reaction from occurring between the backup materials and the sealant.

E. Meet the test requirements in Tables 3 and 4.

Table 3

Test Requirements (Silicone Joint Sealer) and Test Methods		
Tensile Stress; 150% max elongation, 7-d cure @ 25 ± 2 degrees EC. And 45-55 % relative humidity. (rh)	310 kPa	ASTM D 412 (DIE C)
Flow	7.5 mm maximum	MIL S 8802
Extrusion Rate 38 EC to -18 EC.	75-250 grams/min	MIL S 8802
Tack-Free Time		MIL S 8802
Specific Gravity	1.01 - 1.515	ASTM D 794 Method A
Durometer Hardness, shore A: cured 7 days @ 25±2 EC. and 45-55 % relative humidity. (rh)	10-25 (-18 EC.)	ASTM D 2240
Shelf life	6 month minimum from date of shipment from plant or point of manufacture.	
Ozone and Ultraviolet (UV) Resistance	No chalking, cracking, or bond loss after 5000 h	
Bond to concrete mortar concrete briquette air cured 14 d 25±2 EC.	345 kPa minimum	
Movement capability and adhesion. Magnitude of cycles movement shall be appropriate for sealant category, cure 7 d in air 25±2 EC then 7 d in water 25±2 EC.	+100% and -50% of joint width. No more than 325 mm^2 (adhesive or cohesive) failure in the 3 specimens combined after 10 cycles.	

Table 4

Test Requirements for Self-Leveling (Silicone Joint Sealer) and Test Methods		
Flow, sag, or slump	Self-leveling	
Extrusion Rate	275-550 grams/min.	MIL S 8802
Elongation, percent minimum	800 @ 21 days	ASTM D 412 DIE C, Mod.
Modulus @ 150% elongation	207 kPa maximum after 21 days	
Adhesion or Concrete (minimum percent elongation)	+600 after 21 days	ASTM D 3583 (Sect. 14, Mod.)
Accelerated Weathering	No chalking, cracking, or bond loss after 5000 hours	
Shelf Life	6 month min. from date of shipment from plant or point of manufacture.	
Durometer Hardness, Shore OO: cured 14 days @ 25±2 EC. And 45-55%, rh	20-80 (-18 EC.)	ASTM D 2240
Movement capability and adhesion. Magnitude of cycles movement shall be appropriate for sealant category, cure 14 days in air 25±2 EC., and then 7 days in water 25±2 EC.	+100% and -50% of joint width. No more than 325 mm^2 (adhesive or cohesive) failure in the 3 specimens combined after 10 cycles.	

F. DEPARTMENT will determine the bond to concrete mortar with the following test:
   1. Test as specified in AASHTO T 132.
   2. Briquettes molded as specified, sawed in half, and bonded with a thin section of sealant.
   3. Briquettes dried to a constant weight in oven at 38 ± 3 degrees C.

G. DEPARTMENT will use the following test as per ASTM C 719 for movement capability and adhesion:

1. Prepare 25 mm x 25 mm x 75 mm concrete blocks as specified.
2. Use a sawed face for the bond surface.
3. Seal 50 mm of block, leaving 12.5 mm on each end of specimen unsealed.
4. Dimension the sealant to a 9.5 mm depth and a 12.5 mm width.
5. Subject sealant to movement as specified.
6. Magnitude of the movement must meet each specific category, and the rate of extension or compression must be 3.1 mm/h.

H. Take one or more random samples (minimum of 1.9 L per sample) of each lot and seal in airtight containers.

1. Notify ENGINEER when stockpiles located at either the job site or the vendor's place of business are ready to be sampled.
   a. Establish job site stockpiles at least 30 working days prior to use.
   b. Establish vendor's place of business stockpiles 40 working days prior to use.
2. The DEPARTMENT may take samples at the sealant manufacturing plant at least 30 days before shipment to the job site.
3. Laboratory testing may take 30 working days after submitting samples.

I. Do not place any materials until testing is completed and materials are approved by ENGINEER.

J. Sealant must be delivered in the manufacturer's original sealed container, displaying the lot number, expiration date of the shelf-life warranty, and the sealer trade name.

K. Submit Certificate of Compliance to the ENGINEER when the sealant is delivered to the job site. Certificate must include:

1. Verification of test results
2. Manufacturer's name
3. Lot number
4. Expiration date of the shelf-life warranty
5. Sealer trade name
6. Project destination
7. Representative sealant

2.5 BACKER ROD

A. Use closed-cell, polyethylene-foam rods conforming to the requirements in Table 5.

Table 5

Backer Rod Requirements and Test Methods		
Diameter	Joint width + 3.0 mm	
Density	32.1 kg/m^3	ASTM D 1622
Tensile Strength	172 kPa	ASTM D 1623
Absorption	0.5 percent by volume	ASTM C 509
Compression Reflection	25 percent at 56 kPa	ASTM D 1621

2.6 JOINT SEALER (STRUCTURES)

A. Cold-applied, gun-grade, single-component, polyurethane base material that cures under field condition to form a rubber-like, non-sag, elastomeric joint seal, as specified in Federal Specifications TT-S-00230 C. Type II, Class A.

B. Use material that bonds tightly to the sides of the concrete groove and exhibits the physical properties in Table 6 when cured and tested after 21 days at 23 degrees C.

Table 6

Physical Properties of Joint Sealer (Structures) and Test Methods		
Modulus of Elasticity at 100% Elongation	910 kPa	ASTM D 412
Hardness (Shore A)	40 ± 5	
Elongation (at break)	700 %	ASTM D 412
Recovery	Greater than 90%	
Tensile Strength	1310 kPa	ASTM D 412
Adhesive in Peel	3.5 N/mm	TT-S00230 C Type II, Class A
Service Range	-40 EC to 66 EC.	TT-S-00230 C
Initial Cure, Tack Free (Depending on Temperature and Humidity)	6 to 8 hours	
Final Cure	5 to 8 days	
Staining Characteristics	Nonstaining	
Color	Gray	

2.7 WATERSTOPS

A. Provide waterstops as specified.

B. Meet AASHTO Standard Specifications for Highway Bridges, Division II, Subsection 8.9.2.6.

PART 3 EXECUTION Not Used.

END OF SECTION

SECTION 03211

REINFORCING STEEL AND WELDED WIRE - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing reinforcing steel and steel welded wire fabric.

B. Coating for reinforcing steel and steel welded wire fabric.

1.2 REFERENCES

A. AASHTO M 31M: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. AASHTO M 55: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

D. AASHTO M 284: Epoxy Coated Reinforcing Bars.

E. ASTM A 36: Carbon Structural Steel.

F. ASTM A 153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

G. ASTM A 767: Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

1.3 SUBMITTALS

A. Furnish Certificates of Compliance from the manufacturer stating that the materials meeting this specification.

B. Prequalify all coatings meeting AASHTO M 284 Annex A1: "Prequalification of Organic Coatings for Steel Reinforcing Bars."
   1. Furnish a copy of the Prequalification Test Report to the DEPARTMENT's Construction and Materials Division.
   2. Provide a 450 g sample of the coating material from each batch in conformance AASHTO M 284 Annex A1.2.2., to the DEPARTMENT's Construction and Material Division.

C. A copy of the purchase order or a detailed letter to the ENGINEER verifying the warehouses or fabricators of the steel reinforcing bars or welded wire reinforcement with required samples.

D. Samples of the steel reinforcing bars or welded wire reinforcement from the fabricator's source, following UDOT's Minimum Sampling and Testing Guide.
   1. Provide 3 samples of each size cut to 600 mm length.
   2. Samples may be waived if the original contract amount is less than 2000 Kg.
   3. Supply test bars at no additional cost to DEPARTMENT.

E. Splice Shop Drawings: Submit four sets for approval showing the proposed number and locations of each mechanical butt splice splicing
   1. Submit before ordering the reinforcing steel whenever splicing requirements vary from the plans and specifications.
   2. The ENGINEER will determine the length of splices.

F. Submit two sample mechanical butt splices and test to destruction in the presence of the ENGINEER.

1.4 QUALITY ASSURANCE

A. The DEPARTMENT may witness coating processes for project work and will obtain random samples by heat number and manufacturer to conduct verification testing.

B. Prequalification:
   1. Epoxy Coating Suppliers: through UDOT's Quality Management Plan - Reinforcing Steel Epoxy Coating.
   2. Galvanized Coating Suppliers: through UDOT's Quality Management Plan - Reinforcing Steel Galvanized Coating.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not damage the bars or the coating during handling and storage.
   1. Use systems with padded contact areas when handling epoxy coated bars.
   2. Pad all bundling bands for epoxy coated bars.
   3. Lift all bundles with strong-back, multiple supports, or a platform bridge.
   4. Do not drop or drag bars.

B. Repair damaged bars or coating at no additional cost to the DEPARTMENT.

PART 2 PRODUCTS

2.1 REINFORCING STEEL

A. Deformed billet-steel bars as specified.
   1. Metric bar sizes. AASHTO M 31M, Grade 400.
   2. U.S. Customary bar sizes. AASHTO M 31, Grade 60.

2.2 EPOXY AND GALVANIZED COATINGS

A. As specified. Meet AASHTO M 284 OR AASHTO M 111.

B. Coat bars as shown on the plans.
   1. Maintain epoxy coating thickness between 0.2 mm and 0.3 mm.
   2. Maintain galvanized coating thickness as specified. ASTM A 767.
   3. Coat bars after bending, unless the fabricator can show that satisfactory results can be obtained by coating before bending.
   4. Reject any bent bars with visible cracks or damage in the coating.

2.3 WIRE AND WIRE REINFORCEMENT

A. Cold-Drawn Steel Wire: As specified. Meet AASHTO M 55.

B. Welded Steel Wire Reinforcement: As specified. Meet AASHTO M 55.

C. Tie Wire: 16 gauge coated (1.575 mm diameter uncoated).

2.4 BAR SUPPORTS

A. Epoxy-coated, galvanized, or plastic-coated, or plastic bar supports:
   1. Meet the requirements of the "Bar Support" chart following this Section.
   2. Remove contaminants that affect the adhesion of the coating to the wire.
   3. Use an electrostatic-spray method, fluidized bed, or flocking to apply an epoxy coating.
   4. Apply plastic coating by spraying, dipping, or using as a powder.
   5. Maintain galvanized coating thickness as specified. AASHTO M 323, and AASHTO M 111.
   6. Maintain the thickness of epoxy or plastic coatings at a minimum of 0.127 mm with no maximum.
   7. Use patching material per the manufacturer's recommendation to repair damaged coating.
      a. Use patching material that is compatible with the coating, and that is inert in concrete.
      b. Hanger marks on the coated bar supports which result from the coating application process are acceptable and are not considered damaged coating.

B. Precast concrete block bar supports:
   1. Minimum 28-day compressive strength of 17 500 kPa.
   2. Seventy-five millimeter thick supports with sides ranging from 100 mm to 150 mm with a minimum soil contact area of 0.015 m^2.

2.5 NON-METRIC BAR SIZES

A. May choose to use U.S. Customary bar sizes in lieu of metric bar sizes with the following restrictions:

1. When substituting U.S. Customary bars for metric bars, adjust the spacing or the number of bars using the appropriate multiplier in Table 1.
   a. Adjust development and splice lengths in either case.
   b. Apply the appropriate multiplier to bars on each face of all concrete members.
   c. Always round up when calculating the number of bars required.

2. Submit changes for approval prior to fabrication of bars.

Table 1

Conversion of Metric Bars to U.S. Customary Bars				
Metric Bar Size	**Equivalent U.S. Customary Bar Size**	**Multipliers**		
		No. of Bars	**Bar Spacing**	**Development & Splice Lengths**
10	4	1.00	1.00	1.22
15	5	1.00	1.00	1.00
20	6	1.06	0.94	1.00
25	8	1.00	1.00	1.02
30	9	1.09	0.91	1.00
35	11	1.00	1.00	1.01
45	14	1.03	0.97	1.00
55	18	1.00	1.00	1.03

2.6 MECHANICAL ANCHORAGE DEVICE

A. Splice Coupler **(Same coating system as bar)**

1. Reinforcing steel splice coupler shown by tests to be capable of developing in tension 175 percent of the strength of the reinforcing bar without damage to the concrete.
2. Steel Plate: Meet ASTM A 36.

PART 3 EXECUTION

3.1 PLACEMENT

A. Maintain a clean surface keeping all reinforcement free from loose mill scale, loose or thick rust, dirt, paint, oil, or grease.

B. Bend all bars accurately.

C. Place all reinforcement in designated position and securely hold in position while placing and compacting concrete.

D. Wire bars together with ties at all intersections except when spacing is less than 225 mm in each direction, in which case, tie at alternate intersections.

E. Maintain the specified distance from the forms and between layers of reinforcement by means of prefabricated chairs, ties, hangers, or other approved devices.

F. Precast concrete block bar supports are only allowed when the concrete is placed in contact with the soil and then only as the support for the bottom mat of bars.

G. Do not tack weld reinforcing bars in place.

H. Overlap at least one panel of welded-wire fabric sheets to each other and fasten at the ends and edges.

I. Support reinforcing steel for concrete “T” beams, pier caps, approach slabs, and deck slabs on metal chairs or slab bolsters following this Section, paragraph: Bar Supports.

J. Space chairs for supporting the top steel and bolsters for supporting the bottom steel not more than 1.2 m on center of the bar in each direction.

K. Tie deck steel to beams or forms at regular intervals of not more than 1.5 m on center along the beams to prevent steel movement during concrete placement.

L. Support reinforcing steel for slabs on grade on metal chairs attached to a sand plate, or use precast concrete block supports following this Section, paragraph: Bar Supports.

M. ENGINEER will verify placing and fastening of reinforcement in each section of work before any concrete is deposited.

3.2 FIELD CUTTING

A. Saw or shear coated bars that are specified to be cut in the field. Do not flame cut.

B. Repair the sawed or sheared end using the specified patching or repair material.

3.3 SPLICING

A. Furnish all reinforcing steel in the lengths specified.

B. Do not splice bars, except where specified.

C. Stagger splices as far as possible.

D. Place and tie lapped splices in the bars. Maintain the minimum distance to the surface of the concrete shown.

E. Do not lap splice 45M and 55M bars.

1. Use mechanical butt splices when using 45M or 55M bars.
   - a. Decide the number and location of the splices with the following limitations:
     - C Extend bars a minimum of 3 m above the top of footing.
     - C Stagger splices such that no particular bar designation is spliced more than 50 percent in 1.5 m.
   - b. Use a standard, approved, exothermic process for mechanical butt splicing where the molten filler metal, contained by a high-strength steel sleeve of larger inside diameter than the bars, is introduced into the annular space between bars and the sleeve and between the ends of the bars.
   - c. After cooling and hardening of the filler metal, the splice must be capable of transferring the minimum ultimate tensile strength of the reinforcing bar from one bar to the other by the mechanical strength of the splice components.
   - d. The splice must not depend on fusion of the filler metal with the bars.
     - C Do not heat the bars to their melting point during the splicing process.
     - C Do not allow the degree of heat required to effect the splice to decrease the structural properties of the bars or effect their original hardness.
   - e. Splice according to the manufacturer's recommendations using the manufacturer's standard jigs, clamps, ignition devices, and other required accessories to make splices. Preheat bars where required by the manufacturer.

F. Use one of the following mechanical butt splices for bar sizes No. 10 through No. 35 when designated on the plans. Follow the manufacturer's published recommendations for equipment and splicing procedures.

1. A full mechanical connection that develops in tension or compression at least 175 percent of the specified yield strength of the bar.

2. As described in this section, paragraph: Splicing, item E.

3.4 BENDING

A. Bend reinforcement to the shapes specified. Refer to CRSI Manual of Standard Practice.

B. Do not heat the bars during the bending operations.

C. Cut and bend as specified.

D. Complete all bending before coating except as specified for bent bars.

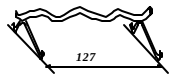
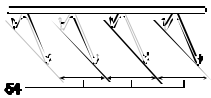
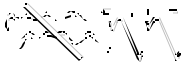
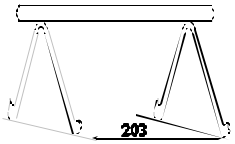
3.5 FIELD QUALITY CONTROL

A. Have the coated bars inspected for damage to the coating after the bars are in place and immediately before concrete placement.

B. Repair all visible defects using the specified method recommended by the coating manufacturer.

END OF SECTION

Bar Supports (all units in mm unless otherwise indicated)

Types & Sizes				Minimum Wire Sizes[2] & Geometry			
Symbol	Bar Support Illustration	Type of Support	Standard Sizes	Nominal Height	Carbon Steel		Geometry
					Top	Legs	
SB[1]		Slab Bolster	19, 25, 38, and 51 mm heights in 1524 and 3048 mm lengths	All	5.72 Corr ugat ed	4.88	Legs Spaced 127 Mm on Center, Vertical Corrugations Spaced 25 Mm on Center (See Note 3)
BB[1]		Beam Bolster	25, 38, 51 Mm; over 51 to 127 Mm Heights in Increments of 6 Mm in Lengths of 1524 mm	Up to 38 Mm Incl. Over 38 Mm To 51 Mm Incl Over 51 to 89 Mm Over 89 mm	4.50 4.50 5.72 5.72	4.50 4.50 5.72 5.72	Legs Spaced 64 Mm on Center (See Note 3)
BC		Indivi-dual Bar Chair	19, 25, 38, and 44 Mm Heights	All	-----	4.50	(See Note 3)
JC		Joist Chair	102, 127, and 152 Mm Widths and 19, 25, and 38 Mm Heights	All	-----	4.88	(See Note 3)
HC or HPC*	* SAND PLATE NEED NOT BE COATED	Indivi-dual High Chair	51 to 381 Mm Heights in Increments of 6 mm	51 to 89 Mm Incl Over 89 to 127 Mm Incl Over 127 to 229 Mm Incl Over 229 to 381 Mm Incl	----- ----- ----- -----	5.72 5.72 6.66 7.77	Legs at 20E or less with Vertical. When Height Exceeds 305 Mm Legs Are Reinforced with Welded Crosswires or Encircling Wires (See Note 4)
CHC		Contin-uous High Chair	Same as Hc in 1524 & 3048 Mm Lengths	51 to 89 Mm Incl Over 89 to 127 Mm Incl Over 127 to 229 Mm Incl Over 229 to 381 Mm Incl	6.66 6.66 6.66 6.66	5.72 5.72 6.66 7.77	Legs at 20E or less with Vertical. All Legs 210 Mm on Center Maximum, with Leg Within 102 Mm of End of Chair, and Spread Between Legs Not less than 50% of Nominal Height. (See Note 5)

NOTES

1 Top wire on continuous supports, not otherwise designated as corrugated, may be straight or corrugated at the option of the manufacturer.

2 Minimum wire sizes are American steel & wire gauges.

3 To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support shall not be less than 70% of the nominal height.

4 To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support shall not be less than 55% of the nominal height.

5 To provide adequate stability against overturning and to provide adequate load capacity, the leg spread measured between points of support on the minor axis of the support shall not exceed the minimum and maximum percentages of the nominal height, as shown.

Nominal Height (Mm)	**Distance Between Supports, % of Nominal Height**	
	Minimum	**Maximum**
UNDER 102	70	NO LIMIT
102	70	95
152	65	90
203	60	85
254	55	80
305	50	75
OVER 305	50	75

Notes:

1 Top wire on continuous supports, not otherwise designated as corrugated, may be straight or corrugated at the option of the manufacturer.

2 Minimum wire sizes are American steel & wire gauges.

3 To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support shall not be less than 70 percent of the nominal height.

4 To provide adequate stability against overturning, the leg spread measured between points of support on the minor axis of the support shall not be less than 55 percent of the nominal height.

5 To provide adequate stability against overturning and to provide adequate load capacity, the leg spread measured between points of support on the minor axis of the support shall not exceed the minimum and maximum percentages of the nominal height, as shown.

Nominal Height (mm)	**Distance Between supports, Percent of Nominal Height**	
	Minimum	**Maximum**
Under 102	70	No Limit
102	70	95
152	65	90
203	60	85
254	55	80
305	50	75
Over 305	50	75

SECTION 03310

STRUCTURAL CONCRETE - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing structural concrete, including concrete slope protection.

1.2 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 01282: Payment.

C. Section 02316: Roadway Excavation.

D. Section 02317: Structural Excavation.

E. Section 02752: Portland Cement Concrete Pavement.

F. Section 02841: Traffic Barriers.

G. Section 03055: Portland Cement Concrete.

H. Section 03152: Concrete Joint Control.

I. Section 03390: Concrete Curing.

J. Section 03211: Reinforcing Steel and Welded Wire.

K. Section 05832: Expansion Joints.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete.

C. AASHTO M 183: Structural Steel.

D. AASHTO M 153: Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

E. AASHTO M 213: Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).

F. AASHTO M 235: Epoxy Resin Adhesives.

G. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

1.4 SUBMITTALS

A. Falsework Drawing: When required in the contract, submit three copies (prepared by a licensed engineer) for approval at least three weeks before construction starts.

B. Use AASHTO Division II Section 3 (Temporary Work) for minimum design criteria.

PART 2 PRODUCTS

2.1 CONCRETE

A. Class AA(AE) concrete.

B. Concrete Slope Protection: Class A(AE).

C. Refer to Section 03055.

2.2 REINFORCING STEEL AND WELDED WIRE (COATED)

A. Refer to Section 03211, Part 2.

2.3 JOINTS AND SEALERS

A. Pre-Molded Joint Filler meeting AASHTO M 153.
   1. Concrete Slope Protection: Refer to Section 03152, Part 2, paragraph: Silicone Joint Sealer.

B. Preformed Joint Filler: AASHTO M 213.

2.4 BACKER ROD

A. Use backer rod composed of closed-cell polyethylene foam of sufficient size to prevent the sealant from passing to the bottom of the groove.

B. Refer to Section 03152, Part 2.

2.5 WATERSTOPS

A. Refer to Section 03152, Part 2.

2.6 RIGID PLASTIC FOAM

A. Preformed, extruded, cellular polystyrene thermal insulation material that has a water absorption property of 0.3 or less.

B. ASTM C 578.

2.7 CURING COMPOUND

A. As specified. AASHTO M 148, Type I-D, Class A.

2.8 FORMS

A. Plywood, wood, metal, glass, or a combination of these materials.

2.9 BARRIER REFLECTORS

A. Refer to Section 02841.

B. Comply with UDOT Standard Drawing 726-1.

2.10 PARAPET CONNECTION BARS

A. AASHTO M 183.

B. Galvanize as indicated on the drawings. AASHTO M 111.

2.11 PARAPET ANCHOR BOLTS

A. Meet AASHTO M 213.

PART 3 EXECUTION

3.1 PREPARATION

A. Falsework
   1. Construction:

a. Use materials able to sustain the stresses required by the falsework design.
b. Use suitable jacks or wedges to set the forms to the grade or camber required, and to prevent settling.
c. Produce a finished structure of the specified camber, and built to the lines and grades indicated.

2. Footing Construction:
   a. Build falsework on a solid footing that is safe against undermining, protected from softening, and capable of supporting any imposed loads.
   b. Demonstrate that the soil bearing values do not exceed the supporting capacity of the soil. (Conduct test loads or have soils investigation conducted by a licensed engineer.)
   c. Use piling or caissons to support falsework which cannot be founded on a solid footing.
   d. Space, drive, and remove piles following approved falsework drawings.

B. Forms
1. Use mortar-tight concrete forms, true to the dimensions, lines, and grades of the structure, and of sufficient strength to prevent deflection during the placement of concrete.
2. Discontinue using any form or forming system that produces a concrete surface with excessive undulations until modifications have been made. Undulations are excessive if they exceed either 2 mm or 1/270 of the center-to-center distance between studs, joints, forms, fasteners, or wales.
3. Countersink all bolt and rivet holes when using metal forms for exposed surfaces so that a plane, smooth surface of the desired contour is obtained.
4. Use lumber that is free of knotholes, loose knots, cracks, splits, warps, or other defects that affect the strength or appearance of the structure. Rough lumber may be used for forming surfaces if visible rough surfaces do not show on the final structure.
5. Form all exposed surfaces of each element of a concrete structure with the same forming material or with such materials that produce a concrete surface that is uniform in texture, color, and appearance.
6. Clean the inside surface of forms of all dirt, mortar, and foreign material before concrete placement.
7. Use form oil that permits the ready release of the forms and does not discolor the concrete.
8. Do not place concrete in the forms until:
   a. All work connected with form construction has been completed.
   b. All embedded materials have been placed.
   c. All dirt, chips, sawdust, water, and other foreign materials have been removed.

d. Inspection and approval have been obtained.

9. Do not use stay-in-place deck forms.

C. Footings

1. Earthwork: Refer to Section 02316.
2. The ENGINEER may direct written changes in dimensions or elevations necessary to secure a satisfactory foundation.
3. Do not dewater by pumping during concrete placement, or for 24 hours thereafter, unless pumping is outside the enclosure. Do not use well points to dewater footing.

3.2 GIRDERS SLABS, AND COLUMNS

A. Slab Span: Place concrete in one continuous operation.

B. Through-Girder Superstructures:

1. Place concrete in one continuous operation unless otherwise specified.
2. If otherwise specified, provide special shear anchorage to assure monolithic action between girder and deck.

C. Cast-In-Place T-Beams:

1. Place concrete in one or two continuous operations: The first to the top of the girder stems and the second to completion.
2. Obtain a bond between the stem and slab that is positive and mechanical, and secured by means of shear keys in the top of the girder stem.

D. Concrete in columns:

1. Place concrete in one continuous operation.
2. Allow concrete to set at least 2 days before placing caps.
3. Do not place concrete in the superstructure until the columns have been stripped and approved.
4. Do not place the superstructure load on the bents until it has been in place a minimum of 14 days.

3.3 BOX CULVERTS

A. Allow base slab and footing to cure for 24 hours before the remainder of the culvert is constructed.

B. Construct side walls and top slab monolithically unless the wall height exceeds 3 m. Keep the construction joints vertical and at right angles to the axis of the culvert.

C. When side walls and top slab are not placed monolithically, construct shear keys in the top of the side walls for anchoring the top slab.

D. Construct wingwalls monolithically.

3.4 CONCRETE SLOPE PROTECTION

A. Preparing subgrade:
   1. Prepare the area to be paved by smoothing and shaping the berms and slopes and excavating for the cut-off walls.
   2. Fill and compact all depressions and humps.
   3. Furnish extra material to properly finish the slopes when required.
   4. Compact all soft and yielding material resulting in a firm and substantial subgrade of uniform density.
   5. Thoroughly sprinkle the area with water before placing the concrete.
   6. Have the ENGINEER approve all surfaces before placing concrete.

B. Placing concrete:
   1. Do not place concrete upon spongy, frozen, or unstable surfaces.
   2. Provide concrete of a consistency that it can be placed on the slopes without deformation.
   3. Complete all scoring as indicated on the plans.
   4. Complete the entire pavement in one placement if possible, or terminate the placement with a construction joint located in a scoring or at the junction of the slope and the abutment.
   5. Finish and cure concrete using a Floated Surface Finish. Refer to this Section, Part 3, paragraphs: Concrete Surface Finishing Classifications; and Curing Structures.

C. Sealing joints and closures:
   1. Furnish 25 mm thick, rigid plastic foam (styrofoam) for all expansion joints located between structural members and the slope protection.
   2. Place the rigid plastic foam material against the surface of all structural members before placing the concrete slope protection.
   3. Anchor the rigid plastic foam in place with a compatible adhesive or other approved methods.
   4. Seal this area just before final inspection.
   5. Remove curing compounds, oil, grease, dirt, and any other foreign materials from concrete surfaces and grooves by sandblasting or other permitted methods.
   6. Place the backer rod and sealant after the concrete has properly cured.
   7. Apply the backer rod and sealant to clean and dry concrete surfaces.
   8. Place sealant with hand or power-operated caulking guns after placing the backing materials.
      a. Limit the depth of sealant in the groove to 10 mm.
      b. Start the placement at one side and proceed to the other side on horizontal grooves and from top to bottom on vertical grooves.
      c. Use a concave pointing tool with soap solution to tool the sealant.

9. Do not place the sealant unless temperatures are at least 10 degrees C and rising.

3.5 PLACING CONCRETE

A. Remove struts, stays, and braces that hold the forms in correct shape and alignment when no longer necessary.

B. Mix and place concrete within the limitations specified in Section 03055.

C. Do not deviate from the placement schedule without written approval.

D. If the concrete cannot be protected during adverse weather, the ENGINEER may postpone placement operations.

E. Observe the following precautions when handling concrete:
   1. Avoid segregation of the ingredients.
   2. Arrange chutes, troughs, or pipes used as aids in placing concrete so the concrete does not separate.
   3. Use metal or metal-lined chutes and troughs. (Do not use aluminum.)
   4. Equip chutes with baffle boards or a reversed section at the end of the outlet when placing on steep slopes.
   5. Extend open troughs and chutes down inside the forms or through holes left in the forms; terminate the ends in vertical downspouts.
   6. Thoroughly flush all chutes, troughs, and pipes with water before and after each placement.
   7. Do not allow the free-fall of concrete to exceed 3 m for thin walls (maximum 250 mm thickness) or 1.5 m for other types of construction without the use of a tremie or a flexible metal spout.
   8. Use flexible metal spout sections composed of conical sections not more than 0.9 m long, with the diameter of the outlet and the taper of the various sections such that the concrete does fill the outlet and retards concrete flow.

F. Observe the following precautions when placing concrete:
   1. Deposit concrete as close as possible to its final position, without allowing it to flow laterally in the form.
   2. Spread fresh concrete in horizontal layers with thickness not greater than what can be compacted with vibrators.
   3. Do not use vibrators to flow concrete laterally.
   4. Limit placement interruptions to 45 minutes.
   5. Place and compact each layer before the preceding layer has taken initial set.
   6. Do not place concrete in water flowing under head within the area of a footing.

   7. Pass the screed over the area with a screed face device to measure the cover before concrete placement.

8. Relocate and tie reinforcing steel that projects above the specified level before placing the concrete.
9. Raise and support reinforcing steel that is more than 6 mm below the specified level before placing the concrete.
10. Firmly support screed rails for bridge deck slabs to prevent movement during concrete placement. When using a finishing machine, support the machine rails on the bridge beams. (Do not place the machine rails on the forms unless the form supports have been strengthened and the ENGINEER gives written approval.)

G. Observe the following precautions when compacting concrete:
1. Use high frequency internal vibrators to compact all concrete for structures (except concrete placed under water).
2. Supply enough vibrators to compact the fresh concrete to the desired degree within 15 minutes after it is deposited in the forms.
3. Supply at least two vibrators for structures involving more than 20 m^3 of concrete.
4. Do not attach vibrators to or against the forms or the reinforcing steel.
5. Do not allow vibrators to penetrate layers of concrete that have taken initial set.
6. Use spades or wedge-shaped tampers to secure a smooth and even texture of the exposed surface.

3.6 PLACING CONCRETE UNDER WATER

A. Place and deposit concrete under water when specified on the plans.

B. Seal the forms or cofferdams watertight.

C. Do not pump water while placing concrete or disturb the concrete until it has set at least 24 hours, or attained at least 50 percent of its design strength.

D. Regulate placing to keep surfaces approximately horizontal at all times.

E. Place the concrete by beginning at one end of the form and progressing in a zig-zag movement from side to side across the length of the form.

F. Place the concrete using a tremie or concrete pumping equipment.

G. Observe the following steps when placing concrete with a tremie:
1. Use a 200 mm to 300 mm diameter steel tube tremie constructed with watertight connections, a hopper to receive concrete, and a device at the bottom to exclude water from entering the tube.

2. Use support that permits the discharge end to move over the entire top work surface and permits the tremie to be rapidly lowered to stop or retard flow when necessary.
3. Minimize the number of tremie location shifts for continuous placement.
4. Keep the tremie tube full to the bottom of the hopper during placement.
5. Slightly raise the tremie when a batch is dumped into the hopper, but do not raise it out of the concrete at the bottom until the batch discharges to the bottom of the hopper. If the concrete seal around the tube is lost, re-plug the end and refill the tube with concrete.

3.7 PUMPING CONCRETE

A. Place concrete with a concrete pump in good operating condition. Replace pump that causes excessive or erratic loss of air entrainment.
   1. Use a pump that produces a continuous stream of concrete without air pockets.
   2. Do not add water to the concrete in the pump hopper.

B. Do not allow pump vibrations to damage freshly placed concrete.

C. Do not use concrete contaminated by the priming or cleaning of the pump.

3.8 LIMITATIONS

A. Place all concrete possible in daylight.

B. If either mixing, placing, or finishing occurs after daylight hours, light the work site so all operations are plainly visible. Refer to Section 00555, paragraph: Limitation of Operations.

C. Keep traffic off concrete bridges and culverts for 21 days after final concrete placement.

D. Hot and Cold Weather Limitations: Refer to Section 03055, Part 3.

3.9 EXPANSION JOINTS

A. Refer to Section 05832, Part 3.

B. Adjust bearing positions and joint widths as directed when steel or concrete is installed at temperatures above 20 degrees C and below 10 degrees C.

3.10 CONSTRUCTION JOINTS

A. Make construction joints where shown on plans or in the placing schedule.

B. Obtain ENGINEER's written approval when additional construction joints are desired and meet the following requirements:

1. Place and construct without impairing strength and appearance.
2. Place in planes perpendicular to the principal lines of stress and at points of minimum shear.
3. Make monolithic structures by extending the reinforcing across the joint.
4. Avoid construction joints through paneled wing walls or large surfaces which are to be treated architecturally.
5. Make a straight line joint across the face of the pour for the full width of the bridge deck.
6. Leave a rough surface to increase the bond with the concrete placed later.
7. Form tapered sections with an insert so that the succeeding layer of concrete ends in a section at least 150 mm thick.
8. Place a bulkhead from the surface to the top mat of steel to ensure a straight vertical face. Shape the concrete below the top steel to a near vertical face in line with the bulkhead.
9. When a bulkhead cannot be placed, establish a straight vertical face by saw cutting to a minimum depth of 25 mm. Shape the concrete below the saw cut to a near vertical face.

C. Before resuming concrete placement, meet the following:

1. Re-tighten forms.
2. Roughen the surface of hardened concrete without leaving loosened particles or damaged concrete.
3. Clean off concrete surface of foreign matter and laitance by sandblasting.
4. Saturate concrete surface with water.
5. Apply epoxy adhesive as specified to face of construction joints. AASHTO M 235 Type II.

3.11 CONCRETE SURFACE FINISHING CLASSIFICATIONS

A. Ordinary Surface Finish: A true and uniform finished surface.

B. Rubbed Finish: A surface smooth in texture and uniform in appearance, free of all form marks or irregularities.

C. Wire Brush or Scrubbed Finish:

1. A finished surface with the cement surface film completely removed and the aggregate particles exposed leaving an even-pebbled texture.
2. An appearance ranging from fine granite to coarse conglomerate depends on the size and grading of the aggregate used.

D. Floated Surface Finish:

1. For flat work: strike off and use a floated surface finish.
2. For bridge decks and approach slabs: machine finish only.

3.12 CONCRETE SURFACE FINISHING

A. Give all formed concrete surfaces at least an Ordinary Surface Finish.

B. Use other types of finishes as required in addition to the Ordinary Surface Finish.

C. Provide a Rubbed Finish for all surfaces that cannot meet Ordinary Surface Finish requirements due to irregularities, honeycombing, excessive surface voids, discoloration, and other defects.

3.13 CONCRETE SURFACE FINISHING PROCEDURES

A. Ordinary Surface Finish:
   1. After removing forms, remove all fins and projections.
      a. Clean, point, and true all honeycomb spots, broken corners or edges, cavities made by form ties, and other holes and defects.
      b. Keep all areas to receive mortar saturated with water for at least 30 minutes before mortar placement.
   2. For pointing, use a mortar of cement and fine aggregate, not more than 1 hour old, mixed in the proportions used in the grade of concrete being finished.
   3. Cure the mortar patches and rub to blend with surrounding concrete.
   4. Tool and free all joints of mortar and concrete. Leave the full length of the joint filler exposed with clean and true edges.

B. Rubbed Finish:
   1. Wet the surface of concrete while still green, paint with grout, and rub with a wooden float until the surface is covered with a lather of cement and water.
      a. A thin grout (1 part cement, 1 part fine sand) may be used in the rubbing.
      b. Let this lather set for at least 5 days, then rub lightly with a fine carborundum stone until smooth.
   2. For hardened concrete, use a mechanically operated carborundum stone to finish the surface at least 4 days after placing.
      a. Finish in the same manner as above; however, let the lather set for at least 15 days before lightly rubbing with a fine carborundum stone until smooth.
   3. Commercial grade rubbing mortar may be used if approved by ENGINEER.

C. Wire Brush or Scrubbed Finish:
   1. After the forms are removed and the concrete is green, scrub the surface with stiff wire or fiber brushes using a solution of muriatic acid (1 part acid, 4 parts water).
   2. Once the scrubbing produces the desired texture, wash the entire surface.
   3. Use water mixed with 5 percent by volume ammonium hydroxide to remove all traces of the acid.

D. Floated Surface Finish on flat work other than bridge decks and approach slabs:

1. Striking Off:
   a. After compaction, carefully rod and strike off the surface with a strike board following the cross sections and grades shown on the plans.
   b. Allow for camber as required.
   c. Operate the strike board longitudinally or transversely and move it forward with a combined longitudinal and transverse motion, ensuring that neither end is raised from the side forms during the process.
   d. Keep a slight excess of concrete in front of the cutting edge at all times.
2. Floating:
   a. Use longitudinal, or transverse floating, or both to create a uniform surface.
   b. Longitudinal floating is required except in places where it is not feasible.
3. Longitudinal Floating:
   a. Work the longitudinal float, operated from foot bridges, with a sawing motion while holding it parallel to the road centerline.
   b. Pass gradually from one side of the pavement to the other. Move the float forward one-half of its length and repeat operation.
   c. Substitute machine floating, if equivalent results are produced.
4. Transverse Floating:
   a. Operate the transverse float across the concrete surface by starting at the edge and slowly moving to the center and back again to the edge.
   b. Move the float forward one-half of its length and repeat the operation.
   c. Preserve the crown and cross section of the concrete surface.
5. Straightedging:
   a. Test the concrete surface for trueness with a straightedge after the longitudinal floating has been completed and the excess water has been removed, but while the concrete is still plastic.
   b. Furnish and use an accurate 3 m straightedge held parallel to the road centerline in contact with the surface.
   c. Check the entire area, immediately filling depressions with freshly mixed concrete, then strike off, consolidate, and refinish.
   d. Cut down and refinish high areas.
   e. Continue the straightedge testing and re-floating until the concrete surface is at the required grade and contour.

E. Floated Surface Finish for bridge decks and approach slabs:

1. Machine-finish exposed surfaces unless otherwise permitted.
2. Finish concrete by striking off and floating the surface.
3. Allow the ENGINEER enough time to inspect finishing machines during daylight hours before concrete placement.

4. Stop finishing operations hampered by darkness unless lighting facilities are provided.
5. Extend finishing machine rails beyond both ends of the scheduled placement, and allow sufficient distance to permit the float to fully clear the concrete.
6. Use adjustable rails set to elevations established by the ENGINEER, installed to prevent springing or deflection under the weight of the finishing equipment, and placed to operate without interruption.
7. Place screed machine parallel to the abutments and bents within 10 degrees.
8. Support screed rails to prevent movement during placing of the concrete.
9. Either support finishing machine rails on the bridge beams or on form supports stiffened to prevent deflection.
    a. Obtain written approval before using form supports.
    b. This may require load tests.
10. Attach a measuring device to the screed face and pass it over the area.
11. Before placing concrete, relocate and tie reinforcing steel that projects above the specified level, and raise and support steel that is more than 6 mm below the specified level.
12. Place concrete in a uniform heading approximately parallel to the screed machine.
13. Limit the rate of placing to allow enough time to finish the surface before initial set.
14. Continuously place concrete the full length of the structure or superstructure unit unless otherwise shown or approved.
15. Provide sufficient material, equipment, and manpower to place deck concrete at a minimum rate of 20 m^3/h.
16. Strike off the surface to the required elevations with the finishing machine immediately after placing and consolidating the concrete.
17. Do not add water to the concrete in front of or behind the screed.
18. Have the strike-off method and equipment approved. Maintain satisfactory performance. Use equipment capable of finishing concrete within the surface tolerances specified. Maintain satisfactory consolidation and surface tolerance to prevent shutdown and rejection of the equipment.
19. Furnish a 3 m straightedge to check the surface tolerance, placed both longitudinally and transversely, immediately behind the screed machine and hand-finished areas.
20. Correct irregularities greater than 3 mm from the straightedge, before additional placement, and immediately fill depressions with concrete, and refinish.
21. Cut down and refinish high areas.
22. Continue straightedge testing and corrective measures until the entire surface is free of observable departures from the straightedge.

F. Final texturing for bridge decks and approach slabs: (a textured hardened finish):
1. After floating, do not texture finish concrete deck surfaces which are to be covered by a water-proofing membrane system.

2. Use a texture process that produces regular 3 mm wide transverse grooves spaced randomly from 12 mm to 19 mm on centers and 3 mm deep.
3. Keep the finished surface free from porous spots and surface irregularities.
4. Furnish a work bridge that follows the finishing machine to facilitate texturing and application of the membrane-curing compound.
5. Check the surface smoothness for acceptance after the concrete has hardened.
6. If the surface deviates more than 3 mm from a 3 m straightedge, remove irregularities by grinding following Section 02752.

3.14 CURING STRUCTURES

A. Refer to Section 03390, Part 3.

3.15 FORM REMOVAL

A. Obtain approval before removing forms.

B. Remove wood forms from the concrete.

C. Do not use any method of form removal likely to cause overstressing of the concrete.

D. Remove supports to permit the concrete to uniformly and gradually take the stresses due to its own weight.

E. Do not remove forms used in ornamental work, railings, parapets, and exposed vertical surfaces for at least 6 hours after placement.

F. To determine the condition of columns, always remove forms before removing shoring from beneath beams and girders.

G. Removing falsework:
1. Do not remove until the fills in back of the abutments have been placed up to the bottom of the approach slab.
2. Do not remove falsework supporting the deck of rigid frame structures until the fill has been placed in back of the vertical legs.
3. Keep falsework and forms in place under slabs, beams, and girders for 14 days after the day of last concrete placement. Forms for slabs having clear space of less than 3 m may be removed after 7 days.
4. In cold weather, keep forms and falsework in place as approved in the written plan for cold weather concrete.

H. Patch formed surfaces within 24 hours after form removal:

1. Cut back and remove all projecting wire or metal devices used for holding the forms in place and that pass through the body of the concrete at least 25 mm beneath the surface of the concrete.
2. Remove lips of mortar and all irregularities caused by form joints.
3. Fill all small holes, depressions, and voids with cement mortar mixed in the same proportions as that used in the body of the work.
4. To patch larger holes or honeycombs, obtain a solid uniform surface by chipping away coarse or broken material.
5. Cut away feathered edges to form faces perpendicular to the surface.
6. Cover with epoxy-adhesive coating as specified. AASHTO M 235, Type II.
7. Fill the cavity with stiff mortar composed of 1 part Portland Cement to 2 parts sand thoroughly tamped into place.
8. Pre-shrink the mortar by mixing it approximately 20 minutes. Vary the time according to manufacturer's recommendations, temperature, humidity, and other local conditions.
9. Float the surface of this mortar with a wooden float before initial set.
10. Keep the patch wet for 5 days.
11. After curing, rub patches on exposed surfaces to blend them with surrounding concrete.
12. Add coarse aggregate to the patching material when patching large or deep areas.
13. Make a dense, well-bonded, and properly cured patch.

I. Areas with honeycomb will be rejected. After receiving written notice of rejection, remove and rebuild the structure in part or wholly, as specified, at no additional cost to the DEPARTMENT.

3.16 MISCELLANEOUS CONSTRUCTION

A. Drainage and weep holes:
1. Construct drainage and weep holes at locations indicated on the plans or as directed.
2. Place ports or vents for equalizing hydrostatic pressure below low water.
3. Use non-corrosive materials for weep hole forms.
4. Remove wooden forms after the concrete is placed.
5. Paint exposed surfaces of metal drains as indicated on the plans.

B. Anchor Bolts: Securely and accurately set all necessary anchor bolts in piers, abutments, or pedestals as the concrete is being placed.

C. Bearing plate areas:
1. Finish bridge seat bearing areas high and rub or grind to grade within a tolerance of ±1.5 mm.
2. Do not grout under bearing plates.

3.17 CLEANING

A. Clean up by removing all falsework and falsework piling, (down to 0.6 m below the finished ground line) rubbish, and temporary building materials before final inspection.

END OF SECTION

Section added by Supplemental Specification

SECTION 03390

CONCRETE CURING - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete curing materials and methods.

1.2 REFERENCES

A. AASHTO M 148: Liquid Membrane-Forming Compounds for Curing Concrete.

B. ASTM C 156: Water Retention by Concrete Curing Materials.

C. ASTM C 309: Liquid Membrane-Forming Compounds for Curing Concrete.

D. ASTM D 3960: Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

E. ASTM E 1347: Color and Color-Difference Measurement by Tristimulus (Filter) Colorimetry.

1.3 SUBMITTALS

A. For Concrete Curing Compound:
   1. Provide a manufacturer's certificate of compliance as verification for all concrete work.
   2. Provide the ENGINEER with test results before placement of concrete pavement.

PART 2 PRODUCTS

2.1 CURING COMPOUND FOR STRUCTURAL AND ARCHITECTURAL CONCRETE

A. Meet AASHTO M 148, Type I D, Class A.

2.2 CURING COMPOUND FOR PORTLAND CEMENT CONCRETE PAVEMENT

A. Select a curing compound from the Qualified Products List maintained by the UDOT Research Division.

1. Meet ASHTO M 148, Type 2, Class B.
2. Conform to the criteria in Table 1.
3. Resin type: Poly-alpha-methylstyrene (PAMS).
4. Compound shall not exhibit significant phase separation for a 24 hour period following thorough agitation.

Table 1

Characteristics (Curing compound for PCC)	**Min.**	**Max.**	**ASTM**
Total Solids, percent by weight compound	35		
$Ti0_2$ Pigment, percent reflectance	60		E 1347
Drying Time: Set to touch, min. Track Free, min		 60 120	C 309
Coverage rate, m^2/L		0.30	
Water Loss, kg/m^2 in 72 hours	38		C 156
Flash point, degrees C		350	
V.O.C. Content, $g/L_{N.W.}$			D 3960

2.3 CURING COMPOUND FOR LEAN CONCRETE BASE COURSE

A. Select from the Qualified Products List maintained by UDOT Research Division.
   1. Use a curing compound with a wax base.
   2. Meet AASHTO M 148, Type 2

2.4 CURING COMPOUND FOR CONCRETE BARRIER

A. Meet AASHTO M 148, Type 1-D, Class B.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify concrete surfaces are ready for curing. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until unsatisfactory conditions are corrected.

B. Follow product manufacturer's recommendations for preparing surfaces.

C. For newly placed concrete using membrane-curing compound method:
   1. Deliver the curing compound in a ready-mixed form with the pigment uniformly disbursed without diluting or altering the compound. If the compound is chilled and too viscous, warm it to a maximum of 38 degrees C.
   2. Keep surfaces moist until the curing compound is applied.
   3. Complete all patching or surface finishing before applying compound.

D. For lean concrete base course curing: Do not dilute or alter the compound.

3.2 CURING STRUCTURES

A. Bridge Decks, Approach Slabs, Curbs, and Parapets.
   1. Apply membrane-curing compound so that no portion of the deck or approach slab is exposed to the atmosphere for more than 20 minutes after the tining or finishing operation.
   2. Work bridge to follow immediately after the finishing machine to allow application of the curing compound while the concrete is still plastic.
   3. As soon as the concrete is sufficiently set to support the materials, cover bridge decks, approach slabs, curbs, and parapet walls with material that retains moisture and does not prevent evaporation, such as cotton or burlap mats.
      a. Restrain the cotton or burlap mats to prevent wind or other forces from removing them.
      b. Do not damage the finish.
   4. Keep concrete moist continuously for 7 days after placement. Keep the entire surface damp, but do not wash away or erode the surface.

B. Other newly placed concrete: Use membrane-curing compound method.
   1. Keep surfaces wet and moist until the curing compound is applied.
   2. Complete all patching or surface finishing before applying compound.
   3. Warm chilled compound that is too viscous to a maximum of 38 degrees C.
   4. Apply curing compound immediately after finishing operations are completed.
   5. Spray the entire surface of the concrete with a membrane curing compound at a uniform rate of 0.4 m^2/L of area.
   6. Immediately re-spray any portion damaged before the 7 day curing expires.

3.3 CURING CURB, GUTTER, FLATWORK, SIDEWALK, DRIVEWAY, AND OTHER MISC CONCRETE ITEMS (CONCRETE SLOPE PROTECTION)

A. Refer to this Section, Part 3, paragraph: Preparation, and paragraph: Curing Structures, item B - Other newly place concrete.

3.4 CURING PRE-STRESSED CONCRETE

A. Cure following this Section, Part 3, paragraph: Curing Structures, or paragraph: Steam Curing, until concrete has reached a strength of 28 MPa.

3.5 CURING PRE-CAST CONCRETE BARRIER

A. Cure exposed surfaces immediately after finishing operations are completed.
   1. Apply the curing compound at a rate of 0.4 L/m^2.

B. After removing form, broom clean the surface of the barrier and apply two coats of curing compound.
   1. Apply the first coat at a rate of 0.4 L/m^2.
   2. Allow the first coat to dry throughly before applying the second coat.
   3. Apply the second coat at a rate of 0.2 L/m^2.

3.6 CURING CAST-IN-PLACE CONCRETE BARRIER

A. Cure immediately after finishing operations are completed.

B. Apply two coats of curing compound as specified for Curing Pre-cast Concrete Barrier.

3.7 CURING PRE-CAST NOISE WALL

A. Cover surface of exposed aggregate noise wall panels with a moisture barrier or membrane immediately after initial finishing operations are completed.

B. Leave cover in place until final finishing operations (exposed aggregate) are performed.

C. Remove cover, complete final finishing operations, and immediately apply curing compound.
   1. Apply curing compound at a uniform rate of 0.4 L/m^2
   2. After removing from forms, apply curing compound to all surfaces not previously covered.

D. Cure all other precast noise wall components.
   1. Apply curing compound to all exposed surfaces immediately after finishing or form removal operations are completed.
   2. Apply curing compound at a uniform rate of 0.4 m^2.

3.8 CURING LEAN CONCRETE BASE COURSE

A. After finishing operations are complete, apply curing compound.

1. Spray entire exposed area (top and sides) at a rate of 0.25 L/m^2.
2. Use fully atomizing mechanical sprayers which have a wind-protective hood.
3. Hand spray on small areas and areas inaccessible to mechanical spraying equipment.
4. Provide complete coverage with curing compound at edges, corners, sides, and rough spots.

B. Damage to the film of curing compound occurring within 72 hours of application must be repaired immediately at no additional cost to DEPARTMENT.

3.9 CURING PORTLAND CEMENT CONCRETE PAVEMENT

A. Pretest the liquid membrane curing compound using an infrared spectrometer to determine specification compliance.

B. Provide the ENGINEER with the test results before placing the concrete pavement.

C. Delay placing concrete pavement until an acceptable shipment of curing compound is received.

D. Warm viscous curing-sealing compound to a temperature not to exceed 38 degrees C if necessary.

E. Thoroughly mix the compound during use and uniformly disperse the pigment throughout the vehicle. Stir continuously mechanically during application and do not dilute or alter in any manner.

F. Apply compound to the entire pavement surface and exposed edges immediately after completing finishing operations:
1. Apply the curing compound in two approximately equal applications.
2. Apply the second application in the opposite longitudinal direction as the first at a combined application rate equal to 0.4 L/m^2.
3. Allow at least 30 minutes between applications.
4. Small and irregular areas and areas inaccessible to mechanical spraying equipment may be hand sprayed.

G. Stop paving operations if the application of the compound behind the paving machine is delayed until the problem is resolved.
1. Keep the pavement moist with water until the compound application process is resumed.
2. Apply the water in a fog-mist spray without damaging the pavement surface texture.

H. Immediately repair any damage to the compound film occurring until seven days after the initial application at no additional cost to DEPARTMENT.

3.10 STEAM CURING

A. Steam curing.

1. Provide a complete steam curing system approved by the ENGINEER, including 24 hour temperature control and monitoring devices, and a suitable enclosure to contain live steam and minimize moisture and heat losses.
2. Do not apply steam until the concrete has set. Wait 4 to 6 hours if retarders are used. If no retarders are used, wait 2 to 4 hours.
3. Maintain 100 percent relative humidity in the steam curing enclosure.
4. Do not apply steam directly on the concrete.
5. When applying steam, increase the ambient air temperature at a rate not to exceed a 22 degrees C per hour until a temperature range of 60 degrees to 71 degrees C is reached.
6. Maintain the temperature range until the concrete has reached the specified strength.
7. When discontinuing the steam, decrease the ambient air temperature at a rate not to exceed a 22 degrees C per hour until reaching a temperature of not more than 11 degrees C above the air temperature to which the concrete will be exposed.

END OF SECTION

SECTION 03392

PENETRATING CONCRETE SEALER

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for applying protective penetrating concrete sealer.

1.2 REFERENCES

A. AASHTO T 260: Sampling and Testing for Total Chloride Ion in Concrete and Concrete Raw Materials.

B. ASTM C 267: Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes.

C. ASTM C 666: Resistance of Concrete to Rapid Freezing and Thawing.

D. ASTM E 274: Skid Resistance of Paved Surfaces Using a Full-Scale Tire.

1.3 SUBMITTALS

A. Certificate of Compliance to the ENGINEER or the Construction and Materials Division.

B. One liter of the product to the ENGINEER.

PART 2 PRODUCTS

2.1 PENETRATING CONCRETE SEALERS

A. Choose from the following list:
   1. Silane
   2. Siloxane
   3. Silicate
   4. Siliconate
   5. Organo Silane Ester
   6. Styrene Acrylic Copolymer
   7. Organo Siloxane
   8. Alkalylalkoxy Siloxane
   9. Alkalylalkoxy Silane

B. Comply with requirements of Table 1:

Table 1

Penetrating Concrete Sealer Requirements				
*** Properties**	**Requirements**	**ASTM**	**AASHTO**	**** UDOT**
Accelerated Weathering	As Specified	C 666	T 260	
Freeze-thaw Test Medium	# 3 % Road Salt			Sealer Studies
Minimum Depth Penetration	$ 4mm			Sealer Studies
Freeze-thaw Weight Loss	# 6 % 300 Cycles			Sealer Studies
Chemical Resistance	Subsections: 1.1.2 1/1/3	C 267		
Friction Number	$ 40	E 274		
Infrared Spectrogram	Materials Division Base Comparison			Materials Studies

* Certified test results from a private accredited testing laboratory will suffice for acceptance.

** Utah Department of Transportation, Materials and Research Division concrete sealer studies of 1986 and 1990.

PART 3 EXECUTION

3.1 PREPARATION

A. Keep surfaces dry and free of laitance, dirt, dust, paint, grease, oil, rust, and other contaminants.

B. Remove any curing compound from the surface of the concrete before applying penetrating sealer.

C. Use one of the following cleaning methods:
1. Hydroblasting - 4800 kPa min.
2. Shotblasting
3. Sandblasting
4. Etching

D. Keep concrete surface matrix intact without exposing any large aggregate.

E. Cure concrete for 28 days prior to sealer application.

F. Place the material after obtaining the approval from the ENGINEER.

3.2 APPLICATION

A. Application Rate:
   1. Based upon the residue content at a coverage rate of 59 g/m^2.
   2. Apply according to manufacturers recommendation for each of the following surfaces:
      a. Horizontal
      b. Vertical
      c. Overhead

B. Application Drying Time: Select a sealer with maximum drying time of 1½ hours.

C. Upon application, meet the minimum Friction Number of 40 for at least 90 percent of friction numbers.

END OF SECTION

SECTION 03412

PRESTRESSED CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pretensioning, fabricating, curing, transporting, and storing prestressed concrete.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

C. Section 03390: Concrete Curing.

D. Section 05120: Structural Steel.

1.3 REFERENCES

A. AASHTO M 203: Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.

B. AASHTO M 270: Structural Steel for Bridges.

C. AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.2.

D. ASTM C 150: Portland Cement.

E. Federal Standard TT-P-641: Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces.)

1.4 DELIVERY, STORAGE, AND HANDLING

A. Prestressing Steel:
   1. Protect against physical damage and corrosion during shipping, handling, and storing.
   2. Clearly mark the shipping package or form with handling instructions, and information about the corrosion inhibitor including date, place, safety orders, and instructions for use.

B. Transport precast girders in an upright position. Support the girders during transportation in approximately the same point(s) they will be supported when installed.

C. Prevent cracking or damaging precast units during storage, hoisting, and handling.

D. Installation of lifting devices is permitted provided that any portion of the devices that protrudes above the top of the girder is removed when no longer needed.

1.5 SUBMITTALS

A. Certification stating the manufacturer's minimum guaranteed ultimate tensile strength for each sample of prestressing steel.

B. Submit five sets of working shop drawings of the prestressing system before beginning the project or ordering materials.
   1. Show complete details and substantiating calculations of the method and material to be used in operations including any reinforcing steel alterations from those shown on the plans.
   2. Method and sequence of stressing including complete specification and details of the prestressing steel, working stresses, and all other data pertaining to the prestressing operation. Include the proposed arrangement of the prestressing steel in the members.

PART 2 PRODUCTS

2.1 CONCRETE

A. Portland Cement: Type I or Type II, or Type III, low alkali.

B. Type III cement: conform to ASTM C 150, Table 2, for moderate sulfate resistance.

C. Class AA(AE) concrete per Section 03055, except as modified below.
   1. Air entraining admixture to provide 5.0 to 7.5 percent entrained air.
   2. Minimum compressive strength 35 000 kPa at 28 days.
   3. Minimum compressive strength for transfer of prestressing force is 28 000 kPa.
   4. Maximum slump is 175 mm.
   5. Coarse aggregate gradation meeting the 19.0 mm to 4.75 mm sieve per Section 03055, Table 2.
   6. Minimum cement content must be 362 kg/m^3.
   7. Water-Cement ratio must not exceed 0.44 by weight, including free-water in the aggregates.

D. Girders: Reject if the average 28-day compressive strength of representative cylinders is less than 94 percent of the specified strength. Core tests are not permitted for compressive strength tests.

2.2 PRESTRESSING STEEL

A. Meet AASHTO M 203. 12.70 mm diameter, Grade 270.

B. Replace prestressing steel that has damage, loose rust, pitting, or serious corrosion. Slight rusting that occurs after placement in the beds is acceptable if it does not cause visible pits.

C. Oiling or greasing the strand is not acceptable.

2.3 REINFORCING STEEL (EPOXY-COATED)

A. As specified. Refer to Section 03211.

2.4 ELASTOMERIC BEARING PADS

A. As specified. AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.2.

2.5 ZINC-RICH PAINT

A. As specified. Federal Standard TT-P-641.

2.6 THREADED RODS

A. Stainless Steel per Section 05120. AASHTO M 270, Grade 250.

2.7 BEARING PLATE

A. As specified. AASHTO M 270, Grade 250.

2.8 SOURCE QUALITY CONTROL

A. Prestressing Steel:
   1. Furnish three 1.5 m long strand samples from each reel or portion of reel that will be used on the project, at no additional cost to the DEPARTMENT.
   2. Testing may require 14 calendar days after the date of receipt without granting an increase in contract time.
   3. The contract time will be increased by the number of days of delay if test results are not returned within 14 calendar days and construction operations are delayed. Make written notification for any additional claim resulting from delay within 5 working days after approval of the materials.

2.9 QUALITY ASSURANCE

A. DEPARTMENT will pre-qualify CONTRACTOR as a supplier of pre-cast concrete products in accordance with "Quality Management Plan: Precast/Prestressed Concrete Structures."

PART 3 EXECUTION

3.1 PREPARATION

A. All equipment (jacks, pressure gauges, load cells) used to stress tendons must be accurate.
   1. Calibrate each jack and its gauge as a unit with the cylinder extension in the final jacking force position.
   2. Furnish a certified calibration chart.

B. Calibrate the load cell and provide an indicator to determine the prestressing force in the tendon. The range of the load cell must be such that the lower 10 percent of the manufacturer's rated capacity is not used in determining the jacking stress.

C. The prestressing force may be tested by ENGINEER.

D. Provide sufficient labor, equipment, and material to install and support testing equipment at the prestressing tendons, and to remove the equipment when testing is completed.

3.2 PRETENSIONING

A. Install and support testing equipment at the prestressing tendons, and remove the testing equipment after the testing is completed.

B. Tension all prestressing steel with hydralic jacks so that the force in the prestressing steel is not less than the value shown.

C. Do not allow the initial stress to exceed 70 percent of the specified minimum ultimate tensile strength.

D. Average working stress in the prestressing steel must not exceed 60 percent of the specified minimum ultimate tensile strength of the prestressing steel unless otherwise shown.

E. Maximum temporary tensile stress (jacking stress) in prestressing steel to exceed 75 percent of the specified minimum ultimate tensile strength.

F. Working force and working stress are the force and stress remaining in the prestressing steel after all losses peculiar to prestressing have either taken place or been provided for. These losses include creep and shrinkage of concrete, elastic compression of concrete, creep of steel, and take up of anchorages.

G. Anchor the prestressing steel at stresses (initial stress) that result in the ultimate retention of working forces not less than those shown.

H. The loss in stress in pretensioned, prestressing steel due to creep and shrinkage of concrete, creep of steel, and elastic compression of concrete is assumed to be 241 000 kPa. If lightweight concrete is used, the loss is assumed to be 275 000 kPa.

I. Do not cut or release prestressing steel in pretensioned members until the concrete in the member has attained a compressive strength of not less than the value shown on the plans or 28 000 kPa, whichever is the greater.

J. Check prestressing steel strands in pretensioned members, if tensioned individually, for loss of prestress not more than 12 hours before placing concrete for the members. Use methods and equipment acceptable to ENGINEER.

K. Re-tension all strands that show a loss of prestress in excess of 3 percent.

L. Increase the calculated elongation of the prestressing steel in pretensioned members to compensate for the loss in stress when it is tensioned at a temperature appreciably lower than the estimated temperature of the concrete and the prestressing steel at the time of initial set of the concrete. Do not allow the jacking stress to exceed 75 percent of the specified minimum ultimate tensile strength.

M. Maintain a minimum lateral eccentricity of prestress when cutting and releasing prestressing steel in pretensioned members. Submit a cutting or release pattern to the ENGINEER for prior approval.

N. Cut off all pretensioned, prestressing steel flush with the end of the member and the exposed ends of the prestressing steel, and then clean and paint a 25 mm strip of adjoining concrete; or cut the strands a minimum of 25 mm back from the girder end, fill the recess with grout, and finish flush with the girder ends.

O. Remove all dirt and residue not firmly bonded to the metal or concrete surfaces.

P. Cover the surfaces with a thick application of zinc-rich paint. Apply two applications to surfaces that are not covered by concrete or mortar. Thoroughly mix the paint at the time of application and work it into voids in the prestressing tendons.

3.3 PLACING CONCRETE

A. Do not place concrete into forms until the placement of the reinforcement and prestressing steel has been DEPARTMENT inspected.

B. Vibrate the concrete internally, externally, or both.

C. Avoid displacing reinforcing steel or strands.

3.4 LIMITATIONS

A. Refer to Section 03055 for hot and cold weather limitations.

B. Remove side forms of the prestressing members within one to two days provided satisfactory arrangement has been made for curing the concrete.

C. Adequately support the members at all times to prevent deadload bending until after the anchorages for pretensioned members have been released.

3.5 CURING

A. Cure as specified in Section 03390.

3.6 INSPECTION

A. Provide free entry to inspectors while the work on the contract is being performed.
B. Materials showing defects during or previous to installation will be rejected.

END OF SECTION

SECTION 03575

FLOWABLE FILL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for placing flowable fill.

1.2 REFERENCES

A. AASHTO M 194: Chemical Admixture for Concrete.

B. AASHTO M 154: Air-Entraining Admixtures for Concrete.

C. ASTM C 150: Portland Cement.

D. ASTM C 618: Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

E. ASTM D 4832: Preparation and Testing of Controlled Low Strength Material (CLSM) Test.

1.3 SUBMITTALS

A. Batch Proportions: submit to ENGINEER 7 days before placement.

B. Trial Batch:
   1. Submit certified test results or conduct laboratory trial batch to verify strength prior to placement.
   2. The DEPARTMENT or its representative will witness the trial batch.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C 150.

B. Pozzolan: ASTM C 618.

C. Sand.

D. Coarse aggregate: Determine a suitable aggregate size and gradation for the intended application.

E. Admixtures:
   1. Water reducers and set accelerators: AASHTO M 194.
   2. Air entrainment: AASHTO M 154.

PART 3 EXECUTION

3.1 INSTALLATION

A. Combine materials to meet the requirements for strength and constructability as required:
   1. Minimum strength: 0.3 MPa. ASTM D 4832.
   2. Maximum strength: 1.0 MPa. ASTM D 4832.
   3. Slump: 130 mm to 250 mm.

B. Determine a suitable aggregate size and gradation for the intended application.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

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Section added by Supplemental Specification

Section added by Supplemental Specification

DIVISION 4 - MASONRY

NOT USED BY UDOT

DIVISION 5 - METALS

SECTION 05120

STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for erecting structural metals.

1.2 RELATED SECTIONS

A. Section 09972: Painting for Structural Steel.

1.3 REFERENCES

A. AASHTO Standard Specifications for Highway Bridges.

B. ANSI/AASHTO AWS D1.5.

C. AASHTO M 164: High-Strength Bolts for Structural Steel Joints.

D. AASHTO M 270: Structural Steel for Bridges.

E. AASHTO M 291M: Carbon and Alloy Steel Nuts.

F. AASHTO M 293: Hardened Steel Washers.

G. ASTM A 123: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.

H. ASTM F 606: Determining the Mechanical Properties of Externally and Internally Threaded Fasteners, Washers, and Rivets.

I. ASTM F 959: Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.

1.4 SUBMITTALS

A. Supply written detailed evidence of foreign manufacturer's sufficiency.

B. Manufacturer's certificate of compliance for nut proof load tests as specified. AASHTO M 291.

1. Certificate must show corresponding lot numbers appearing on the shipping package, certification, test location, time and date, and results of all testing.

2. Include rotational capacity and proof load test results.

C. Three copies of certified mill test reports for all fabricated structure materials before fabrication, including materials manufactured outside the United States.

D. Shop Drawings: Submit five copies of shop detail drawings for all fabricated materials.
1. Submit on “A1" metric series size, 841 mm x 594 mm sheets with a 50 mm blank margin on the left edge, and the department project designation data, drawing number, and sheet number in the lower right corner.
2. All details are subject to modification or approval.
3. Do not order materials or begin work until receiving final approval of the shop detail drawings.
4. Do not deviate from the approved shop drawings unless authorized in writing. CONTRACTOR is responsible for costs incurred doe to faulty detailing or fabrication.
5. ENGINEER reserves the right to retain these drawings up to 14 calendar days without granting an increase in the number of working days for the project. This right applies each time the drawings are submitted.
   a. If the drawings are held in excess of 14 calendar days and cause a delay in the Contractor's operations, the contract time may be increased by the number of days delayed.
   b. Written notification and justification must be submitted within 5 working days after approval if claiming an increase in contract time.

1.5 QUALITY ASSURANCE

A. Bolts and Nuts (Black and Galvanized): Subject to the Rotational Capacity Test, Section 8.5, and the following requirements. AASHTO M 164:
1. Go through twice the required number of turns (from snug tight condition) in a Skidmore-Wilhelm Calibrator or equivalent tension measuring device without stripping or failure as specified.
2. Modify Table 8 in AASHTO M 164 as follows:

Bolt Length / Bolt Diameters	**Nominal Nut Rotation, Degree (Turn)**
# 4	240E (2/3)
> 4 and # 8	360E (1)
> 8	480E (1 1/3)

3. Maximum recorded tensile strength must be equal to or greater than 1.15 times the required fastener tension as specified.

4. Measured torque necessary to produce the required fastener tension must not exceed the value obtained by the following equation:

Torque # 0.25 PD

Where: Torque = Measured Torque (Newton meter)

P = Measured Bolt Tension (Newtons)

D = nominal diameter (meter)

5. Bolts and nuts require proof load tests as specified in ASTM F 606, Method 1 (Proof Load).
6. Bolts and nuts require wedge tests as specified in AASHTO M 164, Section 8.3.

B. Foreign Materials:
1. Have inspected, sampled, and tested at a distribution point in the United States, all materials that have been manufactured outside the United States.
2. Furnish facilities and arrange for all testing beyond the DEPARTMENT's capability.
   a. All tests must be witnessed by ENGINEER or representative of ENGINEER.
   b. Reimburse DEPARTMENT for travel expenses if testing of foreign materials is conducted outside Utah.
   c. Reimburse DEPARTMENT for all excess costs connected with out-of-state shop inspection for foreign materials including travel expenses or the services of an approved inspection agency
   d. Pay for in-plant inspections deemed necessary.
3. Use foreign manufacturers who have previously established the ability to furnish material uniformly and consistently within the specifications.

C. Welding operators must be prequalified. Comply with UDOT Steel and Concrete Construction Manual.

PART 2 PRODUCTS

2.1 STRUCTURAL METALS

A. As specified unless otherwise indicated. Follow AASHTO Standard Specifications for Highway Bridges, Division II, Section 11.3.

2.2 HIGH TENSILE STRENGTH NUTS, BOLTS, AND WASHERS

A. Use bolts, nuts and washers displaying the manufacturer's markings.

B. Bolts: As specified in AASHTO M 164 with the following modifications:
   1. Maximum hardness: Rockwell C33
   2. Minimum hardness: Rockwell C24
   3. Maximum tensile strength:
      a. 1034 MPa for bolts 25.4 mm or less in diameter
      b. 827 MPa for bolts larger than 25.4 mm in diameter
   4. Lubricate bolts before installing.

C. Nuts:
   1. As specified in AASHTO M 291M or AASHTO M 293.
   2. Use heat treated Grades DH and 2H, except use Type DH3 nuts when Type 3 bolts are called for.

D. Washers: As specified in AASHTO M 293.

E. Load Indicator Washers: As specified in ASTM F 959.

2.3 ELASTOMERIC BEARING PADS

A. As specified in AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.2.

2.4 FABRICATION

A. As specified in AASHTO Standard Specifications for Highway Bridges, and UDOT Steel and Concrete Construction Manual. ANSI/AASHTO/AWS D 1.5.

B. If steel structure is to be part of a bridge structure, the fabricator must have American Institute of Steel Construction (AISC), Category III, Quality Certification.
   1. Category III, Quality Certification not required for railings, grates, grate frames, and drain pipes.

2.5 APPROACH SLAB DRAIN ANGLES AND GRATE

A. AASHTO M 270M, Grade 250.

B. Hot-dip galvanize after fabrication. ASTM A 123.

PART 3 EXECUTION

3.1 INSPECTION

A. Notify ENGINEER immediately upon placing the fabrication order to allow time for shop inspection.
   1. Do not begin fabrication until arrangements for shop inspection have been made.

2. Facilitate inspection procedures on site and supply personnel as needed to properly inspect the work.

B. Allow authorized inspectors free and immediate access to all parts of the plant.

C. Furnish facilities for inspection of material and workmanship in the mill and shop.

D. The Inspector has the authority to reject any materials or work not meeting the specifications.
   1. Material accepted by the Inspector may be rejected if found defective at a later time.
   2. Replace or correct rejected material at no additional cost to the DEPARTMENT.
   3. CONTRACTOR may appeal disputes with the Inspector to the ENGINEER for a final decision.

3.2 INSTALLING HIGH STRENGTH BOLTS

A. Testing:
   1. Provide a Skidmore-Wilhelm calibrator or other acceptable bolt tension indicating device for bolt testing at the job site.
   2. Use direct-tension indicators with solid plates when the fastener-grip length is too short to be tested in a Skidmore-Wilhelm calibrator.
   3. Check the direct-tension indicators in a Skidmore-Wilhelm calibrator using bolts of sufficient length before using.

B. Test the installed bolt/nut/washer assembly periodically to verify compliance.

C. Use direct-tension indicator washers as specified to tighten high strength bolts.
   1. ASTM F 959.
   2. Tighten bolts according to the manufacturer's methods and procedures or as modified by ENGINEER.
   3. Tighten the fastener to reduce the gap to 0.127 mm or less regardless of which element is turned for tightening.

D. Install bolts as specified in AASHTO Standard Specifications for Highway Bridges, Division II, Section 11.5.6.4. and in the following procedure.
   1. Complete the *Bolted Field Splice Certification* form at the end of this section as bolt tightening progresses.
   2. Place direct-tension indicator washer where the washers will not be embedded in concrete.
   3. Use drift pins to align bolt holes and maintain dimensions and camber of the member.
   4. Insert bolts in open holes with washers as specified by the manufacturer, and hand tighten.

5. Tighten at least 50 percent of the bolts (more as required) to approximately ½ final tension to draw all plies of the connection into firm contact. Do not tighten any bolts to indicated full tension at this time.
6. Remove drift pins and replace with bolts.
7. Tighten all bolts to full tension. Tighten bolts progressively from fixed or rigid points to the free edges.

E. Store the bolts and nuts in the original containers until used.
1. Protect from dirt and moisture.
2. Remove only as many fasteners from protected storage as can be tightened during a work shift, and return unused fasteners to protected storage at the end of each work shift.
3. Clean and re-lubricate fasteners that accumulate rust or dirt resulting from site conditions.

3.3 WELDING

A. As specified in ANST/AASHTO/AWS D1.5, except as modified by the contract.

B. Field welds must meet the same requirements as shop welds, including inspection by the DEPARTMENT.

C. When AISC Category III is required for the fabrication of the element, all field welding must be done under the fabrication certification.

D. Comply with welding procedures and inspection requirements. UDOT Steel and Concrete Construction Manual.

E. For surface preparation and painting, refer to Section 09970: Painting for Structural Steel.

3.4 BEARINGS AND ANCHORAGES

A. Do not place masonry bearing plates upon bridge seat bearing areas that are improperly finished, deformed, or irregular. Set bearing plates level in exact position with full even bearing.

B. Locate the anchor bolts in relation to the slotted holes in expansion shoes to correspond with the temperatures at the time of erection. Adjust nut-gap on anchor bolts as shown at the expansion ends to permit free movement of the span.

C. Form bridge seat bearing areas and place anchor bolts according to details shown.

END OF SECTION

Bolted Field Splice Certification

Consecutively number splices looking stations ahead and increasing from left to right. Copy this page as required. Initial the appropriate box to certify that the bolt tightening has been done in accordance with the specifications.

Do not perform final tightening until the inspector certifies that plates are drawn into full contact. Do not place concrete deck until the inspector has certified that all bolts are properly tightened.

Prior to the final inspection, send a completed copy of this form to the Chief Structural Engineer, 4501 South 2700 West, Salt Lake City, UT 84119.

Project Number Structure Number

Splice No.	**Top Flange**		**Web**		**Bottom Flange**	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.127 mm.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	**Top Flange**		**Web**		**Bottom Flange**	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.127 mm.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

Splice No.	**Top Flange**		**Web**		**Bottom Flange**	
Plates were drawn into contact with each other before final tightening of any bolts.	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials
Bolts are tightened to spec. (Gap under direct tension indicator is less than or equal to 0.127 mm.)	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials	Contr. Initials	Inspect. Initials

SECTION 05822

EXPANSION BEARINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install expansion bearings, and mating surface.

1.2 RELATED SECTIONS

A. Section 05120: Structural Steel.

1.3 REFERENCES

A. AASHTO Standard Specifications for Highway Bridges, Division II, Section 18.8, and Section 18.10

B. AASHTO M 270: Structural Steel for Bridges.

C. ASTM A 240, Type 304: Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

D. Federal Specifications MMM-A-134:

1.4 DEFINITIONS

A. **Mating surface:** stainless steel sheet welded to the girder sole plate.

B. **Prefabricated expansion bearing:** Polytetraflouroethylene (TFE) sliding surface bonded to the preformed fabric pad.

PART 2 PRODUCTS

2.1 POLYTETRAFLUOROETHYLENE (TFE)

A. Meet AASHTO Standard Specifications for Highway Bridges Division II, Section 18.8.

B. Material composed of either filled or unfilled virgin TFE sheets as specified.

C. Unfilled sheets must have minimum thickness of 0.794 mm, and filled sheets must be 2.5 mm ± 0.25 mm thick.

2.2 STAINLESS STEEL PLATE

A. Meet ASTM A 240, Type 304.

B. Minimum thickness of 6 mm and minimum 508 Fmm (root mean square) mirror-like finish on the side which contacts the TFE.

2.3 ADHESIVE MATERIAL

A. Meet Federal Specifications MMM-A-134.

B. Epoxy resin, FEP film or approved equal.

2.4 PREFORMED FABRIC PAD

A. Meet AASHTO Standard Specifications for Highway Bridges, Division II, Article 18.10.

B. As specified with dimensions in compliance with the plans.

2.5 STRUCTURAL STEEL

A. Painted Structural Steel: As specified. Meet AASHTO M 270, Grade 36 Type steel.

B. Unpainted Weathering Steel for girders: As specified. Meet AASHTO M 270, grade 50W.

C. These standards do not apply to the stainless steel plate.

2.6 MANUFACTURE - EXPANSION BEARINGS

A. The preformed fabric pad must be bonded to the TFE at the bearing manufacturer's factory under controlled conditions and in strict conformance to the adhesive system manufacturer's written instructions.

B. Bond the filled or unfilled TFE to a rigid, confining substrate that limits the flow (elongation) of the confined TFE to not more than 0.229 mm under a load of 14 000 kPa for 15 minutes at 26 degrees C for a 50 mm x 75 mm test sample. **Do not bond the TFE to the preformed fabric pad.**

1. Make the bonded TFE surface smooth and free from bubbles.
2. Polish the filled TFE surfaces.

C. Weld the stainless steel with 3 mm continuous fillet welds to the sole plate.
   1. Do not allow the weld metal to project beyond the plane of the sliding surface.
   2. Use Type 309 electrodes or filler rods.
   3. Use welding procedures compatible with the stainless steel specified.

D. Prevent damage to the sliding surface.

E. Protect stainless steel and TFE sliding surfaces during manufacture, shipment, and erection.
   1. Wipe the sliding surfaces clean immediately before setting the girder in place.
   2. Reject portion of the sliding surfaces damaged by scratches, weld splatter, gouges, or overspray from painting, or other defects.
   3. Replace the damaged units with new units in good condition at no additional cost to the DEPARTMENT.

F. Coefficient of friction between the TFE and the stainless steel not more than 0.10 at 14 000 kPa bearing pressure.

PART 3 EXECUTION Not used.

END OF SECTION

Section added by Supplemental Specification

SECTION 05832

EXPANSION JOINT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing expansion joint systems.

1.2 RELATED SECTIONS

A. Section 05120: Structural Steel.

B. Section 03055: Portland Cement Concrete.

1.3 REFERENCES

A. AASHTO M 270: Structural Steel for Bridges.

B. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

C. ASTM D 240: Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter.

D. ASTM D 395: Rubber Property-Compression Set.

E. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomer-Tension.

F. ASTM D 1149: Rubber Deterioration-Surface Ozone Cracking in a Chamber.

G. Federal Specification TT-S-00230

1.4 DEFINITIONS

A. Expansion Joint System: Extruded neoprene seal element inserted into and bonded to a steel extrusion.

1.5 SUBMITTALS

A. Five copies of shop drawings for all fabricated structural steel materials. For details, refer to Section 05120: Part 1.

PART 2 PRODUCTS

2.1 JOINT SYSTEMS LIST

A. Select an expansion joint system from the DEPARTMENT's approved list of joint systems, available from the Structures Division , 4501 South 2700 West, Salt Lake City, UT 84119.

2.2 STRUCTURAL STEEL

A. As specified.

B. Steel Extrusion: Meet AASHTO M 270, Grade 50W.

C. Plates and Round Bars: Meet AASHTO M 270, Grade 36

D. Lubricating Material: Meet Federal Specification TT-S-00230.

E. Neoprene Gland: Single convolution type with physical properties that comply with the following requirements:

Table 1

Property	Requirements	ASTM
Tensile Strength, min. kPa	14 000	D 412
Elongation @ Break, min. percent	250	D 412
Hardness, Type A Durometer (Modified)	(55 ± 5)	D 240
Compression Set, 70 hours @ 100 EC Method B (Modified)	40%	D 395
Oven Aging, 70 hours @ 100 EC Tensile strength, loss, max. Elongation, loss, max.	 20% 20%	
Hardness, Type A Durometer (Points change)	0 to + 10	
Oil Swell, ASTM Oil 3, 70 hours @ 100 EC Weight Change, max.	 45%	
Ozone Resistance 20% Strain, 300 pphm, in air @ 40 EC (wiped with toluene to remove contamination)	 No cracks	 D 1149

2.3 RIGID PLASTIC FOAM

A. Any preformed, extruded, cellular polystyrene thermal insulation material that has a water absorption property of 0.3 or less.

B. Meet ASTM C 578.

2.4 FABRICATION - EXPANSION JOINT

A. Comply with Section 05120, Part 2, paragraph: Fabrication, except that AISC, Category I certification or the DEPARTMENT's Quality Certification program is acceptable.

2.5 SOURCE QUALITY CONTROL - EXPANSION JOINT

A. After fabrication of the expansion joint and anchorage system, examine the gland face and top of the extruded steel shape of each section for straightness. Use a string line stretched taut from curb point to curb angle point or necessary construction joint end.

B. Shop Tolerances: Steel surfaces must not deviate in straightness by more than 3 mm. When string line is stretched between either end and the point of maximum departure from true, the surface must not deviate more than 2 mm.

PART 3 EXECUTION

3.1 INSTALLATION OF EXPANSION JOINT SYSTEM

A. Install expansion joint system using manufacturer's recommendations. A factory-trained representative must be present during setting of the system, placement of concrete, and installation of the neoprene seal element.

B. Joint Width:
   1. Form the joint width using rigid plastic foam as shown on the plans. Anchor securely.
   2. Maintain separation of sections by placing rigid plastic foam between sections of the concrete parapet.

C. Joint Gland:
   1. Install the gland after the complete steel extrusion installation to ensure that the length of the joint has a continuous seal, except as noted in the plans.
   2. Lubricate the steel extrusion cavity before installing the neoprene gland.
   3. Remove the foam used to form the joint opening and any other objects that may interfere with the installation and operation of the gland so the gland convolution hangs freely after installation.

3.2 FIELD QUALITY CONTROL

A. Test expansion system to verify that joint areas can hold water for two hours without leakage.

B. If leaking occurs during testing, remove any leaking seals, clean steel extrusion grooves, and install new seals.

C. Field Tolerances for Expansion Joint: Re-examine steel surfaces again for straightness and shop tolerance requirements after installing joint system in its final position and before placing concrete.

D. Final In-place Tolerances for Expansion Joint:
   1. Re-examine the extrusion gland face again after concrete placement. Deviations from the string line of more than 6 mm are not allowed. The parallel extrusion faces must not deviate from each other by more than 3 mm at any location.
   2. Finish the top of the extrusion to the grade requirements of the concrete or bituminous material being placed on the bridge deck.

END OF SECTION

DIVISION 6 - WOOD AND PLASTICS

SECTION 06055

TIMBER AND TIMBER TREATMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Timber for signs, guardrails, and posts, and the preservative treatment for timber.

1.2 REFERENCES

A. AASHTO M 133: Preservatives and Pressure Treatment Processes for Timber.

B. AASHTO M 168: Wood Products.

C. AASHTO Standard Specifications for Highways and Bridges.

D. American Wood Preservers' Association (AWPA) Standard Grading Rules.

E. Western Wood Products Association (WWPA)Standard Grading Rules.

PART 2 PRODUCTS

2.1 STRUCTURAL TIMBER, LUMBER

A. As specified in AASHTO M 168.

B. Treat if required following AASHTO M 133.

2.2 POSTS

A. Wood posts that comply with the current AWPA Standard Grading Rules.

B. Pressure treated.

C. Sign posts:
   1. Use only one type of wood species on any one project.
   2. S4S, 80 percent FOHC, Douglas Fir-Larch, Grade No. 2 or better.
   3. Hem-fir, Lodgepole Pine, or Ponderosa Pine, Grade No. 1 or better.

D. Guardrail Post:
   1. Surfaced or rough-sawn posts and offset blocks.

2. Use only one species of wood on any one project.
3. Douglas Fir-Larch, Hem-Fir, Lodgepole Pine, or Ponderosa Pine.
4. Grade No. 1 or better.

E. Steel Post with Wood Block:
1. Routed wood offset block of Southern Yellow Pine.
2. Surfaced or rough sawn blocks.
3. Grade No. 1.

F. Mailbox Post: Provide new material for post, shelf, and brace.
1. Sound fir, hemlock, or pine.
2. Free from all decay, splits, or other defects that would weaken the material.
3. Dimensions as shown on the plans.

2.3 TREATMENT

A. Meet AASHTO Standard Specifications for Highway Bridges and AASHTO M 133.

B. As specified. Use pentachlorphenol, ammoniacal copper arsenite, or chromated copper arsenate, Type A or B, whichever is compatible with the timber.

C. Use rodent-repellent treatment for any timber in contact with the ground.

D. Apply salt treatment to mailbox post and lumber requiring painting.

PART 3 EXECUTION Not used.

END OF SECTION

DIVISION 7 - THERMAL AND MOISTURE PROTECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

DIVISION 8 - DOORS AND WINDOWS

NOT USED BY UDOT

DIVISION 9 - FINISHES

SECTION 09972

PAINTING FOR STRUCTURAL STEEL - See Supplemental

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prepare and paint all surfaces except where indicated otherwise.

1.2 REFERENCES

A. ASTM E 11: Wire Cloth and Sieves for Testing Purposes.

B. Federal Standard No. 595: Color.

C. SSPC-SP 6: Commercial Grade Blast Cleaning.

D. SSPC-SP 10.

E. SSPC-PA 1-64.

F. SSPC Paint Application Guide No. 3: "A Guide to Safety in Paint Application."

1.3 SUBMITTALS

A. Detailed plan for approval for protection methods that includes Environmental Protection.

B. Source and gradation of the sandblast abrasive.

C. Type and source of solvent, if required.

D. Manufacturer's information regarding the specified coating materials, including:
   1. Required wet- and dry-film thickness
   2. Project safety data
   3. Thinning recommendations
   4. Temperature requirements
   5. Profile recommendations
   6. Mixing and application procedures
   7. Required equipment

E. Test samples as required.

1.4 SAMPLES

A. DEPARTMENT will test samples from each batch or lot of paint using infrared and gas chromatography techniques prior to use.
   1. Submit samples to UDOT's Central Chemistry Lab.
   2. Paints must match the spectrum samples on file in the UDOT Central Laboratory.

B. Reject paint that does not match the standard.

1.5 PAINTER AND SANDBLASTER QUALIFICATIONS

A. Individuals who perform painting and sandblasting must be evaluated by the DEPARTMENT, except for shop painting or sandblasting.
   1. They will be judged on their ability to prepare the surface and to apply specified coatings with the proper tools and equipment.
   2. Lack of proper tools or equipment is cause for disqualification.

B. Coating application evaluation
   1. Establish a test area about 10 m^2 as determined by the DEPARTMENT.
   2. Apply the coating using the technique and the application equipment that are consistent with the specified coating materials and with the paint manufacturer's recommendations.
   3. Prepare the surfaces of the test area according to the project specifications. The painter's ability to apply the specified coating to a uniform dry-film thickness will be judged.
   4. Treat primer, intermediate, and finish coats as separate applications, waiting the specified drying time before inspecting each completed coat.
   5. Painter, sandblaster, or both should consult with the manufacturer for answers to technical questions relating to the application of specified coating materials.
   6. Painter must be familiar with specified coating material and acceptance criteria, and be aware of any difficulties in applying the coating to any specified surface.
   7. Obtain surface preparation approval from the inspector before applying paint.
   8. Take dry-film thickness readings on all portions of the test area including nuts and bolts.
   9. Disqualification will result from inadequate surface preparation, improper profile, runs, sags, overspray, thin film thickness, excessive film build, uneven coating, nonuniform color, improper curing, or any other defect in the coating system.
   10. Qualification may be withdrawn any time the qualifying inspector has reasons to question the performance of the painter, sandblaster, or the equipment.
   11. The disqualified person or equipment may be required to re-qualify or be removed from the project site at the option of the ENGINEER.
   12. To requalify:

c. ENGINEER may accept the qualifications of a sandblaster or painter who has been qualified on a previous DEPARTMENT project within one year.

d. The sandblaster, painter, or both must re-qualify if any material or equipment changes are made from the original qualification.

C. Painter provides:

1. Coating materials properly mixed meeting the manufacturer's recommendations and project specification.
2. Necessary equipment for properly applying the specified coating.
3. Practice area outside the project limits to adjust and test the equipment before performing the test.
4. Safety and equipment as specified in SSPC Paint Application Guide.
5. Wet- and dry- film thickness gauges for testing the coating thickness during and after application.

PART 2 PRODUCTS

2.1 MATERIALS

A. Select a complete coating system from the Produce Acceptability Listing available from the Research Division (4501 South 2700 West, Salt Lake City, UT 84119).

B. Use paint color No. 26293 for the first field coat and No. 26306 for the top coat as per Federal Standard 595.

PART 3 EXECUTION

3.1 INSPECTION

A. ENGINEER will examine surfaces prior to surface preparation and prior to application of each succeeding coating. Correct any condition that may potentially affect proper surface cleaning or coating application.

B. Provide safe access to permit inspection of the steel before and after painting. Use rubber rollers or other approved protective devices for scaffold fastenings. Do not mar or damage freshly coated surfaces.

3.2 PREPARING SURFACES

A. Painted steel: Clean surfaces with clean petroleum solvents and then blast clean to a near-white following SSPC-SP 10. Use clean oil-free air.

1. Grind off all fins, tears, slivers, and burred or sharp edges present on any steel member, or those that result from the blasting operation.

a. Reblast where needed.
b. Remove heavy scale.
c. Do not scar metal.
d. Produce a 0.05 mm uniform profile.

2. Remove all abrasive and paint residue using either a commercial vacuum cleaner or by double blowing.
   a. Equip commercial vacuum cleaner with a brush-type cleaning tool.
   b. Double blowing: vacuum the top surfaces of all structural steel, including top and bottom flanges, longitudinal stiffeners, splice plates, hangers, etc., after the double-blowing operations are completed.
3. Keep the steel dust-free and prime within 24 hours after cleaning. Reblast to a near-white condition if any rust is visible before priming.
4. Protect freshly coated surfaces from subsequent blast-cleaning operations.
   a. Repair surface if damaged.
   b. Mask all areas requiring field welding before shop painting.
5. Have the surfaces inspected and approved by ENGINEER or Construction and Materials Division respresentative of DEPARTMENT before applying shop coat.
6. Apply the shop coat at the fabrication site.

B. Field painting:
1. Repair all damage to shop coat that occurs during shipping, handling, and erection.
2. Power wash steel without the field coat to remove contaminants or other foreign matter from the primed surface.
3. Blast clean any rusted areas to a near-white finish. Thoroughly clean the coating surrounding the blasted area and re-prime using the same paint and the same dry-film thickness specified for the shop coat. (SSPC-SP 10)
4. Remove all concrete drippings, abrasive and paint residue. If using double blowing, vacuum the top and bottom flanges, splice plates, longitudinal stiffeners, hangers, etc., after completing double-blowing operations.
5. Allow the touch-up coat to dry at least 2 days before applying the field coats.

C. Weathering steel:
1. Construct so that erection marks on the steel are not visible after the structure is completed.
2. Commercially sandblast all faying surfaces according to the specification standards. Meet SSPC-SP6.
3. Blast clean the following surfaces after the deck concrete is placed to specified surface finish:
   a. Underside of the exterior portion of the top flange, and underside of all bottom flanges.
   b. The exterior portion of web.
   c. Top side and outside edge of the exterior portion of the bottom flange.

3.3 PREPARING PAINT MATERIALS

A. Mix and thin paint materials per manufacturer's product data sheets for both shop and field painting. If weather conditions require paint thinning, follow manufacturer's recommendations.

B. Mix the paint to a lump-free consistency with a high shear mixer (such as a Jiffy mixer), according to the producer's directions.
   1. Do not use paddle mixers or paint shakers.
   2. Keep paint in the original containers
   3. Mix until all the metallic powder or pigment is suspended, and until all paint solids that may have settled to the bottom of the container are thoroughly dispersed.

C. Strain the paint through a screen having openings no larger than those specified for a 300 Fm sieve per the material standard. ASTM E 11.

D. After straining, continuously agitate the mixed material up to and during the time of application.

3.4 APPLYING PAINT

A. Apply each coat at proper consistency and thickness, and in accordance with the manufacturer's recommendations, including field coating. When using spray nozzles, use pressures recommended by the producer of the coating system.

B. Produce a uniform, even coating that bonds to the underlying surface. Follow SSPC-PA 1-64.

C. Apply field coats at the construction site after steel erection work is completed.
   1. Do not apply field coats until ENGINEER approves the surface.
   2. Dry-film thickness of the first field coat should be greater than 0.10 mm.
   3. Keep the dry-film thickness of the top coat greater than 0.05 mm.

D. Weather:
   1. If weather conditions require paint thinning, follow the manufacturer's recommendations.
   2. Temperature of the air and the steel must be above 4 degrees C, but not so hot as to cause the paint to blister.
   3. Relative humidity must be less than 85 percent or the combination of temperature, and humidity conditions must inhibit surface condensation.
   4. Test humidity by applying a thin film of water to a small area. If the film evaporates with 15 minutes, the surface may be painted.

E. Scrape any shop coat that produces “mud-cracking” or adds more than 0.18 mm to a soundly bonded coating or bare steel.

F. Thoroughly clean areas having deficient primer thickness to remove all dirt.

G. Apply a top coat to any surface at the fabrication site that will be inaccessible for painting after field erection.

H. Do not load material for shipment until shop paint is dry to the touch, and until the UDOT inspection sticker is placed on the member by the inspector. Remove sticker before final inspection.

3.5 PROTECTION

A. Suspend work if protection is unsatisfactory.

B. Protect pedestrian and vehicular traffic.

C. Protect from splatter, splashes and overspray all portions of the structures that are not to be painted including superstructure, substructure, slope, and highway appurtenances. Protect where other damage during painting and blast cleaning operations could occur.

D. Use barriers during any blast-cleaning operations to protect pedestrians and vehicles, and to prevent spreading or falling of abrasive materials and debris on the traveled portions of the pavement. Remove any abrasive materials and debris on pavement, shoulders, or slope paving before reopening work areas to traffic.

E. Provide employees performing the blast-cleaning operations air-supplied sandblasting hoods approved by the US Bureau of Mines.

F. Minimum requirements for the air supply system:
   1. Airline filter, pressure-reducing valve with gauge, and pressure release valve.
   2. Do not allow the air supply to be contaminated with harmful materials or elements.

3.6 FIELD QUALITY ASSURANCE

A. Minimum Coating Thickness: Apply two or more coats if the required film thickness cannot be obtained by one coat without producing runs, bubbles, or sags.

END OF SECTION

Section added by Supplemental Specification

Section added by Supplemental Specification

DIVISION 10 - SPECIALTIES

NOT USED BY UDOT

DIVISION 11 - EQUIPMENT

NOT USED BY UDOT

DIVISION 12 - FURNISHINGS

NOT USED BY UDOT

DIVISION 13 - SPECIAL CONSTRUCTION

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

Section added by Supplemental Specification

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DIVISION 14 - CONVEYING SYSTEMS

NOT USED BY UDOT

DIVISION 15 - MECHANICAL

NOT USED BY UDOT

DIVISION 16 - ELECTRICAL

SECTION 16135

ELECTRICAL JUNCTION BOXES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical junction boxes and extensions, including maintenance markers.

1.2 RELATED SECTIONS

A. Section 02061: Select Aggregate.

B. Section 02842: Delineators.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 183M: Structural Steel. (Metric)

C. ASTM D 256: Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.

D. ASTM D 543: Evaluating the Resistance of Plastics to Chemical Reagents.

E. ASTM D 635: Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.

F. ASTM D 638: Tensile Properties of Plastic.

G. ASTM D 648: Deflection Temperature of Plastics Under Flexural Load.

H. ASTM D 790: Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

PART 2 PRODUCTS

2.1 PLASTIC JUNCTION AND PULL BOXES

A. Plastic body and cover meeting the physical and chemical requirements listed in Table 1 and the following:

1. All components constructed of a high density polyethylene with ultraviolet inhibitors.
2. Non-skid surface on lid required.
3. Vandal resistant recessed bolts.
4. Capacity to support a 160 mm diameter load of 2270 kg with a maximum lid deflection of 25 mm.
5. Withstand a 3600 kg wheel load without cracking.

B. Minimum wall thickness of 6.25 mm.

C. Self-extinguishing when tested by the industry standard. ASTM D 635.

D. Show no appreciable change in physical properties when exposed to the weather.

Table 1

Properties	ASTM Test	Value
Tensile Strength	D 638	29 650 kPa
Flexural Modulus	D 790	1310 MPa
Defection Temp @ 455 kPa	D 648	74 degrees C.
Notched Impact	D 256	0.107 N@m/mm
Effect of Acids	D 543	Very Resistant
Effect of Alkalies	D 543	Very Resistant

E. Mark the junction box lid in the logo area with 25 mm letters:
1. "Traffic Signal" when the junction box contains traffic signal conductors with or without street lighting conductors.
2. "Street Lighting" when the junction box contains street lighting conductor only. Inscribe "High Voltage" below the words "Street Lighting" when the junction box contains voltage above 600 V.
3. "Communication" when the communication conduit is in the junction box.
4. "Sprinkler Control" when the sprinkler control conduit enters the junction box.
5. "Count Station" when the traffic count station conduit enters the junction box.

F. All ferrous metal parts: minimum chromium content of 18 percent and a minimum nickel content of 8 percent.

2.2 STEEL JUNCTION BOX

A. Provide galvanized steel junction box with welds as specified.

B. Meet requirements of:
   1. AASHTO M 183M
   2. AWS D 1.5
   3. AASHTO M 111

2.3 DUCT CAULKING

A. For junction boxes: waterproof, rodent proof, non-corrosive, non-oxidizing, and non-hardening when subject to temperatures ranging from -25 degrees C to 65 degrees C.

2.4 MAINTENANCE MARKERS

A. At junction box.

B. Steel posts: Refer to Section 02842.

2.5 BACKFILL

A. Free draining granular backfill borrow. Refer to Section 02061.

PART 3 EXECUTION

3.1 INSTALLATION

A. Place the top of junction boxes flush with adjacent surface.

B. Junction box and extension:
   1. Holes drilled in junction box must not be more than 6 mm larger than conduit diameter. Seal conduit ends inside all non-metallic junction boxes with at least 50 mm thick duct caulking after wires are installed.
   2. Hand tamp the backfill material around the junction box. Match the top 100 mm to the composition, density, and elevation of the surrounding surface.

END OF SECTION

SECTION 16525

HIGHWAY LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing lighting for highway, understructure, sign, bridge, parking lot, and other lighting systems.

1.2 RELATED SECTIONS

A. Section 00727: Control of Work.

B. Section 02741: Hot Mix Asphalt.

C. Section 02842: Delineators.

D. Section 02892: Traffic Signal.

E. Section 03055: Portland Cement Concrete.

F. Section 03211: Reinforcing Steel and Welded Wire.

G. Section 03575: Flowable Fill.

H. Section 09972: Painting for Structural Steel.

I. Section 05210: Structural Steel.

J. Section 16135: Electrical Junction Boxes.

1.3 REFERENCES

A. American Wire Gauge

B. American Iron & Steel Institute (AISI) Type 201: Stainless Steel

C. ANSI/UL 467

D. ANSI/UL 486A

E. ANSI 136.10, NEMA Base

F. ANSI C80

G. ANSI C82.4, C82.6 & C92.1

H. ANSI/IEEE C37.13. C37.27 and C62.41; Relays

I. ANSI C57.12.25. And C57.27 NEMA 260 (Cabinet): Substation

J. ANSI/UL 1029

K. AASHTO Standard Specification Structures Supports for Highway Signs, Luminaires, and Traffic Signals (current edition)

L. AASHTO M 111: Zinc (Hot-dipped Galvanized) Coatings on Iron and Steel Products.

M. AASHTO M 183: Structural Steel.

N. ASTM A 123 (Cabinet): Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

O. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

P. ASTM A 570, Grade 33: Steel, Sheet and Strip, Carbon Hot-rolled Structural Quality.

Q. ASTM A 576: Steel Bars, Carbon, Hot Wrought, Special Quality.

R. ASTM B 3: Soft or Annealed Copper Wire.

S. ASTM B 8: Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

T. ASTM B 117: Operating Salt Spray (Fog) Apparatus.

U. ASTM B 209: Aluminum and Aluminum-Alloy Sheet and Plate. (Alloy 5052-H38).

V. ASTM B 766: Electrodeposited Coatings of Cadmium.

W. Insulated Power Cable Engineers Association (IPCEA) Standards

X. ITE/ANSI Lamp Codes: I, M, H, and S

Y. NEC 250-1.

Z. NEMA 3R K91, Type HD.

AA. NEMA 3R, Type 4.

BB. NEMA FAI 1973R1979: Understructure, sign bridge luminaire

CC. NEMA TC-2/TC-3 UL Listed

DD. NEMA WC7:

EE. NFPA 70: National Electric Code.

FF. Standard Specifications for Construction and Bridges on Federal Highway Projects FP-92 type III Flexible.

GG. UL: Underwriters' Laboratories, Inc.

HH. UL Class CC, RK5, R, and 1572.

II. UL E-50076.

1.4 SUBMITTALS

A. Samples of all materials.

B. Wiring schematics, detailed shop drawings, and certifications within 15 calendar days after receiving the Notice to Proceed.

C. Manufacturer's warranties, guarantees, instruction sheets, and parts lists.

D. List of equipment and materials including name of manufacturer, size, and identification numbers. (Within calendar 15 days after receiving the Notice to Proceed).

1.5 QUALITY ASSURANCE

A. Electrical components must conform to the requirements of the National Electrical Code. (NEC)

PART 2 PRODUCTS

2.1 MATERIALS

A. Wire and Cable: As per American Wire Gauge.

B. Conductors:

1. Wire up to 600 V: Single-conductor, copper cable with cross-link polyethylene insulation per ASTM B3 and B8, RHH-USE-RHW, as specified.
2. Cable above 600 V: Conform to NEMA WC7. Single-conductor, stranded copper with full concentric neutral as specified.

C. Ground wire: Bare, soft-drawn copper wire per NEC 250-1, as specified.

D. Ground Rod: Copper-coated steel per ANSI/UL 467, as specified.

E. Insulation: RHH-USE-RHW grade cross link polyethylene compound.

F. Splicing: Compression splice compatible with individual cable insulation and water seal for underground use. Comply with UL code.

G. Conduit: as indicated.
1. Schedule 40 PVC and 80 PVC conduit and fittings rated at 90 degrees C as specified. NEMA TC-2/TC-3 UL.
2. Galvanized rigid steel conduit and fittings as specified. Meet ANSI C80.

2.2 JUNCTION BOXES

A. Refer to Section 16135.

2.3 POWER CABLE ROUTE MARKER

A. Meet ASTM B 29, alloy 5052-H38. 2 mm thick sheet aluminum as specified.

B. White and red enamel paint: Refer to Section 09972.

C. Mounting hardware: Refer to Section 05120.

D. Flanged channel mount post: Refer to Section 02842.

2.4 SPLICE, MOLDED CONNECTOR, AND FUSE HOLDER

A. Use individually insulated and water sealed compression splice.

B. Use spring-loaded, molded connector and fuse holder with 90 percent minimum conductivity as per ANSI/UL 486A, as specified.

2.5 FUSE

A. 600 V current limiting with 200 000 A interrupting rating. Meet UL Class CC.

B. Light pole fuses with rating according to Table 1.

Table 1

Voltage	Wattage	Current (Amps)
120	250/400	20
208/240	250/400	15
277/480	250/400	10

C. Lighting Circuit Fuses: Meet UL Class RK5, as specified.

D. Service Disconnect Fuses: Meet UL Class R, as specified.

2.6 POLES - GENERAL

A. Use tapered steel poles per Standard Drawings 755-1, 755-2 and 755-6, and AASHTO Standard Specifications Structural Supports for Highway Sign, Luminaires and Traffic Signals (current edition).

B. Galvanized per ASTM A 123, as specified.

C. Performance criteria:
1. Wind load: 130 km/h wind with 170 km/h gusts.
2. Designed for luminaire weight of 35 kg with projected area of 0.3 m^2.
3. Maximum allowable deflection of 120 mm (Deflection criteria is based on a 445 N. horizontal load applied at 150 mm below shaft top).

D. Pole designated for decorative lighting:
1. Provide a festoon outlet located 5 m from the base plate with duplex receptacle and weather-proof cover.
2. As per UL Listed.

E. Light Pole Numbers:
1. 100 mm series C legend, green reflectorized sheeting as specified.
2. Meet Standard Specification for Construction and Bridges on Federal Highway Projects, FP-92 type III Flexible.

F. Foundation:
1. Concrete: A(AE). Refer to Section 03055.
2. Coated reinforcing steel. Refer to Section 03211.
3. Anchor bolts: Galvanized steel per ASTM A 307 and ASTM A 123.

2.7 POLES - MOUNTING HEIGHT UNDER 14 M

A. Allowable stresses for steel, as specified, except increased 40 percent for Group II and Group III loading. Meet ASTM A 570, Grade 33.
   1. F_b = 150.17 MPa (0.66 F_y)
   2. F_v = 75.08 MPa (0.33 F_y)

B. Breakaway base: Standard Drawing 755-2.

C. Steel Base Plate: Type NS.

D. Anchor bolts:
   1. Meet ASTM A 307 and A 123.
   2. Minimum yield strength of 330 MPa, as specified.

E. Slip bolts:
   1. Cadmium-plated. Type NS.
   2. With nuts and washers.

2.8 POLES - MOUNTING HEIGHT OVER 14 M (HIGH MAST)

A. Allowable steel stresses as specified. Meet ASTM A 570, Grade 33.
   1. F_b = 150.17 MPa(0.66 F_y)
   2. Fv = 75.08 MPa (0.33 F_y)

B. Steel base-plate. ASTM A 570, Grade 36, as specified.

C. Anchor bolts: Minimum yield strength of 380 MPa as per ASTM A 576, as specified.

D. High mast service hoist assembly:
   1. Head frame: zinc, electroplated with yellow chromatic dip after fabrication, and a head frame cover of spun aluminum, and with 6 each 127 mm cast aluminum hoist cable sheaves with oil-impregnated, sintered-bronze bushings with stainless steel shaft.
   2. Aircraft cables: 3 each stainless steel 7 x 19 strand (minimum 4.76 mm).
   3. Latch shaft, cam, and hardware: stainless steel.
   4. Luminaire support ring: minimum 7-gauge galvanized steel; rising rate of at least 3.5 m/min.
   5. Power cable sheaves: minimum 150 mm diameter, brushed with oil-impregnated, sintered-bronze bushings with a stainless steel shaft.
   6. Centering arm: roller-contact, spring-loaded, water-resistant, non-marking roller on stainless steel shaft.
   7. Winch: worm-gear driven, self-locking, with reversing electric motor.

E. Portable drive unit, UL Listed as heavy duty, reversing, with torque limiter, and 125 V transformer.

2.9 LUMINAIRE

A. As specified, with die cast aluminum top housing, pre-wired integral ballasts with quick disconnect plugs mounted for ease of removal.
   1. Reflectors, sockets, mounting cradles, and clamps fitted to upper housing.
   2. Optical assembly: formed aluminum reflectors with a chemically bonded, non-breakable, glass finish.
   3. Adjustable mogul base sockets: split-shell, tempered-brass, lamp grips, free-floating, spring-loaded, center contacts, and heat- and impact-resistant glass prismatic refractors.
   4. Weight: No more than 35 kg, with a projected area of not more than 0.3 m^2.
   5. Mounting adjustment: Not less than 10 degrees above a horizontal position on reflector and refractor, and not less than 5 degrees of adjustment from a vertical position on the bracket arm.
   6. Glare shields: Steel or aluminum, when indicated on the plans.

B. High mast luminaire: UL 1572, and as specified.
   1. Symmetrical or asymmetrical with the asymmetrical capable of a 360 degrees rotation.
   2. Cast aluminum ballast, slipfitter mounts with adjustment of at least 3 degrees.
   3. Optical assembly: Enclosed and filtered, with heat and impact resistant tempered glass lens.

C. Understructure luminaire: NEMA FA1-1973R1979, and as specified.
   1. Specifically designed for understructure application.
   2. Die-cast aluminum housing, vandal-proof fastener, integral ballast.
   3. Optical assembly: heat- and impact-resistant, tempered glass lens, stainless steel lens guard.
   4. Adjustable sockets for minimum 60-degree beam angle.

D. Sign bridge luminaire: NEMA FA1-1973R1979, and as specified.
   1. Die-cast aluminum housing, die-cast aluminum door and integral glare shield, single piece, closed-cell gasket. Immunity to rain and snow damage.
   2. 30 mm conduit clamp support.
   3. Refractor: shock-and thermal-resistant, borosilicate, prismatic. Designed specifically for sign illumination.
   4. Integral ballast.

2.10 LUMINAIRE BALLASTS

A. Meet ANSI C82.4, C82.6 and C92.1; and ANSI/UL 1029.

B. High pressure sodium ballast.

1. Power Factor: must maintain 90 percent for nominal secondary load, and a least 70 percent for any 10 percent voltage variation.
2. Lamp Wattage: maintain no more than 5 percent variation.
3. Regulation: maintain no more than 35 percent for 10 percent line-voltage variation.
4. Must start and operate at the rated lamp wattage at ambient temperatures down to -40 degrees C for the rated life of the lamp.
5. Must sustain lamp operation for a minimum of 4 seconds at a voltage dip of 35 percent.

C. Mercury and Metal Halide Ballast.

1. Power Factor: minimum of 90 percent for a 10 percent voltage variation.
2. Lamp Wattage: no more than 5 percent variation.
3. Regulation: maintain no more than 30 percent for 10 percent line-voltage variation.
4. Must start and operate at the rated lamp wattage at ambient temperatures down to -25 degrees C for the rated life of the lamp.
5. Must sustain lamp operation for a minimum or 4 seconds at a voltage dip of 40 percent.

2.11 LAMP

A. Heavy duty, long life incandescent (I) lamp, as specified. Meet ITE/ANSI lamp codes: I, M, H, and S.

B. Phosphor-coated mercury (M) lamp that uses or has:

1. Apparent color temperature of 3300 K.
2. CIE chromaticity of X = 0.410, Y = 0.385.
3. Rated life of no less than 24 000 hours at 10 hours per start-up.

C. Phosphor-coated metal halide (H) lamp that uses or has:

1. Correlated color temperature of 3800 K.
2. CIE chromaticity of X = 0.390, Y = 0.388.
3. Rated life of no less than 15 000 hours at 10 hours per start-up.

D. Clear high pressure sodium (S) lamp that uses or has:

1. Apparent color temperature of 2100 K.
2. CIE chromaticity of X = 0.512, Y = 0.420.
3. Rated life of no less than 24 000 hours at 10 hours per start-up.

2.12 SERVICE DISCONNECT SWITCH

A. Meet NEMA 3R K91, Type HD.

B. 100 A Service disconnect switch with padlock, as specified.

C. Circuit Breaker
   1. 10 000 A interrupting rating for 240 V.
   2. 5 000 A interrupting rating for 480 V.

2.13 CONTROL EQUIPMENT

A. Photocell control units.
   1. Meet ANSI 136.10, NEMA Base.
   2. Solid state photo cells that match input voltage, minimum 1800 VA capacity.
   3. Crystal sensing devices with inverted turn-on and turn-off features.
   4. Fail safe in the "on" position. Turns on at 32 Lx ± 10 percent.
   5. Dedicated, inverted, control circuits with turn-off values of 19 lx ±25 percent.
   6. Time delay range of 5 seconds to 10 seconds.
   7. Minimum 320 J metal oxide varistor lighting arrestors.
   8. Secondary sensor diodes and transient filters.
   9. Flame-retardant, high-impact covers, and acrylic windows with ultra-violet stabilizers.
   10. Clip voltage at 400 V.

B. Lighting contactor:
   1. Hermetically sealed, steel tube mercury contacts.
   2. Manually operated, mechanically held contact.
   3. Remote, or photoelectric-operated, magnetic, electrically held contactor.
   4. Three-position slide selector with "on-off-auto" switch.

C. Control Relay: Meet ANSI/IEEE C37.13, C37.27 and C62.41.
   1. Contact rating of 3,000 W minimum.
   2. Normally open.
   3. Multiple relay: Zinc/di-chromate-plated magnet; Class B insulation rating coil; Cadmium oxide contact, dual expulsion gap lightning arrester; valve type line arrester with no less than 650 V rating.

D. Enclosure: NEMA 3R Type 4. Encase in a cabinet with padlock as specified.

E. Circuit breaker UL rated at:
   1. 240 V at 10 000 A interrupting rating.
   2. 480 V at 5000 A interrupting rating.

2.14 SUBSTATION

A. ANSI C57.12.25 and C57.27 NEMA 260 (cabinet) as specified.

B. 480 V secondary power, IOCA oil coolant, 65 degrees C temperature rise, 60 Hz frequency, ±2 ½ percent voltage compensation taps.

C. Foundation: Follow Standard Drawing 755-3.

2.15 UNDERGROUND SERVICE PEDESTAL

A. Meet ASTM B 117, A 123 (cabinet), UL E-50076 as specified.

B. Galvanized Steel: Enclosure 3 mm, covers 2 mm. Meet ASTM A 123.

C. Bottom access opening; detachable, pad mount base; baffled ventilation louver.

D. Paint: Meet ASTM B 117. Environmental green, baked enamel over zinc-chromate primer as specified.

E. Circuit Breaker: Main, with six space metered bus and six space unmetered bus.

F. Meter socket with safety socket test blocks.

2.16 CONCRETE

A. Concrete: Class A(AE) per Section 03055.

B. Asphalt Concrete: Refer to Section 02741.

C. Flowable Fill: Refer to Section 03575.

2.17 HARDWARE

A. Screws: Stainless steel.

B. Nuts, bolts, and washers:
   1. Galvanized: ASTM A 123.
   2. Cadmium-plated: ASTM A 165.
   3. Type NS, as specified.

C. Mounting bands and buckles: stainless steel, 19 mm wide, from 0.50 mm to 0.56 mm thick that meets AISI, Type 201.

D. Padlock: Master, No. P-848.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate utility locations. Refer to Section 00727, paragraph: Cooperation with Utilities.
   1. Contact the appropriate power company at least 30 days before the desired connection date.
   2. Verify the exact location, voltage, procedures, and material required by the appropriate power company.

B. Saw cut concrete or other improved surface that requires removal in the sidewalk area. Replace with in-kind material to match the existing grade.

C. Load, transport and install State-furnished material.

3.2 POLE FOUNDATION

A. Construct foundation following Standard Drawings 755-1 and 755-6.

B. Do not weld reinforcing steel, conduit, or anchor bolts.

C. Tie reinforcing steel and conduit securely in place.

D. Place the concrete directly into the excavation. Use minimum forming.

E. Align and secure anchor bolts or extensions with a template.

3.3 CONDUIT TRENCHING

A. Refer to Section 02892, Part 3, paragraph: Trench for Conduit.

B. Conduit offset from roadway by more than 6 m may be installed by plowing.

C. Installing high voltage power cable (exceeding 600 V);
   1. Trench should be no more than 460 mm wide and at least 1 m deep.
   2. Place 75 mm of sand in the bottom of trench before installing cable.
   3. Cover the power cables with at least 150 mm of sand.

3.4 INSTALL CONDUIT

A. Refer to Section 02892, Part 3, paragraph: Install Conduit.

3.5 INSTALL WIRING

A. Refer to Section 02892, Part 3, paragraph: Install Wiring, items A-E.

B. Install molded connectors on the cable so that the load side will retain the fuse when it is disconnected at the cable's breakaway point.

C. When splicing, use compression or split bolt, and waterproof as specified, meeting UL Listed.

D. When using 600 V or higher power cable:
   1. Provide a manufacturer's certified plot of X.Y. partial discharge.
   2. Perform a high-voltage DC field test per the industry standard before connecting to the high voltage power source.
   3. Must meet Insulated Power Cable Engineers Association (IPCEA) standards.

3.6 INSTALL CONDUCTOR

A. Install wiring in accordance with the appropriate articles of NFPA 70. Neatly arrange wiring within cabinets, junction boxes, etc.

3.7 INSTALL LUMINAIRES AND BALLASTS

A. Immediately prior to installation, clean all light control surfaces, refractors, and reflectors to provide the maximum lumen output possible. Clean in accordance with the luminaire manufacturer's recommendations.

B. Adjust luminaires with a level.

C. Adjust sign bridge luminaires for optimum and uniform light distribution.

D. High mast luminaire:
   1. Employ a representative from the luminaire company to optimize the light pattern.
   2. Obtain manufacturer's certification that the service hoist operation is correctly installed.

3.8 INSTALL POWER SOURCE CONNECTION

A. Install the grounded neutral conductor from secondary power source to the switch box.

B. Install mounting bracket within 300 mm of both top and bottom of the switch box and within 1 m of other cabinet or fitting.

C. Provide and install material required by the appropriate power company.

D. Install padlock on the switch box door and handle.

3.9 INSTALL SUBSTATION

A. Follow Standard Drawing 755-3.

B. Locate foundation in a well-drained area.

C. Dig a trench and backfill for the primary power cable.

D. Install padlocks on doors.

3.10 PHOTO-ELECTRIC CONTROL

A. Adjust to “North Sky” position.

3.11 POLE

A. Follow Standard Drawings 755-1, 755-6, and 755-7.

B. Center the shaft top over the center of the foundation after the arm extension, luminaire, and all accessories are in place or per the manufacturer’s requirements.

C. Install pole identification numbers at a 45 degree angle to approaching traffic. Remove old identification numbers without damage to galvanizing.

D. Torque:
   1. Anchor bolts to 160 N·m.
   2. Slip bolts to 109 N·m, release, and re-torque to 90 N·m.

E. When installing items on a pole:
   1. Do not drill steel pole.
   2. Use stainless steel mounting bands.

3.12 FIELD QUALITY CONTROL (ACCEPTANCE TESTS)

A. Continuity of grounding conductor to maintain 1000 watt load at circuit ends, maintaining 95 percent of supply voltage.

B. Test for grounds in each circuit.

C. Insulation resistance of supply conductor to ground shall be no less than 40 MÙ (500 V megger meter test).

3.13 SALVAGE

A. Remove equipment to be reused or salvaged carefully so that it will remain in the condition existing prior to its removal.

B. Pole assembly remains the property of the DEPARTMENT. Transport to the location specified.

C. Remove luminaire, arm, and conductor.
   1. Grease and reinstall fastener.
   2. Remove foundation to a depth of 150 mm below the existing surface and backfill with local material.
   3. Dispose of discarded junction box. Backfill with local material and compact to match adjacent area.

END OF SECTION

SECTION 16526

ELECTRICAL WORK BRIDGES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing bridge electrical work.

1.2 REFERENCES

A. AASHTO M 55: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

B. ASTM A 123: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. ASTM A 153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

D. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

E. ASTM B 766: Electrodeposited Coatings of Cadmium.

F. NEMA TC-2.

G. NEMA TC-3.

H. UL 6.

PART 2 PRODUCTS

2.1 ELECTRICAL EQUIPMENT

A. Use equipment conforming to the applicable standards:
   1. National Electrical Manufacturer's Association (NEMA)
   2. Underwriter's Laboratories, Inc. (UL)
   3. Electronic Industries Association (EIA)
   4. Any local ordinances.

2.2 ANCHOR BOLTS, WASHERS, AND NUTS

A. For light poles:
   1. ASTM A 307.
   2. Hot-dip galvanize after fabrication. ASTM A 153.

B. Other Bolts and Anchors:
   1. ASTM A 307.
   2. Electro-plated cadmium. ASTM B 766.

2.3 CONDUIT AND FITTINGS

A. When the conduit is totally enclosed within concrete, use schedule 40 PVC conduit and fittings rated at 90 degrees C as specified.
   1. NEMA TC-2.
   2. NEMA TC-3.
   3. UL Listed.

B. When the conduit is attached to the exterior surface of the structure, use galvanized rigid steel conduit and fittings as specified.
   1. Manufacture from mild steel, wrought iron, or silicon-bronze with no less than 1.25 percent silicon.
   2. UL 6.
   3. ASTM A 123.

2.4 JUNCTION BOXES

A. Use hot dip galvanized cast iron junction boxes of standard manufacture, free of honey comb and other defects, approved by UL as watertight, and suitable for outdoor use for high voltage applications. AASHTO M 55.

B. The boxes shall be a minimum size of 300 mm x 200 mm x 150 mm or of the size and type shown on the plans.

C. Hold the cover rigidly in place by screws or bolts manufactured of a non-corrosive material.

2.5 WORKMANSHIP

A. Conform to the requirements of the National Electric Code and any local ordinances that may apply.

B. Place the anchor bolts accurately. Do not bend the anchor bolts or ream the holes in the base plate.

2.6 LEAD-IN WIRES

A. Install all conduit segments with 10 gauge galvanized steel wire for future use as "lead-in" wire for electrical conductors.
B. Use wire 2 m longer than the conduit segment.
   1. One m coiled at the junction box.

2. One m folded back into the terminus of the conduit so it is easily accessible for future use.

PART 3 EXECUTION Not used.

END OF SECTION

SUPPLEMENTAL SPECIFICATIONS

FOR 1999 METRIC CSI STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION

1999 CSI - Metric

Table of Contents

Project

U							Item
							Use of Minority or Women Owned Banks
							Bid Conditions Disadvantaged Business Enterprise
							Notice to Contractors
							Bidding Schedule
							Measurement and Payment
							Wage Rates Applicable/Wage Rates Non-Applicable
							1999 Metric Standard Specifications for Road and Bridge Construction - CSI Format
	Supplemental Specifications:						
U	**Date**	**Sheet No.**				**Section**	**Item**
	12/11/01		to		*	00120	Instruction to Bidders
	11/14/00				*	00555M	Prosecution and Progress
	11/14/00				*	00725M	Scope of Work
	08/08/00				*	00727M	Control of Work
	08/27/01				**	00810	Owner Controlled Insurance Program (OCIP)
	06/12/01				*	00820M	Legal Relations and Responsibility to Public
	12/11/01					01282	Payment
	01/09/01				*	01285M	Mobilization
	11/14/00					01315M	Public Information Services
	01/11/00				*	01455M	Materials Quality Requirements
	01/08/02					01554	Traffic Control
	01/08/02					01558	Temporary Pavement Markings
	09/12/00					01561M	Temporary Environmental Fence
	08/14/01					02056M	Common Fill
	04/11/00					02061M	Select Aggregate

* This Specification is needed on ***all*** jobs.
** This Specification is needed on ***all*** jobs except Local Governments Projects.

	Supplemental Specifications:					
U	Date	Sheet No.			Section	Item
	08/14/01				02075	Geotextiles
	06/13/00				02225	Asphalt Surfacing Removal (Structures)
	04/11/00				02226	Remove Concrete Slope Protection
	03/13/01				02317M	Structural Excavation
	02/08/00				02324M	Compaction
	06/12/01				02455	Driven Piles
	03/14/00				02466M	Drilled Caissons
	06/12/01				02610	Pipe Culverts
	04/11/00				02624	Approach Slab Catch Basin
	04/11/00				02625	Approach Slab Drain Frame Modification
	06/13/00				02626	Deck Drain Modification or Closure
	01/11/00				02635	Grates, Solid Covers, Frames, and Manhole Steps
	06/13/00				02721M	Untreated Base Course (UTBC)
	09/11/01				02741	HMA (Hot Mix Asphalt)
	03/14/00				02744M	Hot Mix Asphalt - Procurement
	12/11/01				02745	Asphalt Material
	03/14/00				02746M	Hydrated Lime
	02/13/01				02752M	Portland Cement Concrete Pavement
	02/13/01				02753	Full Depth Slab Replacement for Concrete Pavements
	03/13/01				02755	Concrete Slab Jacking
	12/11/01				02761	Longitudinal Rumble Strip
	01/08/02				02765	Pavement Marking Paint
	01/08/02				02768	Pavement Marking Materials
	01/08/02				02785	Chip Seal Coat
	10/10/00				02786M	Plant Mix Seal Coat
	06/12/01				02812M	Pressurized Irrigation Systems
	03/14/00				02822M	Right of Way Fence and Gate
	06/12/01				02825M	Cattle Guard
	12/12/00				02841M	Traffic Barriers
	02/08/00				02843M	Attenuation/End Treatment
	12/12/00				02861M	Precast Retaining/Noise Wall

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	Supplemental Specifications:					
U	Date	Sheet No.			Section	Item
	12/11/01				02891M	Traffic Signs
	12/12/00				02892M	Traffic Signal
	08/14/01				02912M	Topsoil
	03/14/00				02922M	Seed, Turf Seed, and Turf Sod
	03/13/01				02961	Rotomilling
	08/14/01				02962	In-Place Cold Recycled Asphaltic Base
	03/13/01				02963	Profile Rotomilling
	02/13/01				03211M	Reinforcing Steel and Welded Wire
	04/11/00				03310M	Structural Concrete
	09/12/00				03311	Joint Closure
	01/09/01				03390M	Concrete Curing
	03/14/00				03575M	Flowable Fill
	06/13/00				03605	Approach Slab Jacking
	05/22/00				03921	Parapet Surface Repair and Sealing
	05/22/00				03922	Delamination Repair
	05/22/00				03923	Column Sealing
	05/22/00				03924	Structural Concrete Repair
	09/12/00				03932	Concrete Slope Protection Repair
	07/11/00				03933	Parapet/Parapet End Modification
	06/13/00				03934	Structural Pothole Patching
	05/22/00				03935	Epoxy Injection and Sealing
	09/12/00				05831	Expansion Joint Modification
	07/11/00				07105	Waterproofing Membrane
	09/12/00				07921	Sealing Existing Concrete Slope Protection Joints
	05/22/00				07922	Relief Joint Crack Sealing
	08/14/01				09972M	Painting for Structural Steel
	08/14/01				09991	Cleaning and Repainting Structural Steel
	11/14/00				09992	Cleaning and Overcoating Structural Steel
	01/08/02				13551	General ATMS Requirements
	01/08/02				13552	Ramp Meter Signals and Signing
	01/08/02				13553	ATMS Conduit
	01/08/02				13554	Polymer Concrete Junction Box

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** This Specification is needed on ***all*** jobs except Local Governments Projects.

	Supplemental Specifications:						
U	**Date**	**Sheet No.**				**Section**	**Item**
	01/08/02					13555	ATMS Cabinet
	01/08/02					13556	Closed Circuit Television (CCTV) Assembly
	01/08/02					13557	Variable Message Sign
	01/08/02					13591	Traffic Monitoring Detector Loop
	01/08/02					13592	Roadway Weather Information System
	01/08/02					13593	Weigh in Motion
	01/08/02					13594	Fiber Optic Communication

Special Provisions:							
U	**Date**	**Sheet No.**				**Section**	**Item**
			to				
							1. Attention Contractors
							2. Specific Equal Employment Opportunity Responsibilities
							3. Required Contract Provisions, Federal-Aid Construction Contracts (PR-1273)

U	**Sheet No.**				**PDBS Project Summary Report**
		to			PDBS Project Summary of Items
					PDBS Detailed Stationing Summaries Report

* This Specification is needed on ***all*** jobs.
** This Specification is needed on ***all*** jobs except Local Governments Projects.

Materials Minimum Sampling and Testing Manual (Contained in 1999 CSI Spec Book):				
U	**Date**	**Change Number**		**Applicable Section(s)**
	09/12/00	1		02746 (Hydrated Lime, page 46) and 05120 (Structural Steel, page 88)
	02/13/01	2		02745 (Asphalt Material, page 45) and 03055 (Portland Cement Concrete, continued, page 102)
	05/08/01	3		02610 (Pipe Culverts, page 10 - 12)
	01/08/02	4		Modified Quality Management Plan, Asphalt Binder 509

* This Specification is needed on ***all*** jobs.
** This Specification is needed on ***all*** jobs except Local Governments Projects.

December 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 00120

INSTRUCTIONS TO BIDDERS

Delete Section 00120 and replace with the following:

PART 1 GENERAL

1.1 PREQUALIFICATION OF BIDDERS

A. Applies to all projects where the Department Engineer's Estimate is greater than or equal to $500,000.

B. Provide experience information on the "Contractor's Application for Prequalification" form and a confidential financial statement certified by a certified public accountant.
   1. Include a complete report of the bidder's financial resources and liabilities, equipment, past record, and personnel. Department establishes prequalification amount and classification.
   2. Allow a minimum of 10 days for Department approval of the "Contractor's Application for Prequalification."

C. Prequalify at least once a year.
   1. The Department may change the prequalification amount during that period upon the submission of additional favorable reports or upon evidence of unsatisfactory performance.
   2. The prequalification amount limits bidding to individual contracts of a given size or for a particular type of work.

D. If bid exceeds prequalification amount, including work in progress, Contract may not be awarded.

REQUEST FOR BIDDING DOCUMENTS

A. Prequalified bidders must purchase and submit all proposals in the identical name used on their prequalification statement, or in accordance with a filed affidavit of change in firm name or personnel.

B. Bidders must make a written or verbal request to the Construction Division to receive bidding documents.
   1. Include a form entitled "Status of Work Under Contract" in the bidding documents. Show on the form the status of all work under contract and being prosecuted by the bidder both in and outside the State of Utah as of the date of the bidding proposal.
   2. Complete, properly execute, and include the form in the bid proposal.
   3. The Department declares Bid Proposals non-responsive if the Contractor's "Status of Work Under Contract" form:
      a. Is not included in the bid proposal.
      b. Does not show the sum of the amount of uncompleted work, both in and outside the State of Utah.
      c. Shows that the estimate of the amount of work to be bid upon exceeds the amount for which the Contractor is prequalified.

1.3 JOINT VENTURE BIDDING

A. Prior to submitting a joint proposal on a single project, submit a letter of intent to the Department's Prequalification Board Secretary at least 4 working days before the bid opening. The Department consolidates individual prequalification amounts for the bid.

1.4 CONTENTS OF BID PROPOSALS

A. Contents:
   1. The location and description of the contemplated construction.
   2. The estimated quantities.
   3. A schedule of unit bid items.
   4. The time in which the work must be completed.
   5. The amount of the proposal guarantee.
   6. The date, time and place of the opening of proposals.

B. The Department considers papers bound with or attached to the Bid Proposal as part of the Proposal, and does not detach or alter the documents when the Proposal is submitted.

C. The Construction Division considers the plans, supplemental specifications, specifications and other documents that accompany the Bid Proposal as part of the Proposal whether attached or not, and they need not be returned as a part of the Bid Proposal.

1.5 ISSUANCE OF BID PROPOSALS

A. The Department reserves the right to refuse to issue a Bid Proposal or award a Contract to a bidder for any or all of the following reasons:
   1. Lack of prequalification.
   2. Uncompleted work under contract that the Department determines will hinder or prevent the prompt completion of additional work if awarded.
   3. Failure to pay or settle claims.
   4. Failure to comply with any qualification regulations.
   5. Default under previous contracts.
   6. Unsatisfactory performance on previous or current Contract(s)
   7. Debarment by the Department.
   8. Serious misconduct that adversely affects the ability to perform future work.
   9. Failure to reimburse for monies owed on any previously awarded Department contracts including contracts where the prospective bidder was a party in a joint venture which failed to reimburse the Department.

B. If the Department refuses to issue a Bid Proposal for any of the foregoing reasons, bidder may appeal in writing to the UDOT Deputy Director.
   1. Specify the basis for the appeal in the written request.
   2. The Deputy Director may schedule either an informal or formal hearing.

1.6 INTERPRETATION OF QUANTITIES IN BID PROPOSAL

A. Proposal quantities are estimates used for comparison and may be increased, decreased, or be eliminated in their entirety. Department pays for actual work performed and accepted, and materials furnished.

1.7 EXAMINATION OF PLANS, SPECIFICATIONS, SPECIAL PROVISIONS AND WORK SITE

A. Examine proposed work site and all documents before submitting a Bid Proposal.
   1. Bidder is responsible for all site conditions that should have been discovered had a reasonable site investigation been performed.
   2. The Department considers submitting a Bid Proposal as conclusive evidence the bidder knows the conditions to be encountered in performing the work and the requirements of the proposed Contract.

B. All Department boring logs and other records of subsurface investigations are available for information purposes only and are not substitutes for bidder's own investigation, interpretation, and judgement. The Department obtained and used this information for design and estimating purposes only.

C. Bidder is permitted to converse with Department personnel knowledgeable of the project, plans, specifications, materials sites, or conditions generally prevailing in the area of the proposed work to aid in pre-bid investigations.
   1. Bidder conducts independent investigation, including a visit to the work site.
   2. The Engineer is available by appointment.

D. The Department is bound only by written statements, representations, descriptions of conditions and work. No oral explanations or instructions are binding.

E. To request explanations of the written proposal documents, contact the Engineer 14 days prior to bid opening to allow a reply before proposal submission. The Department responds to written requests from prospective bidders by certified letter or electronic communications before the specified time for opening proposals.

F. Bidder acknowledges that he/she has investigated the nature and location of the work and knows the general and local conditions that can affect the work or its cost, including but not limited to:
   1. Conditions bearing upon transportation, disposal, handling, and storage of materials.
   2. The availability of labor, water, electric power, and roads.
   3. Uncertainties of weather, river stages, irrigation channel flow, lake and reservoir levels, or similar physical conditions of the ground.
   4. The type of equipment and facilities needed preliminary to and during work performance.

G. The character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is ascertainable from an inspection of the site, as well as from the drawings and specifications and all exploratory work made available by the Department.

H. Failure to take the actions described and acknowledged in this Article does not relieve the Contractor of the responsibility for estimating the difficulty and cost of successfully performing the work, or from proceeding to successfully perform the work without additional cost to the Department.

1.8 UDOT ELECTRONIC BID SYSTEM

A. Obtain UDOT's Electronic Bid System (EBS).
   1. Obtain software free of charge when purchasing plans and specifications for submitting a bid.

2. Contact the UDOT Construction Division at (801) 965-4346 or (801) 965-4344 for EBS training. Training will be scheduled the week prior to the bid opening.

B. Prepare and submit Proposals using the Department's Electronic Bid System
   1. Specify a unit price in figures for each pay item for which a quantity is given.
   2. The Electronic Bid System calculates the product of the respective unit prices, sub-totals and the total bid.

C. When the Proposal permits a choice (alternate items) to be made, indicate the choice in the Electronic Bid System. The program will not permit an additional choice.

D. Save the bid to a diskette using the Departments' Electronic Bid System. Also print Bid Report using the Electronic Bid System.
   1. The signed, printed Bid Report is the Contractor's official bid. Follow all Standard Specification requirements for the preparation of a bid.
   2. If there are any differences between the data on the diskette and the printed Bid Report, the Department changes the electronic data to match the printed Bid Report.

E. Properly executed proposals consist of: Diskette, Bid Report, **and all required forms** printed from the Electronic Bid System Software.

F. A representative of the bidder authorized to execute bid proposals signs the Bid Report signature page in ink.

G. Confirm receipt of addenda.

H. Provide the name and address of the individual signing the Proposal as well as the following names and addresses, as applicable.

Type of Bidder	Names and Office Addresses Required
Individual	Individual and Post Office address
Partnership	Each Member of the Partnership and each Post office address
Joint Venture	Each Member or officer of Firms represented and each post office address
Corporation	Corporation Name and corporate address

I. By signing the Bid Report, bidders certify they understand and are in compliance with all provisions of this Section, article, "Non-Collusive Bidding Certification," and article, "Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions."

1.9 IRREGULAR BID PROPOSALS

A. The Department considers a Bid Proposal irregular and rejects the Bid Proposal as non-responsive if:
   1. It is in a format other than electronic format, or if any part is detached, altered, or incomplete.
   2. It contains unauthorized additions, conditional or alternate bids, or irregularities that make the Bid Proposal incomplete, indefinite, or ambiguous.
   3. It includes added provisions reserving the right to accept or reject an award, or to enter into a contract pursuant to an award.
      a. This does not exclude a bid proposal limiting the maximum gross amount of awards acceptable to any one bidder at any one bid letting.
      b. Department selects awards.
   4. It contains unit prices which are not typed or completed in ink, or are not legible.
   5. It does not contain a unit price for each pay item listed and the amount for each lump sum item, except in the case of authorized alternate pay items.
   6. It contains changes in the unit prices such as erasures, strikeouts and white-outs that are not initialed in ink.
   7. It is not properly signed.
   8. It has a bid bond that is:
      a. Submitted on a form that is not furnished by the Department.
      b. Not properly signed.
   9. It contains a "Status of Work Under Contract" standard form for contractors who are prequalified for less than Unlimited:
      a. Which is incomplete and improperly executed.
      b. Indicates the sum of the amount of **all** uncompleted work, plus the estimate of the amount of work to be bid upon, exceeds the amount for which the Contractor is prequalified.
   10. Any of the unit bid prices are significantly unbalanced to the potential detriment of the Department. The Department may require written justification for the basis of the unit prices before making a decision as to whether the bid is irregular.
   11. The receipt of Addenda is not acknowledged.
   12. It does not comply with conditions of special provision for certification of Affirmative Action (DBE).

1.10 PROPOSAL GUARANTY

A. The Department will not consider a Bid Proposal unless it is accompanied by a guaranty in the form of a certified check, cashier's check or guaranty bond for not less than 5 percent of the total amount of the bid made payable to the Utah Department of Transportation.

B. Use the proposal guaranty bond form included in the Bid Proposal.

1.11 DELIVERY OF BID PROPOSALS

A. Place Bid Proposals in a sealed envelope plainly marked to indicate a Bid Proposal. Include on envelope the project number, bid opening date, submitting contractor, and company address.

B. Address envelope to: Engineer for Construction, 4501 South 2700 West, Salt Lake City, UT, 84114-8220.

C. File the Bid Proposal before the time and at the place specified in the Advertisement.

D. Bid Proposals received after the time specified for opening are returned unopened.

1.12 WITHDRAWAL OR REVISION OF BID PROPOSALS

A. Bid Proposal may be withdrawn or revised after receipt by the Department.

B. Provide the request for withdrawal or revision to the Department in writing or a telephone call followed by documented electronic communications before the time set for opening bid proposals.

1.13 COMBINATION OR CONDITIONAL BID PROPOSALS

A. Bid Proposals may be issued for projects in combination or separately.
   1. Bid Proposals may be submitted either on the combination or on separate units of the combination.
   2. The award of combination bid proposals or separate bid proposals are made to the advantage of the Department.
   3. The Department will not consider combination bid proposals other than those specifically set up in the Bid Proposal.
   4. The Department writes separate contracts for each individual project included in the combination.

B. The Department considers conditional bid proposals only when specified in the advertisement.

1.14 PUBLIC OPENING OF BID PROPOSALS

A. Bid Proposals are opened and read publicly at the time and place indicated in the advertisement.

1.15 DISQUALIFICATION OF BIDDERS

A. Department disqualifies a bidder and rejects a Bid Proposal for one or both of the following:
   1. More than one Proposal for the same work from an individual, firm, or corporation under the same or different names.
   2. Evidence of collusion among bidders. Collusion participants are not recognized as bidders for future work until they are reinstated as a qualified bidder.

1.16 NON-COLLUSIVE BIDDING CERTIFICATION

A. By submitting this Bid Proposal, each bidder and each person signing on behalf of any bidder certifies as to its own organization, under penalty of perjury, that to the best of their knowledge and belief:
   1. The prices in this Bid Proposal have been arrived at independently without collusion, consultation, communication, or agreement with any other bidder or with any competitor for the purpose of restricting competition.
   2. Unless required by law, the prices that have been quoted in this bid proposal have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before opening of Bid Proposals.
   3. No attempt has been made or will be made by the bidder to induce any other person, partnership, or corporation to submit or not to submit a Bid Proposal for the purpose of restricting competition.
   4. The signers of the Bid Proposal will tender to the Department a sworn statement that the named Contractor(s) has not, whether directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action to restrain free competitive bidding in connection with this Proposal.

B. The Department considers no a Bid Proposal for award, nor makes any award where there has not been compliance with this article, paragraph A, except as follows:

1. If the bidder cannot make the foregoing certification, the bidder must furnish with the bid proposal a signed statement that describes in detail the reasons why the certification cannot be made.
2. The Executive Director, or designee, determines that such disclosure was not made for the purpose of restricting competition.

C. Any of the following does not constitute a disclosure within the meaning of this article, paragraph A, line 1:
1. A bidder has published price lists, rates, or tariffs covering items being procured.
2. A bidder has informed prospective customers of proposed or pending publication of new or revised price lists for such items.
3. A bidder has sold the same items to other customers at the same prices being bid.

D. A Bid Proposal made by a corporation is considered authorized by the board of directors of the bidder. Authorization is defined as signing and submitting the bid proposal, and includes the declaration of non-collusion on the part of the corporation.

E. **UTAH DEPARTMENT OF TRANSPORTATION NON-COLLUSIVE BIDDING CERTIFICATION**

"I declare under penalty of perjury under the laws of the United States and the State of Utah that neither I, nor to the best of my knowledge any member or members of my firm or company have either directly or indirectly restrained free and competitive bidding on this project by entering into any agreement, participating in any collusion, or otherwise taking any action unauthorized by the Utah Department of Transportation, with regard to this Contract."

F. Signing the Bid Proposal at the bottom of the Bid Schedule **certifies compliance** with all provisions of this Non-Collusive Bidding Certification.

1.17 DEBARMENT

A. The Department may debar a Contractor from performing any work on Department or Department administered projects if:
1. The Contractor or an affiliate (defined as an owner, director, manager, officer or fiscal agent of the Contractor) has been convicted of or entered a plea of guilty or *nolo contendere* to a bid-related or a contract-related crime in any Court of competent jurisdiction.
2. The Contractor or an affiliate has made a public admission of any bid-related or contract-related crime.

3. The Contractor or an affiliate has falsified information or submitted deceptive or fraudulent statements in connection with prequalification, bidding, or performance of a contract.
4. The Contractor or an affiliate has violated relevant antitrust laws covering bid rigging, collusion or restraint of free competition among contractors; (Violations covered by the Sherman Antitrust Act, 15 U.S.C. 1, *et seq.* and Title 76, Chapter 10, Section 911, *et se.,* U.C.A. 1953, as amended).
5. The Contractor or an affiliate has demonstrated willful wrongdoing reflecting a lack of integrity in bidding or performing public projects.
6. The Contractor, joint venturer, stockholder of 5 percent or more of the Contract, an affiliate, or any immediate relatives of the aforementioned, has been debarred or affiliated with another debarred person or contractors by the Federal Government or by another State government.
7. The UDOT Deputy Director has reasonable grounds to believe and finds that the Contractor has acted in collusion with others to perform work on a project that supposedly satisfies disadvantaged business enterprise goals or requirements through other than *bona fide* disadvantaged business entities in any combination of individuals, firms or corporations.
8. The Contractor or affiliate has defaulted under previous contracts.
9. The Contractor or affiliate has unsatisfactory performance on previous work or current Contract(s) consisting of, but not limited to:
    a. Noncompliance with Contract.
    b. Failure to complete work on time.
    c. Instances of substantial corrective work before acceptance.
    d. Instances of completed work that requires acceptance at reduced pay.
    e. Production of non-specification work or materials, and when applicable, required price reductions or corrective work.
    f. Failure to provide adequate safety measures and appropriate traffic control that endangered the safety of the work force and public.
10. The Contractor or an affiliate has questionable moral integrity as determined by the Department, the Attorney General of Utah or the Attorney General of the United States.
11. Failure to reimburse the State for monies owed on any previously awarded contract including those where the prospective bidder is a party to a joint venture and the joint venture has failed to reimburse the State for monies owed.
12. The UDOT Deputy Director has reasonable grounds to believe and finds that the public health, welfare or safety imperatively requires such action.

1.18 STATUS PENDING DEBARMENT

A. Contractor notified of proposed debarment as provided above is not permitted to contract with the Department, nor act as a subcontractor unless a request for either an information or formal hearing is pending.

B. The proposed debarment period does not commence until the Department decision has been issued following the said hearing or hearings.

1.19 LENGTH OF DEBARMENT

A. Debarment is for a term of not less than 6 months and up to 3 years as determined by the Deputy Director.

B. Department may adjust the period of debarment for mitigating circumstances including but not limited to the following:
   1. Degree of culpability.
   2. Restitution of damages to the State.
   3. Cooperation in the investigation of other bidding crimes.
   4. Disassociation with those involved in bidding crimes.
   5. Protection of the State that may be required.
   6. If such action would have unintended adverse consequences on competition.

C. Debarment in no way affects the obligation of a Contractor to the Department to perform under existing contracts.

D. The Department also reserves the right to declare a debarred Contractor in default on any existing contracts for adequate cause as provided in such contracts.

1.20 DEBARMENT - PROCEDURES

A. The procedure described in this Section, article "Debarment" applies if it is found that a contractor or an affiliate thereof is violating the prohibited activities.

B. The Engineer for Construction notifies the Contractor in writing and by certified mail of the Department's intention to debar. Written notice specifies:
   1. The grounds for such intended debarment.
   2. The date debarment becomes effective and the intended period of debarment.
   3. The procedure to follow if the Contractor desires to challenge the debarment or to offer information to the Department in mitigation of its alleged actions.

C. Within 15 calendar days of receiving the notice of intended debarment, the Contractor may request either:
   1. An informal hearing before the Engineer for Construction.
   2. A formal hearing before the UDOT Deputy Director.

D. The Contractor who elects to proceed at an informal hearing has the opportunity to appear at a mutually agreed upon time and location.
   1. Contractor may supply information in support of their position and has the opportunity to review the Department's evidence, present evidence, and discuss matters informally.
   2. No legal counsel is permitted for either party at the informal hearing.

E. The UDOT Deputy Director of Transportation or designee conducts a formal hearing with assistance from the State Attorney General's Office. The Contractor who appears may be represented by counsel and has the opportunity to review the Department's evidence, and to present evidence in rebuttal either by sworn affidavit or by sworn testimony.

F. Following either a formal or informal hearing, the Department representative conducting the hearing issues a written decision no later than 30 calendar days following the hearing.

G. The decision of the UDOT Deputy Director following a formal hearing is administratively final and specifies the facts justifying the Department’s actions and conclusion.

H. If the Engineer for Construction’s decision is to be appealed, the Contractor files notice in writing with the UDOT Deputy Director within 20 calendar days after receiving the decision from the Engineer for Construction. The Deputy Director then schedules a formal hearing as specified above.

PART 2 **PRODUCTS** Not used.

PART 3 **EXECUTION** Not used.

END OF SECTION

November 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 00555 M

PROSECUTION AND PROGRESS

September 12, 2000:
Delete line "B1" of Paragraph 1.15, "Extending Contract Time," and replace with the following:

1. Request in writing to add "Contract Time" due to extra work. This is included in a "Change Order" covering the proposed extra work if approved by the Engineer.

November 14, 2000
Add the following to paragraph 1.4 "Progress Schedules:"

C. Prepare the Anticipated Monthly Payment Schedule using the dates and accomplishment shown on the Critical Path Method (CPM) Baseline schedule.

D. Prepare the Monthly Payment Schedule:
   1. Submit the proposed Monthly Payment Schedule before the date established for the first partial payment.
   2. Use form provide at the Preconstruction Conference.
   3. Include both monthly and semi-monthly payments when anticipated due to the volume of work on the project.
   4. Include all months during the life of the contract when payments are anticipated.
   5. Schedule must be supported by and coordinated with the CPM Baseline Schedule.
   6. Include dates of contract start, suspension, completion and milestones that impact payments.

E. Submit Revised Payment Schedule within 30 days of notification by the Engineer. Payment Schedule Revisions are required when:
   1. Actual Payments vary 10 percent or more (plus or minus) from the submitted Payment Schedule and the variance is sustained for 60 days.

2. Contract start, suspension, completion and milestones dates change.
3. Change Orders are approved which increase or reduce the contract amount sufficient to vary actual payments 10 percent or more (plus or minus) from the accepted Payment Schedule.

November 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 00725 M

SCOPE OF WORK

(Revised 4-11-00. Added to paragraph 1.15, Railway - Highway Provisions.)

Add the following to the end of paragraph 1.15, Railway - Highway Provisions:

E. Hold a preconstruction conference and give written notice to the Manager of Industry and Public Projects or equivalent position for the railroad company, when railroads are involved, at least 15 days before beginning any construction work on railroad right-of-way. Coordinate a work schedule based on the actual date both parties can begin work.

F. Give at least 48 hours verbal notice to the Manager of Track Maintenance or equivalent position for the railroad company having responsibility for the area the project is in before beginning work once the work dates have been established.

G. Give written notification to the Superintendent or equivalent position at least five days before any cancellation of work, and 15 days before re-commencing work.

H. Execute a Right of Entry Agreement with the railroad company prior to performing any work within the railroad's right-of-way. Send executed copies of this agreement to the ENGINEER and UDOT's Region Utilities and Railroads Coordinator.

I. Cleanup the right-of-way to the satisfaction of the railroad company. Pay, at CONTRACTOR's expense, for any cleanup done by the railroad company to the railroad company's right-of-way that should have been done by the CONTRACTOR.

J. Flagging and inspection to be done by railroad company personnel when work and/or equipment of the CONTRACTOR is within 7.6 m of any of the railroad company's tracks.

K. Determine the cost of required railroad flagging and/or inspection and cleanup crew. Include these costs in mobilization.

L. UDOT will deduct payment under a construction accounting item for “Railroad Flagging, Inspection and Cleanup,” and pay the railroad directly for verified billings. No other compensation to the CONTRACTOR for this item will be allowed.

M. Refer to project plans for names of railroad companies.

Delete line B of paragraph 1.20 “Value Engineering - Submitting Proposals” and replace with the following:

B. The DEPARTMENT will notify the CONTRACTOR within 5 working days if it is determined that there is insufficient review time for a response.

SUPPLEMENTAL SPECIFICATION

SECTION 00727 M

CONTROL OF WORK

Delete paragraph 1.14 and replace with the following:

1.14 LOAD RESTRICTIONS

A. Observe legal load restrictions when hauling equipment or materials on public roads beyond project limits.
   1. A special permit does not decrease CONTRACTOR liability for damage.
   2. Refer to the "Utah Regulations for Legal & Permitted Vehicles."

B. Do not apply weight restrictions to equipment or materials hauled over subgrade.

C. Do not exceed legal gross weight limits on any public roads, structures, or on any component of the pavement structure excluding granular borrow.

D. Suspend construction operations when load restriction violations are observed until acceptable corrective measures are approved by the ENGINEER.

E. When public roads are used to haul any type of excavation, borrow, backfill, base, or surfacing material, the ENGINEER will contact the appropriate law enforcement agency, if excess load violations are suspected.

F. For materials imported to the job site (i.e. Asphalt, Cement, Concrete, Steel, etc.):
   1. Provide the ENGINEER with invoices showing the gross load weights.
   2. DEPARTMENT will withhold payment for material used in the project if invoices are not provided.
   3. The ENGINEER will notify the appropriate enforcement agency if it is suspected that legal gross load limits are exceeded.

Delete paragraph 1.18 and replace with the following:

1.18 PROJECT ACCEPTANCE - PARTIAL

A. The CONTRACTOR may request final inspection of a unit when:
   1. A unit or portion of the project is substantially complete, and

2. The unit or portion is considered or determined necessary for the convenience of traffic, such as a structure, an interchange, section of road, intersection, substation, or portion of a lighting or signal.

B. If the unit has been completed according to the Contract, the ENGINEER may make written acceptance of that unit as complete and relieve the CONTRACTOR of further responsibility for that unit, with the following exceptions:

1. **Lighting And Signal Warranties And Guarantees**
   a. The notice of acceptance for lighting and signal work will not be given until six months after the date of the inspection.
   b. During this six-month period, all manufacturer's warranties and guarantees on contractor- furnished electrical and mechanical equipment will be enforced.
   c. At the end of the six-month period, and after all electrical and mechanical defects within the scope of warranties and guarantees are corrected, the ENGINEER will make written acceptance of the work completed and relieve the CONTRACTOR of further responsibility for that portion of the project.
   d. Partial acceptance will not void or alter any terms of the Contract.
2. **Plant Establishment Periods:**
   a. The notice of acceptance for plants will not be given until the establishment period as specified in the Contract is completed.
   b. The establishment period on plants will begin after inspection by the ENGINEER and will continue as specified in the Contract.
   c. At the end of the establishment period, and after all unacceptable plants have been replaced, the ENGINEER will make written acceptance of the plants and relieve the CONTRACTOR of further responsibility for that portion of the project.
3. The six-month warranty period for lighting and signal work and the establishment period for plants will not affect the processing of a semi-final estimate when the Contract is 95 percent or more complete, or after completion of work on the project.

Delete paragraph 1.19 and replace with the following:

1.19 Final Acceptance

A. The ENGINEER will conduct an inspection upon receiving notice from the CONTRACTOR of project completion. If the Contract is found to be satisfactorily completed, the inspection shall constitute the final inspection and the ENGINEER will notify the CONTRACTOR in writing the date the Contract was inspected and accepted.

B. Immediately comply with and execute instructions given by the ENGINEER if the inspection discloses any unsatisfactory work.

C. Upon correction of the work, another inspection will be conducted that constitutes the final inspection.

D. If the work has been satisfactorily completed, the ENGINEER will notify the CONTRACTOR in writing of the date of final inspection and acceptance.

August 27, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 00810

OWNER CONTROLLED INSURANCE PROGRAM (OCIP)

Delete Section 00810 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provisions of Owner Controlled Insurance Program (OCIP).

1.2 GENERAL OCIP PROVISIONS

A. The awarded CONTRACTOR is required to complete forms and enroll in OCIP.

B. Awarded CONTRACTOR is responsible for:
   1. Enrollment and compliance with all OCIP requirements for itself and subcontractors of all tiers.
   2. Assistance with enforcement of any OCIP provision that relates to subcontractors.

C. All references to Subcontractors include all subcontractors, consultants and subconsultants **of every tier** to the CONTRACTOR, unless otherwise specified.

D. All references to CONTRACTOR include all contractors, subcontractors, consultants and subconsultants of every tier to the CONTRACTOR, unless otherwise specified.

E. All references to the OCIP Administrator are identified as:
   Willis of Utah
   2890 East Cottonwood Parkway, Suite 350
   Salt Lake City, UT 84121

F. The OCIP requirements are not intended to create any contract between the subcontractors and the Utah Department of Transportation (UDOT or DEPARTMENT).

G. OCIP will minimally provide:
   1. Workers' compensation.
   2. Employer's liability, general liability, contractors pollution liability.
   3. Railroad protective, as required.
   4. Excess liability and builders risk for all eligible CONTRACTORs of every tier enrolled in the OCIP and working at the project site.

H. OCIP will provide liability for architects and engineers for professional errors and omissions.

I. The State agrees to pay all premiums associated with the OCIP including deductibles or self-insured retentions unless otherwise stated in the contract documents.

J. Awarded Contractor and eligible subcontractors will not be allowed to work without enrolling in the OCIP.

K. Carriers in OCIP Program.

1.	Workers' Compensation, Employers Liability, General Liability:	Argonaut
2.	Contractor Pollution Liability:	ECS/Greenwich
3.	Professional Architects and Engineers Errors and Omissions:	DPIC
4.	Excess Coverage:	AIG and Cigna
5.	Railroad Protective:	London
6.	Builder's Risk:	CNA

L. Insurance coverage provided by the DEPARTMENT under the OCIP does not extend to the activities or products of suppliers, material men, vendors, haulers, truckers and "owner/operators" whose employee(s) perform no on-site work or are engaged solely in loading, unloading, stocking, testing, or hauling equipment, supplies or materials.
   1. Such persons are required to provide their own insurance and to promptly provide to UDOT or the OCIP Administrator certificates of insurance giving evidence that all required insurance is in force.
   2. Ineligible and eligible CONTRACTORs are required to maintain their own insurance at no expense to the DEPARTMENT of the types and with the limits found in this Section, paragraph titled "CONTRACTOR-Provided Coverages."
   3. Provide coverage that recognizes the DEPARTMENT's project sites, at no expense to DEPARTMENT.

1.3 ENROLLMENT

A. Required of all awarded CONTRATORs and subcontractors.

B. Enroll in the OCIP by completing the attached OCIP Form 1 and submitting it and the General Liability and Workers Compensation policy information to the OCIP Administrator by the time the executed contra ct is returned to DEPARTMENT, or before beginning work, whichever occurs first.

1. Require that each subcontractor enrolls in the OCIP by submitting the OCIP Form 1 to the OCIP Administrator prior to the subcontractor entering the project site.
2. By completing and submitting this insurance cost information, including supporting documents to the DEPARTMENT or appointed Administrator, CONTRACTOR warrants that all insurance information is correct.

1.4 INSURANCE COSTS

A. The DEPARTMENT will process an Initial Deductive Change Order (IDCO) of 1.722 percent of contract value to transfer the insurance cost into the project insurance program.

1. During the term of the Project including extended periods, UDOT has the right to recover all costs for the Contractor's insurance as described in this section, Item B, paragraphs 1 - 4..
2. UDOT has the right to recover these additional costs through deductive change orders.

B. It is understood and agreed that 1.5 percent of the Initial Deductive Change Order are initial estimates only.

1. The final insurance costs for Workers' Compensation and General Liability is subject to review and audit of actual insurance policy(ies) rate information, actual payrolls and revenues for the initial award, and change orders to the original scope of work.
2. The DEPARTMENT's contract award will be based on the **bid amount** of work which includes the insurance costs that would have been incurred by the CONTRACTOR and its subcontractors if DEPARTMENT did not provide an OCIP.

3. Add .222 percent to the bid for the cost of Contractors Pollution Liability, Excess Coverage, Railroad Protective Liability, and Builder's Risk. UDOT will include this cost in its Initial Deductive Change Order of 1.722 percent.

4. One or more auditors from the insurance companies providing OCIP coverage will audit the payroll and contract revenue of each Contractor within 45 days of the OCIP Administrator receiving Form 4 - Notice of Substantial Completion. If an eligible Contractor fails to provide all required OCIP enrollment documents or by any means prevents the auditor from auditing the payroll and contract amount, UDOT will process a Final Deductive Change Order (FDCO) of 3 percent of contract value.

C. Awarded CONTRACTOR and subcontractors provide OCIP Form 1 and a copy of the declaration page(s) and premium rate page(s) for each applicable policy to the DEPARTMENT or its Administrator before the applicable work begins. Provide all necessary information for the DEPARTMENT or its appointed Administrator to determine the accuracy of its and subcontractors' cost of insurance.

1.5 CHANGE ORDER PRICING

A. Enrolled CONTRACTOR and Subcontractors price change orders to the original scope of work in the same manner as would occur if the DEPARTMENT did not provide an OCIP.
   1. Include markups otherwise provided for in the General Conditions.
   2. The DEPARTMENT will recover the insurance cost associated with change orders through the process provided for in Section 1.4, Insurance Costs, Item B.

1.6 CONTRACTOR'S RESPONSIBILITY FOR SUBCONTRACTORS

A. Include all the provisions of this agreement in every subcontract to be binding upon each subcontractor.

1.7 AUDITING INSURANCE COSTS

A. For insurance purposes, agree, and require all Subcontractors to agree to:
   1. Keep and maintain accurate record of its payroll for operations at the project site.
   2. Furnish to the State or its appointed Administrator, full and accurate payroll data and information in accordance with the requirements of the State of Utah OCIP Manual.
   3. Permit the DEPARTMENT, its Administrator, or Insurance Company to examine and/or audit its books and records, and provide any additional information as may be required to the DEPARTMENT or its Administrator or Carrier.

1.8 STATE PROVIDED COVERAGES

A. The DEPARTMENT at its sole expense has implemented this OCIP to furnish certain insurance coverages for on-site project activities.
   1. The OCIP is for the benefit of the DEPARTMENT and its CONTRACTOR and subcontractors (unless specifically excluded) who have on-site employees.
   2. Such coverage applies only to work performed under this contract at the Project Site. Project Site is defined as the area described in the construction contract documents including the areas available for CONTRACTOR operations, access routes, right-of-ways, and approved additional sites necessary or incidental in connection with the work or emanating from the project site.
   3. CONTRACTOR and subcontractors must provide their own insurance for off-site activities. Off-site activities may be covered in the OCIP if 100 percent dedicated to the project as defined in the State of Utah OCIP Manual.

B. The OCIP policies are available for review by the CONTRACTOR upon request to the DEPARTMENT.
   1. The terms of such policies or programs are incorporated by reference, and may be amended occasionally.
   2. CONTRACTOR agrees to be bound by the terms of coverage as contained in such insurance policies and/or self-insurance programs.

C. The DEPARTMENT at its own expense will minimally provide and maintain in force the types of insurance as listed in Section 1.9, Types of State Supplied Coverage. CONTRACTOR and subcontractors enrolled in OCIP agree that the purpose of this section is to provide a general understanding of the coverage provided by the OCIP.

D. The enrolled CONTRACTOR agrees that the DEPARTMENT will withhold a sum equal to the amount of any covered loss under the policy(ies) caused by the CONTRACTOR or its Subcontractors, but not to exceed the applicable CONTRACTOR/Subcontractor deductible. DEPARTMENT will assess the sum to the CONTRACTOR or subcontractor causing the damage as determined by the Insurer, and will claim the sum as its property.

1.9 TYPES OF STATE SUPPLIED COVERAGE

A. Workers' Compensation and Employer's Liability Insurance (Argonaut Insurance Co.):

1. Scope of Coverage:
   a. Operations. Work of an enrolled CONTRACTOR/ subcontractor of every tier, performed at the Project Site.
   b. Insured. Enrolled CONTRACTOR/subcontractors of every tier. Each enrolled CONTRACTOR/Subcontractor will be issued a policy.
2. Limits:
   a. Worker's Compensation: Statutory
   b. Employer's Liability:
      $1,000,000 - Each Employee Bodily Injury by Accident
      $1,000,000 - Each Employee Bodily Injury by Disease
      $1,000,000 - Bodily Injury by Accident or Disease - Any One Accident
   c. CONTRACTOR's Deductible: Pay a $200 deductible per workers' compensation claim.
3. Effect on Future Experience Modifications.
   a. Report all premiums and loss experience incurred by each enrolled CONTRACTOR/Subcontractor to NCCI or other appropriate authority.
   b. Use all premiums and loss experience in the normal manner for calculating individual future experience modifiers.

B. Commercial General Liability (Argonaut Insurance Co.)
1. Provides coverage for Bodily Injury, Property Damage, Personal Injury and Products and Completed Operations. Completed Operations has a 5-year extension.
2. Scope of Coverage:
   a. Operations: Work of an enrolled CONTRACTOR/subcontractor of every tier performed at the Project Site.
   b. Insureds: The State of Utah, UDOT, enrolled CONTRACTOR/Subcontractors of every tier.
   c. Limits:
      $2,000,000 Bodily Injury & Property Damage Combined Single Limit
      $10,000,000 General Aggregate
      $10,000,000 Products and Completed Operations and Annual Aggregate
3. CONTRACTOR's Deductible: Pay a deductible for Third Party PD/BI cost of claims up to $5,000 per occurence or $10,000 per vehicle accident.

C. Railroad Protective (as required) (Lloyd's Underwriters)

1. Liability coverage for railroad companies.
2. Scope of Coverage:
   a. Operations: Work of any enrolled CONTRACTOR or Subcontractor of every tier performed on the Project Site.
   b. Insured: All railroads affected.
   c. Limits:
      $5,000,000 Each Occurrence
      $10,000,000 Aggregate

D. Excess General Liability Insurance (Cigna and AIG)

1. Liability coverage in excess of Primary Commercial General Liability, Employer's Liability, and Railroad Protective Liability.
2. Scope of Coverage:
   a. Operations: Work of an enrolled CONTRACTOR, or subcontractor of every tier, performed at the Project Site.
   b. Insured: The State of Utah, UDOT, enrolled CONTRACTOR/Subcontractors of every tier.
   c. Limits:
      $100,000,000 Each Occurrence for all Insureds
      $100,000,000 Aggregate for all Insureds

E. Professional Errors & Omissions Liability (DPIC/Security Insurance Co. of Hartford)

1. Liability coverage for Negligent Acts, Error or Omissions of the Insureds who have provided professional services for the State of Utah OCIP.
2. Scope of Coverage:
   a. Operations. Work done in conjunction with the State of Utah OCIP by Design and Consulting Engineers, Architects, Construction Managers and subconsultants.
   b. Insured. The State of Utah, UDOT (as defined in policy), enrolled Design and Consulting Engineers, Architects, Construction Managers, subconsultants and CONTRACTORs, to the extent they provide professional services.
   c. Limits-Project Term.
      $25,000,000 Claim
      $50,000,000 Aggregate
   d. Consultant's Deductible:
      $50,000 Claim

F. CONTRACTOR's Pollution Liability (Greenwich Insurance Company)
   1. Coverage for Liability arising from pollution releases during construction or remediation work.
   2. Scope of Coverage:
      a. Operations. Work done in conjunction with the State of Utah OCIP by enrolled CONTRACTORs and subcontractors of every tier.
      b. Insured. State of Utah, UDOT, and enrolled Contractors or Subcontractors of every tier.
      c. Limits - Project Term.
         $10,000,000 Occurrence
         $10,000,000 Aggregate
      d. CONTRACTOR's Deductible. $5,000 Occurrence

1.10 CERTIFICATES AND POLICIES

A. All the DEPARTMENT-furnished insurance coverages:
   1. Are either written by insurance companies approved by the DEPARTMENT or are self-insured.
   2. The DEPARTMENT or appointed Administrator will provide CONTRACTOR and subcontractors with appropriate certificates of insurance or self-insurance evidencing the coverage outlined above.

B. Termination/Modification of the OCIP:
   1. The DEPARTMENT reserves the right to terminate or to modify the OCIP or any portion thereof.
   2. To exercise this right, the DEPARTMENT will provide 90 days advance written notice to all prime or general CONTRACTORs covered by the OCIP.
   3. CONTRACTORs and Subcontractors are required to immediately obtain appropriate replacement insurance coverage acceptable to the DEPARTMENT. The DEPARTMENT will reimburse the reasonable cost of such replacement insurance.
   4. Provide written evidence of such insurance to the DEPARTMENT prior to the effective date of the termination or modification of the OCIP.

1.11 CONTRACTOR RESPONSIBILITIES

A. Cooperate with the DEPARTMENT and its OCIP Administrator regarding the administration and operation of the OCIP.

B. The CONTRACTOR's responsibilities include, but are not limited to:

1. Complying with applicable Construction Safety Program(s), State of Utah OCIP Manual, and State of Utah OCIP Safety and Health Manual;
2. Providing construction contract, operations and insurance information;
3. Immediately notifying the OCIP Administrator of all subcontractors upon contract award.
4. Maintaining and providing payroll records and other records as necessary for premium and Deductive Change Order/s computations;
5. Cooperating with any insurance company and OCIP Administrator with respect to requests for claims, payroll or other information required under the program;
6. Immediately notifying the DEPARTMENT that any CONTRACTOR-provided coverage has been canceled, materially changed, or not been renewed; and,
7. Completing the following administrative forms within the time frames specified:
   a. UDOT OCIP Form 1 - OCIP Wrap-Up Enrollment. Upon execution of the contract.
   b. Commercial General Liability Declarations page, Workers Compensation Information page, Premium Development Schedules for both and Insurance Certificate evidencing coverage upon execution of the contract.
   c. UDOT OCIP Form 4 - Notice of Substantial Completion. Upon completion of all work being performed under the contract.
8. DEPARTMENT will send completed forms to the DEPARTMENT's OCIP Administrator at the following address:

   Willis of Utah
   2890 East Cottonwood Parkway, Suite 350
   Salt Lake City, UT 84121

9. Failure to follow the procedures outlined in the State of Utah OCIP Manual and State of Utah OCIP Safety and Health Manual may result in forfeiture of coverage, fines and/or penalties assessed against the CONTRACTOR. The DEPARTMENT will deduct from monies due or to become due under payments of this contract for any applicable fines that are assessed as well as any other legal remedies available to the DEPARTMENT, which remedies may be cumulative.

1.12 ASSIGNMENT OF RETURN PREMIUMS

A. The DEPARTMENT will be responsible for the payment of all premiums associated solely with the OCIP and will be the sole recipient of any dividend(s) and/or return premium(s) generated by the OCIP.

B. In consideration of the DEPARTMENT's providing said coverages the CONTRACTOR agrees to:
   1. Provide cost information for themselves for worker's compensation, employer's liability, and general liability insurance as instructed on OCIP Form 1. This information may be inclusive of but not limited to insurance premiums, expected losses within any retention or deductible program, overhead and profit.
   2. Irrevocably assign to and for the benefit of the DEPARTMENT, all return premiums, premium refunds, premium discounts, dividends, retentions, credits, and any other monies due the DEPARTMENT in connection with the insurance which the DEPARTMENT agrees to provide, and agrees to evidence same by a formal instrument of assignment, if requested, to be promptly executed in the form prepared by the DEPARTMENT.
   3. The Awarded CONTRACTOR further agrees to require all tiers of enrolled subcontractors to execute a similar assignment for the benefit of the DEPARTMENT.

1.13 CONTRACTOR-PROVIDED COVERAGES

A. Provide the following coverages even if OCIP provides coverage.

B. For any work under this contract, and until completion and final acceptance of the work, promptly furnish to the DEPARTMENT's OCIP Administrator, at no cost to the DEPARTMENT, certificates of insurance giving evidence that certain coverages are in force. CONTRACTOR is responsible for subcontractors' compliance under this program.

C. Enrolled CONTRACTORs and Subcontractors will endorse their Workers' Compensation and Employer's Liability policy with Designated Workplace Exclusion Endorsement and endorse its Commercial General Liability Polices with an Exclusion - Designated Work Endorsement (ISO Form CG 21 54 01 96) **to exclude operations on Project Site from its coverage**.

D. Prior to entering the Project Site, CONTRACTOR and subcontractors will agree to obtain the insurance set out in this exhibit from a company or companies acceptable to the DEPARTMENT as follows:
   1. Workers Compensation Insurance:

a. Provide at their own expense to cover full liability under the Worker's Compensation.
b. Laws of the jurisdiction in which the Project is located at the statutory limits required by said jurisdiction's laws.

2. Employer's Liability Insurance: Provide at their own expense with the following minimum limits of liability:

$100,000	Each Accident
$500,000	Disease-Policy Limit
$100,000	Disease-Each Employee

3. Commercial General Liability Insurance.
   a. Provide at their own expense on an "occurrence basis", including insurance for operations, independent CONTRACTORs, products/completed operations, and contractual liability specifically designating the Indemnity provisions of this Contract Agreement as an insured contract on the Certificate of Insurance. Endorse the Commercial General Liability Insurance with a Broad Form Property Damage Endorsement (including Completed Operations) and afford coverage for explosion, collapse and underground hazards.
   b. Provide insurance with limits not less than the following:

$2,000,000	General Aggregate
$2,000,000	Products-Completed Operations Aggregate
$1,000,000	Personal & Advertising Injury
$1,000,000	Each Occurrence
$50,000	Fire Damage (Any one fire)
$5,000	Medical Expense (Any one person)

State on the certificate that the required Commercial General Liability policy has been endorsed to name the State of Utah and DEPARTMENT as an Additional Insured.

4. Automobile Liability Insurance (Coverage not provided in OCIP)
   a. Provide at their own expense, for claims arising from the ownership, maintenance, or use of a motor vehicle at, upon, or away from the Project Site.
   b. Cover all owned, non-owned, and hired automobiles used in connection with the work, with the following minimum limits of liability:

$1,000,000 Combined Single Limit Bodily Injury and Property Damage Per Occurrence

c. State on the certificate that the required Automobile Liability Insurance policy has been endorsed to name the State of Utah and DEPARTMENT as an Additional Insured.

5. Aircraft Liability Insurance (Coverage not provided in OCIP)
   a. Maintain Aircraft Liability Insurance with a combined single limit of not less than $1,000,000 per occurrence. Applies to each CONTRACTOR and subcontractor using its own aircraft, or employing aircraft in connection with the work performed under this Program.
   b. State on the certificate that the required Aircraft Liability Insurance policy has been endorsed to name the State of Utah and DEPARTMENT as an Additional Insured.

6. Valuable Papers and Records and or Electronic Data Processing (Data and Media) Coverage. (Coverage not provided in OCIP)
   a. Provide coverage for the physical loss of or destruction to their work product including drawings, specifications and electronic data and media if needed.

1.14 CERTIFICATES OF INSURANCE

A. Prior to entering the Project Site, CONTRACTOR and its subcontractors agree to provide to the DEPARTMENT's OCIP Administrator a Certificate of Insurance setting out required coverages and limits, and amendments to the certificate necessitated by changes to the work to be performed under the contract until the date of final payment.

B. State on the certificate that the policies required have been endorsed to provide that the insurers will give the DEPARTMENT thirty days written notice prior to any cancellation or change in coverage.

C. Endorse all required policies to include waivers of subrogation in favor of the DEPARTMENT.

D. Maintain all required insurance without interruption from the date of commencement of the Work throughout the warranty period as scheduled in the Contract Agreement.

E. All insurance policies provided must be primary and non-contributing with, and not in excess of, any other insurance available to the DEPARTMENT.

F. Forward certificates to Willis of Utah, Attn: Sandy J. Gibbons, OCIP Administrator, 2890 East Cottonwood Parkway, Suite 350, Salt Lake City, UT 84121.

1.15 NOTICE OF CANCELLATION

A. Provide policies and/or certificates that specify a 30-day notice of cancellation, non-renewal or material change to be sent to the OCIP Administrator.

1.16 OTHER INSURANCE

A. CONTRACTOR is responsible to provide at its own expense any type of insurance or any increase of limits of liability not described above which a CONTRACTOR requires for its own protection or to comply with any statute.

B. The OCIP is not an attempt to provide the CONTRACTOR and its subcontractors with complete insurance programs.
   1. The DEPARTMENT is not responsible to provide any insurance coverage not specified above.
   2. The CONTRACTOR and its Subcontractors are responsible for obtaining insurance programs that fit their particular needs, or which they deem advisable, whether or not specified above.

1.17 SUBCONTRACTOR PARTICIPATION

A. Upon execution of the Contract, immediately report all new eligible Subcontractors to the OCIP Administrator for enrollment in the OCIP.
   1. Incorporate all the provisions of this agreement in any Subcontractor agreement and cause subcontractors to cooperate fully with the DEPARTMENT and insurance companies for the project in the administration of the OCIP.
   2. Agree to cooperate in the safety and accident prevention program and claim handling procedures as established for the project by the DEPARTMENT.
   3. In accordance with this paragraph and subparagraphs, do not permit any subcontractor to enter the Project Site prior to submitting enrollment forms in the DEPARTMENT's OCIP. Failure to do so will negate the afforded coverage(s).

1.18 WAIVER OF SUBROGATON

A. Waive all rights of subrogation and recovery against the DEPARTMENT, its designees(s), Construction Managers, General CONTRACTORs and subcontractor(s) to the extent of any loss or damage that is insured under the OCIP.

B. Waive rights of subrogation and recovery for damage to any property or equipment against the DEPARTMENT, its designees(s), Construction Managers, General CONTRACTORs and subcontractor(s).

C. Require all subcontractor(s) to similarly waive their rights of subrogation and recovery in each of their respective construction contracts with respect to their work.

1.19 NO RELEASE

A. Carrying the above-described insurance does not relieve the CONTRACTOR of any other responsibility or liability under this agreement or any applicable law, statute, regulation or order.

1.20 APPROVAL OF FORMS AND COMPANIES

A. All insurance described in this contract shall be written by an insurance company or companies satisfactory to the DEPARTMENT and licensed to do business in Utah and shall be in a form and content satisfactory to the DEPARTMENT.
   1. No party subject to the provisions of this contract shall violate or knowingly permit to be violated any of the provisions of the policies of insurance described herein.
   2. All insurance should be provided by insurance companies with a Best's rating A- VIII or better.

1.21 OCIP MANUAL, OCIP SAFETY AND HEALTH MANUAL AND CLAIMS PROCEDURES

A. CONTRACTOR and subcontractors agree to adhere to and perform all reporting requirements as detailed in the State of Utah OCIP Manual, and the State of Utah Safety and Health Manual.

1.22 OCIP FORMS

A. OCIP forms are located on the web at http://www.dot.state.ut.us/cns/ocip/ocip_forms.htm.

STATE OF UTAH

Owner Controlled Insurance Program (OCIP)
Safety Overview

The effectiveness of the Safety and Health Program depends upon the active participation and personal cooperation of all. Project cooperation and coordination of efforts toward carrying out the overall safety responsibilities are needed for an effective program.

The State of Utah-UDOT / OCIP Team will assist in monitoring CONTRACTORs and/or Subcontractor's implementation and application of their respective safety programs and the State of Utah-UDOT/OCIP safety programs at the work site. The State of Utah-UDOT/OCIP Team has the authority to stop work when either site conditions and/or work practices present an imminent danger (i.e. may result in serious injury, death or extensive property damage) until those conditions and/or practices are corrected.

Each CONTRACTOR is held responsible for its own and its subcontractor's compliance with the project safety requirements.

Each CONTRACTOR and its Subcontractors shall establish and enforce an effective disciplinary program.

Each CONTRACTOR and its Subcontractors shall designate an on-the-job safety administrator. The administrator may be a supervisor/foreman with safety knowledge, and will be the State of Utah-UDOT/OCIP Team's contact for safety concerns.

All CONTRACTOR's and Subcontractor's supervision will need to attend S.T.A.R.T. training produced by the insurance carrier, approximately a 3-hour course. Contact Argonaut Safety Representative at 801-293-1100.

All employees (CONTRACTORs, Subcontractors, Engineers, etc.) working on the job will need to attend a construction orientation produced by the insurance carrier, approximately a 10 minute video and 3-page job rules and questions. This must be completed before beginning work on the site.

All employees (CONTRACTORs, Subcontractors, Engineers, etc.) working on the job shall have the proper Personal Protective Equipment for the job task they are performing. At the minimum a hard hat, safety glasses, safety vest, long pants, shirt with minimal 4-inch sleeve and work boots.

All employees (CONTRACTORs, Subcontractors, Engineers, etc.) shall have the proper training for the job task they are performing (confined space, fall protection, powder actuated tools, traffic control, equipment operating, etc.).

Each CONTRACTOR and its Subcontractors shall at a minimum conduct a weekly ToolBox safety meeting with all employees.

Each CONTRACTOR and its Subcontractors shall assure that a qualified "Competent Person" is provided at work locations where required by OSHA.

Each CONTRACTOR and its Subcontractors shall assure that all applicable forms (confined space permit, hot work permit, lock out/tag out, critical lift checklist, JSA, excavation permit, etc.) are provided at work locations where required by OSHA.

Each CONTRACTOR and Subcontractor shall adhere to a 100% drug/alcohol free work zone. At a minimum a pre-employment and post accident testing is required. The CONTRACTOR will bear the cost or expenses associated with pre-employment testing. The Insurance Carrier will bear the cost of the post accident testing.

This is only a brief overview of the "State of Utah Owner Controlled Insurance Program" Safety and Health Manual. The more stringent applies if a conflict occurs between the provisions of this overview, the OCIP manual and applicable local, State or federal safety and health laws, regulations and/or standards, contract documents or the CONTRACTOR's Safety Plan.

June 12, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 00820 M

LEGAL RELATIONS AND RESPONSIBILITY TO PUBLIC

(Revised 6/12/2001. Added to paragraph 1.14, Responsibility for Damage Claims)

Add the following to the end of paragraph 1.14, Responsibility for Damage Claims:

D. Local Government Projects Only:

1. When railroads are involved, CONTRACTOR must provide UDOT with insurance policies and certificates for the railroad company in the following kinds and amounts:
   a. Workman's compensation in statutory limits.
   b. CONTRACTOR's Comprehensive General Liability in the minimum limits of $2 million for injury of any person of $6 million for injury or death of more than one person in any one accident, and $2 million for damage to property in any one accident.
   c. Railroad Protective Liability insurance naming in one policy, the railroad company as the insured, the policy being in conformance with and providing the minimum coverage described in the **23 CODE OF FEDERAL REGULATIONS** PART 646A Section 646.11 which provides: "Coverage for bodily injury, death and property damage related to a combined single limit to $2 million per occurrence with an aggregate of $6 million for the term of the policy with respect to property damage."
2. CONTRACTOR will require the railroad company furnishing insurance policies to refer to UDOT's Project Number listed on the Bid Book on those policies. Write insurance policies in the name of the railroad company.
3. Refer to the project plans for names of railroad companies.

Delete paragraphs 1.18, 1.19. 1.20. 1.21, 1.22, and 1.23, and replace with the following:

1.18 HAULING BY TRUCK - GENERAL

A. When additional trucks are needed for a Federal or State funded project, a lease agreement or subcontract must be in the project office before the additional trucks begin work on the project site.

1.19 HAULING BY TRUCK - COMPLIANCE WITH STATE REGULATIONS

A. Comply with all State regulations regarding hauling by truck.

B. Comply with all Federal and State regulations regarding hauling for Federal Funded Projects, including wages and hours.

C. When using Independent Owner-Operators, follow written guidance provided by the U. S. Department of Labor in WH Publication 1297: "Employment Relationships under the Fair Labor Standards Act."

1. The owner-operator must qualify under those guidelines to be classified an Owner-operator and be exempt from the pre-determined wage rates.
2. The driver of the truck must be the registered owner and be shown as such on the vehicle registration. Corporations and partnerships do not qualify.
3. A subcontract must be approved and in the project office before the owner-operator can work on the project.
4. Show the owner-operator's name, address and social security on the payroll and classify them as "owner-operator. Hours worked and wages paid are not required.

D. When leasing additional trucks, place the drivers of the leased trucks on the CONTRACTOR or subcontractor payrolls.

December 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 01282

PAYMENT

Delete Section 01282 and replace with the following:

PART 1 GENERAL

1.1 RELATED SECTIONS

A. Section 00555: Prosecution and Progress

B. Section 00570: Definitions

C. Section 00725: Scope of Work

D. Section 00727: Control of Work

E. Section 01280: Measurement

1.2 SCOPE OF PAYMENT

A. Department fully compensates Contractor as provided in the Contract for:
   1. Furnishing all materials, labor, equipment, tools, transportation and incidentals required for completion of the work.
   2. All loss or damage due to the nature of the work, action of the elements and unforeseen difficulties until final acceptance by the Department, subject to the provisions of Section 00725, article, “Contractor's Responsibility for Work.”
   3. All costs arising from any infringement of a patent, trademark, or copyright.

B. Lump sum: Complete payment for the work described in the Contract when used as an item of payment.

C. Department will not pay Contractor for:
   1. Work that is in excess of that contained in the Contract.
   2. Removal and replacement of defective work.
   3. Loss of anticipated profits.

D. Neither partial payment nor release of retainage relieves the Contractor of the obligation to correct all defective work or materials.

1.3 ALTERED QUANTITIES

A. When the accepted quantities of work vary from the estimated quantities in the Contract, the Department pays the original contract unit prices for the accepted quantities of work done.
   1. Department does not allow for any increased expenses, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly from such alterations or indirectly from unbalanced allocation among the contract items of overhead expense and subsequent loss of expected reimbursement or from any other cause.
   2. Exceptions: as provided in
      a. Section 00555, article, "Termination of Contract for Convenience of the Department."
      b. Section 00725, article, "Differing Site Conditions."
      c. Section 00725, article, "Significant Changes in the Character of the Work."
      d. Section 00725, article, "Suspensions of Work Ordered by the Engineer."

1.4 DIFFERING SITE CONDITIONS, CHANGES, EXTRA WORK

A. Department pays for differing site conditions, changes, and extra work performed under Section 00725 at unit price or lump sum as stipulated in the order authorizing the work.

B. The Contractor's representative and the Engineer compare independent cost estimates to determine the cost of extra work.

C. At the Engineer's request, provide a cost analysis for the extra work detailed as follows:
   1. Labor classifications, total hours for each classification, wage rate, and extension for each classification.
   2. Cost of fringe benefits and subsistence.
   3. Quantities of materials, prices, and extensions.
   4. Equipment classifications, total hours, rental rate, and extension for each unit of machinery and equipment.
   5. Transportation of materials and equipment.
   6. If applicable, subcontractors' cost analysis.

1.5 FORCE ACCOUNT WORK - GENERAL

A. Instead of a unit price or lump sum basis specified above, the Department may require the Contractor to do such work on a force account basis.

B. Department does not make additional allowance for:
   1. Timekeepers, bookkeepers, or other general office help.
   2. General superintendent except for the time spent in direct supervision of the force account work.
   3. The use of small tools (tools costing $400 or less) or other costs for which no specific allowance is herein provided.

C. Department does not pay for pickup trucks used solely for transportation.

D. Department pays straight time for all hours worked. Overtime must have the prior written approval of the Engineer.

1.6 FORCE ACCOUNT WORK - LABOR

A. Compensation for labor: Department pays for all labor, including direct supervision, used in the actual and direct performance of the work, at the rate of wage (or scale) agreed upon in writing before beginning work.

B. Department reimburses for actual costs paid to, or in behalf of workmen, including subsistence and travel allowances, and health and welfare required by collective bargaining agreements or other employment contract generally applicable to the classes of labor employed on the work.
   1. Department pays to Contractor an amount equal to 60 percent of the sum of the above items to cover the costs of bonds, insurance, taxes, etc.
   2. Contractor`s wage, payroll, and cost records pertaining to work paid for on a force account basis is open to inspection or audit.

1.7 FORCE ACCOUNT WORK - MATERIALS

A. Department pays for all materials accepted by the Engineer and incorporated in the project at actual cost:
   1. Including sales taxes and transportation charges plus 15 percent.
   2. Excluding machinery rentals as hereinafter set forth.

B. Include invoices with statements for all materials used. Certify by affidavit the cost of material furnished from Contractor's stocks when no invoice is available.

1.8 FORCE ACCOUNT WORK - CONTRACTOR OWNED EQUIPMENT

A. Department pays for machinery or special equipment, excluding small tools, authorized by the Engineer at an hourly rate obtained from the "*Rental Rate Blue Book For Construction Equipment*," (Blue Book). These hourly rental rates are determined by the monthly rental rate taken from the above mentioned publication divided by 176. Updated supplements are authorized for use Statewide on specified dates. Obtain this publication through:

Equipment Watch
1735 Technology Drive, Suite 410
San Jose, CA 95110-1313
Phone: (800) 669-3282
Fax: (408) 467-6795
www.equipmentwatch.com

B. The total hourly rates derived from the above have been computed from equipment costs currently in effect. The rates derived do not include costs for operating personnel.

C. The rates require adjustment by a Regional Factor and a Depreciation Factor found in the front of each Chapter in the Rental Rate Blue Book.

D. Equipment Rental rates can fall in the following two categories:
   1. Operating Rate - For those hours the equipment is actually in use. Includes ownership and operating costs. Adjusted for depreciation using Rate Adjustment Table and region using the Regional Adjustment Maps.
   2. Standby Rate - Compensation for equipment required to be at the work site but not operating. Includes ownership costs only. This rate is 50 percent of the adjusted ownership costs computed in the previous article. The duration of allowable standby time is to be approved in writing by the Engineer with a maximum of 8 hours per day or 40 hours in a normal week.

E. When the "Manufacturer's Rated Capacity" falls between those shown in this manual, the Department uses the shown capacity which is closest to the manufacturer's. Do not interpolate for rates in between.

F. Agree upon all rates in writing before work is begun and measured as provided in Section 01280.

G. Equipment rental rates not provided by the aforementioned manual must be approved by the Office of Construction and Materials before the start of any "force account work."

H. Department allows "move-in" and "move-out" transportation cost for a piece of equipment not available on the job, if the particular piece of equipment is not moved onto the job under its own power.
   1. Department allows hourly operating rate for equipment moved to the site under its own power.
   2. Department pays these charges only once for any particular piece of equipment except in unusual circumstances that must be justified in writing and agreed to by the Engineer.

1.9 FORCE ACCOUNT WORK - RENTED OR LEASED EQUIPMENT

A. When the equipment to be used is specialized in nature and is not available in the Contractor's inventory and is rented or leased from an outside source, Department adds a 10 percent allowance on the first $5,000 plus five percent of the balance in excess of $5,000 for overhead for all rented or leased equipment paid for by invoices.
   1. Where the rental rate charged exceeds the rate determined by the Blue Book, submit the rental or lease agreement to the Engineer for Construction and Materials for approval.
   2. Department pays equipment operating costs at the rate from the Blue Book for rented or leased equipment for each hour the equipment was actually used.

B. When the required equipment is in the Contractor's available inventory but not on the project site, the equipment may be rented from a local source. The Engineer may approve rental rates for equipment obtained from local sources when such rates are within 10 percent of the Blue Book. When the equipment is to be used less than a week, "move-in" and "move-out" costs for Contractor owned equipment may be considered when comparing rental costs of equipment obtained from local sources.
   1. This option is only allowed when the cost of locally rented equipment would be less than using Contractor owned equipment including "move-in" and "move-out" charges.
   2. Such rentals must be supported by a cost analysis indicating the method used was the least expensive.
   3. If the Contractor elects to rent equipment of a type that is in the Contractor's inventory and the rental costs exceed that allowed by this article, the Department reimburses for such equipment based on the Blue Book.

1.10 FORCE ACCOUNT WORK - SUBCONTRACTS

A. For all force account work performed under an approved subcontract, Department pays an additional allowance equal to ten percent of the first $5,000 plus 5 percent of the balance in excess of $5,000 for overhead for the subcontract.

B. The Engineer reviews each situation to determine that performing the work by subcontract is justified.

1.11 FORCE ACCOUNT WORK - STATEMENTS

A. The Contractor's representative and the Engineer compare records of the cost of work done as ordered on a force account basis.

B. At the Engineer's request, provide an itemized statement of the cost of the force account work detailed as follows:

1. Name, classification, date, daily hours designating straight time and overtime, total hours, rate, and extension for each laborer and supervisor. (Payrolls may be used for part of this information.)
2. Designation, dates, daily hours, total hours, rental rate, and extension for each unit of machinery and equipment.
3. Quantities of materials, prices, and extensions.
4. Transportation of materials and equipment.
5. Cost of fringe benefits and subsistence.
6. Subcontractors.

1.12 ELIMINATED ITEMS

A. If the Department determines items contained in the Contract are unnecessary, the Engineer eliminates the items from the Contract with a Change Order to the Contractor. This action does not invalidate the Contract.

B. When a Contractor is notified of eliminated items, Department reimburses for actual work done under the provisions of Section 01282, article, “Differing Site Conditions, Changes, Extra Work;” and articles concerning Force Account Work (General, Labor, Materials, Contractor-Owned Equipment, Rented or Leased Equipment, Subcontracts, Compensation).

1.13 PROGRESS PAYMENTS

A. Department makes progress payments at least once each month as the work is progressing.

B. More frequent payments may be made during any period when the Department determines that the value of work performed during the period is of sufficient amount to warrant a payment.

C. Payments are based on estimates prepared by the Engineer of the value of the work performed and materials in place under the Contract and for materials delivered under this Section, article, "Payment for Material on Hand."

D. Department makes no progress payment when the total value of the work done since the last estimate is less than $1,000.

E. From the total of the payable amounts, the Department deducts and retains 5 percent until after the entire Contract has been completed in an acceptable manner. When no less than 95 percent of the work has been completed, and with the consent of the Surety, the Engineer may prepare a semi-final estimate from which the Department retains 1-1/2 percent of the original contract amount. The Department certifies the remainder for payment, less all previous payments.

F. The Contractor may enter into an addendum agreement providing for the payment of retained monies into an escrow account, or the Department does so automatically.
   1. These monies are to be applied toward the purchase of approved securities that are to be held by an escrow agent until satisfactory completion of the construction Contract.
   2. The value of the securities placed in escrow has a minimum value equal to or greater than the amount that would otherwise be retained.
   3. The addendum agreement must be executed concurrently with the execution of the construction Contract. Agreement forms are available in the office of the Department's Engineer for Construction and Materials.

G. The Department pays the Contractor within 14 calendar days after certification and approval of billings and estimates.
   1. Contractor and Engineer agree to a Saturday partial estimate closing date. Succeeding partial estimates close on the same Saturday for each succeeding month.
   2. One month's work to be accomplished prior to submission of partial estimate. Engineer may process more than one partial estimate during the same estimate period if a large segment of work completed by the Contractor is greater than $100,000.
   3. Contractor approves partial estimate prior to submission.

1.14 PAYMENT FOR MATERIAL ON HAND

A. When the Contractor presents delivery copies of invoices, the Department may include in the partial payment invoice, advance payments for acceptable nonperishable materials purchased expressly to be incorporated into the work when delivered in the vicinity of the project, or stored in approved storage place.
   1. The Engineer determines the amount to be included in the estimate, but in no case will the amount exceed the value of the materials as shown on the delivery invoice, or 75 percent of the in-place price, whichever is less.
   2. When the approved storage location is other than the project site, furnish evidence that the stockpiled materials are irrevocably obligated to the project.
   3. Department does not pay when the invoice value of such materials, as determined by the Engineer, amounts to less than $2,000 or if materials are to be stored less than 30 calendar days.
   4. Within 60 calendar days following the date of the estimate invoice on which the stockpile material is to be paid by the Department, furnish to the Engineer certified paid invoices or a certified statement with a copy of the check showing payment.
   5. Material will be removed from the next partial estimate as stockpiled materials if proper invoices showing payment to the supplier is not received.

B. Department makes no partial payment on living or perishable materials until incorporated as specified in the Contract.

C. Department does not pay for materials brought onto the site at the Contractor's election that may be incorporated into the project such as fuels, supplies, metal decking forms, ties, or supplies used to improve efficiency of operations.

D. Approval of partial payment for stockpiled materials does not constitute final acceptance of such materials for use in completing items of work.

E. Department purchases at actual cost and without any percentage allowance for profit, materials delivered to the project in compliance with the Contract or left unused due to changes in plans or variation in quantities, if the materials are not practicably returnable for credit.
   1. Purchased materials become the property of the Department.
   2. Actual costs are based on invoice price plus transportation costs to the work.

F. Payment is limited to contract quantities unless ordered by the Engineer. Assume responsibility for excess materials delivered to the project, or aggregate produced beyond the contract amount without authority from the Engineer.

G. At the option of the Department, surplus aggregates up to the contract quantities may be purchased provided:
   1. The material is stockpiled where directed, and
   2. The material meets specification requirements when stockpiled.

H. Department pays for material accepted on an agreed price basis, which price is normally the Contractor's production cost. In addition, the Department pays the cost to haul the materials to the stockpile site and place in pile at the rate of 9 cents per ton mile or 20 cents per cubic yard mile.

1.15 ACCEPTANCE AND FINAL PAYMENT

A. When the project has been accepted as provided in Section 00727, articles, "Project Acceptance - Partial," and "Project Acceptance - Final," the Engineer prepares the final estimate of work performed.
   1. If the Contractor approves the final estimate or does not object to the quantities within 30 calendar days of receiving the final estimate, the Department processes the estimate for final payment.
   2. After approval of the final estimate by the Contractor, Department pays for the entire sum due after deducting all previous payments and all amounts to be retained or deducted under the provisions of the Contract.

B. If additional payment is due from the Department, file with the Department a full, complete, and itemized written statement justifying the adjustment within 30 calendar days after the final estimate is submitted for approval.
   1. All disputes not itemized in said statement are waived by the Contractor.
   2. Submission of disputes by the Contractor will not be reason for withholding full payment of the total value of work shown on the Engineer's final estimate.
   3. The Department evaluates the dispute. If it is determined that additional payment is due, the final estimate is revised accordingly, under the terms of the Contract. If not, the estimate as submitted is final.

C. All prior partial estimates and payments is subject to correction in the final estimate and payment.

D. The Department has the final estimate complete and to the Contractor within six months of when the Contractor meets substantial completion of the project and has supplied the Engineer with all project certifications.

1.16 ADJUSTMENTS FOR FUEL COST

A. This price adjustment provision is intended to minimize risk to the Contractor due to potential volatile price fluctuations for fuel that might occur throughout the duration of the Contract.
   1. The Contractor may invoke this provision at any time during the Contract by written notification to the Engineer.
   2. Adjustments are then made on all prior and future partial estimates. When this provision becomes effective, it remains in effect for the duration of the Contract.

B. This provision is not designed to estimate actual quantities of fuel used in construction operations, but to provide a reasonable basis for calculating a fuel price adjustment based on average conditions.

C. Department determines compensation adjustments under the provisions of this Section, and presumes that the Contractor has relied on these provisions for compensation adjustments when determining unit bid prices.

D. Terms for calculating adjustments for fuel costs:
   1. Fuel Partial Estimate Base Price (EP): - The average of all base prices determined during the partial estimate period.
      a. The Department determines the base price per barrel for crude on the first working day of each week, using postings from the commodities and futures section of the Wall Street Journal for West Texas Intermediate (WTI) crude using the spot price for that date as a basis.
      b. A conversion factor of 42 gallons per barrel is used.

   2. Fuel Contract Base Price (CP): The base price determined for the week during which the bid opening is held. The source of the price is the same as that used for the (EP).

   3. Fuel Usage Factors (FU): A combined diesel and gasoline factor. Table 1 contains the items for which adjustments may be made, and the fuel usage factors upon which the adjustment is based.

E. Determining Adjustments (AF): The Engineer computes the adjustments separately for each partial estimate period. The adjustment is determined based on appropriate items in Table 1 using the formula with the following constraints.
   1. The Partial Estimate Base Price must change plus or minus 15 percent from the Contract Base Price before an adjustment is made; then add or deduct 5 percent per the formula.

2. Engineer adjusts only major contract items as defined by Section 00570, article, "Terms," paragraph, "Major and Minor Contract Items," or items that have an individual value of $100,000 or more based on original contract quantities.
3. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.

F. Work Beyond Contract Time: Adjustment will not apply to any work performed after the expiration of contract time plus approved time extensions.

G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the Department determines whether it is feasible for the remainder of the project to proceed, and notifies the Contractor in writing if the project is to be terminated.

H. Adjustment Formula:

EP greater than CP:

$$AF = \frac{[(EP - CP) - 0.05\ CP]\ Q\ (FU)}{42}$$

EP less than CP:

$$AF = \frac{[(EP - CP) + 0.05\ CP]\ Q\ (FU)}{42}$$

Where:

EP	=	Partial Estimate Base Price per barrel (dollars)
CP	=	Contract Base Price per barrel (dollars)
Q	=	Quantity of Acceptable Work Performed on Item
FU	=	Fuel Usage Factor for that Item
AF	=	Adjustment for Fuel Costs in Dollars
42	=	Gallons per Barrel of Crude

Table 1
Adjustable Items and Fuel Usage Factors

Item of Work	Quantity of Work (Q)	Combined Diesel & Gasoline Usage Factor (FU)
Roadway Excavation, Borrow, Embankment, Granular Borrow, Top Soil	Cubic Yard Ton	0.45 0.25
Loose Riprap	Cubic Yard	0.57
Underdrain Granular Backfill	Cubic Yard	1.16
Untreated Base Course	Ton	0.84
Hot Mix Asphalt	Ton	3.60
Open-Graded Surface Course	Cubic Yard Ton	7.20 3.60
Cover Material: Produced and Placed on Roadway Produced and Stockpiled	 Ton Ton	 0.64 0.36
Portland Cement Concrete Pavement Lean Concrete Base Course	1 inch thick Sq Yard	0.214 0.048
Structures (includes: Concrete, Piles, Reinforcing Steel, Structural Steel) Pipe Culvert Special Pipe Culvert (includes excavation for structures) Underdrains Right-of-Way Fence & Gates Seeding Concrete Small Structures Portland Cement Concrete Highway Traffic Paint Precast Concrete Barrier Guardrail	$	0.038 Gal

1.17 ADJUSTMENT FOR ASPHALT MATERIALS

A. This price adjustment provision is intended to minimize risk to the Contractor due to potential volatile price fluctuations for asphalt materials that might occur throughout the duration of the Contract.
   1. The Contractor may invoke this provision at any time during the Contract by written notice to the Engineer.
   2. Department then adjusts future partial estimates. When this provision becomes effective it remains in effect for the duration of the Contract.

B. Department adjusts the price of asphalt materials for work done on bid items that contain asphalt materials, including asphalt cement, liquid asphalt, and emulsified asphalt.

C. Department determines compensation adjustments under the provisions of this Section, and presumes that the Contractor has relied on these provisions for compensation adjustments when determining unit bid prices.

D. Terms for calculating adjustments for asphalt materials are as follows:
   1. Asphalt Partial Estimate Base Price (EP): The average of all the base prices determined during the partial estimate period.
      a. On the first working day of each week, the Department determines the base price per barrel for crude oil using postings from the commodities and futures section of the Wall Street Journal for West Texas Sour (WTS).
      b. A conversion factor of 5.6 barrels per ton is used.
   2. Asphalt Contract Base Price (CP) - The base price determined for the week during which the bid opening is held is the Contract Base Price. The source of the price is the same as that used for the (EP).

E. Determining Adjustments (AF): The Engineer computes the adjustments separately for each partial estimate period. The adjustment on each item is determined using the formula with the following constraints.
   1. The Partial Estimate Base Price of asphalt materials must change plus or minus 15 percent from the Contract Base Price before an adjustment is made; then add or deduct 5 percent per the formula.
   2. Adjustments in compensation may be either plus or minus depending on the differences between the Contract Base Price and the Partial Estimate Base Price.

F. Work Beyond Contract Time: Adjustment will not apply to any work performed after the expiration of contract time plus approved time extensions.

G. Upward Ceiling: If the Partial Estimate Base Price increases by more than 50 percent from the Contract Base Price for an adjustable bid item, the Department determines the feasibility for proceeding with the remainder of the project and notifies the Contractor in writing if the project is to be terminated.

H. Adjustment Formula

EP greater than CP:

$AF = [(EP - CP) - 0.05\ CP]\ (5.6)\ Q$

EP less than CP:

$AF = [(EP - CP) + 0.05\ CP]\ (5.6)\ Q$

Where:

EP	=	Partial Estimate Base Price per barrel (dollars)
CP	=	Contract Base Price per barrel (dollars)
Q	=	Quantity in ton of Asphalt Materials used
AF	=	Adjustment for Asphalt Costs in dollars
5.6	=	Barrels per ton of Asphalt

The Engineer calculates the tons of asphalt product that will be Q in the above equation for the following:

HMA (Hot Mix Asphalt)
Open-Graded Surface Course
Emulsified Asphalts
Cutback Asphalts

PART 2 PRODUCTS Not used.

PART 3 EXECUTION Not used.

END OF SECTION

January 9, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 01285 M

MOBILIZATION

Delete paragraph 1.1 and add the following:

1.1 SECTION INCLUDES

A. Preparatory work and operations necessary for moving personnel, equipment, supplies, and incidentals to the project site before beginning work.

November 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 01315 M

PUBLIC INFORMATION SERVICES

June 13, 2000

Add the following to paragraph 1.3, "Public Information Manager (PIM) Responsibilities"

I. Is primarily responsible for public information services.

J. Is not the superintendent and does not have other duties that interfere with the successful accomplishment of public information responsibilities.

Added November 14, 2000
Delete line A of paragraph 3.1, "Construction Traffic Signs," and replace with the following:

A. Erect signs with the Contractor's Public Information office phone number according to Standard Drawing 745-2A.

January 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 01455 M

MATERIALS QUALITY REQUIREMENTS

Add the following to paragraph 1.6 “Samples, Tests, and Referenced Specifications”:

H. All DEPARTMENT and Consultant/CONTRACTOR materials laboratories, materials test technicians, and construction technician inspectors must be qualified under the requirements of the UDOT Quality Assurance Manual to perform material sampling and testing and construction inspection on State, Federal-Aid, local government and maintenance projects.

January 8, 2002

SUPPLEMENT SPECIFICATION

SECTION 01554

TRAFFIC CONTROL

Delete Section 01554 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Traffic Control Plan requirements, and materials and labor necessary for implementation.

B Traffic Control Maintainer, and Flagging

C. Work zone traffic control devices, advance warning arrow panels, and pilot cars.

1.2 RELATED SECTIONS

A. Section 00555: Prosecution and Progress.

B. Section 00725: Scope of Work

C. Section 00727: Control of Work

D. Section 01558: Temporary Pavement Markings

E. Section 02842: Delineators.

F. Section 02891: Traffic Signs

G. Section 02765: Pavement Marking Paint

1.3 REFERENCES

A. AASHTO Roadside Design Guide, Current Edition

B. Manual on Uniform Traffic Control Devices (MUTCD), Current Edition

C. ATSSA: American Traffic Safety Services Association.
   1. Quality Standards for Work Zone Traffic Control Devices

D. NCHRP- Report 350 Recommended Procedures for the Safety Performance Evaluation of Highway Features

1.4 BIDDING REQUIREMENTS

A. The apparent low bidder:
   1. Submit three copies of the Traffic Control Plan to the Engineer no later than the fourth Wednesday following bid opening. Submit plans in 11 x 17 format prepared using CAD software. All plans must be signed and sealed by a professional engineer licensed in the State of Utah. When available, the Department will provide basemap CAD files in Microstation format to the Contractor on a CD-ROM at no cost.
   2. Attend a mandatory meeting at the time and location as directed by the Engineer:
      a. Contractor's Traffic Control Designer
      b. Contractor's Traffic Control Maintainer
      c. Resident Engineer
      d. Region Traffic Engineer or designated representative
   3. Ensure compliance with the plans and specifications. Modify plan if necessary to meet all applicable requirements.
   4. The Department will grant no additional contract time for preparing or modifying the Traffic Control Plan.
   5. Do not begin work begin until the Traffic Control Plan is implemented for that phase of work. Do not implement traffic control until written authorization is received from the Engineer.

1.5 CERTIFICATIONS

A. After April 1, 2002 use devices and systems which meet NCHRP-350 Report crash test requirements as defined in the four categories by the Federal Highway Administration. Some exception will be acceptable as stated below.
   1. Category 1: cones, tubular marker, delineators, and drums without lights must be certified by the manufacturer as meeting NCHRP-350 Report requirements.

2. Category 2: portable sign stands with signs, Type I, II and III barricades, vertical panels, Category 1 devices with light attachments and devices not expected to cause significant vehicle velocity change. These devices and systems must be certified by FHWA as meeting NCHRP-350 Report test requirements.
3. Category 3: Portable/Temporary pre-cast concrete barrier manufactured after October 1, 2002 must be certified as meeting NCHRP-350 Report test requirements.
    a. Manufactured date to be stamped into top of each barrier section using a numeric format (ex: 10/2002) with 75 mm X 50 mm numerals, 6 mm deep.
    b. Portable/Temporary pre-cast concrete barrier manufactured prior to October 1, 2002 and meeting NCHRP 230 may be used until they are no longer serviceable.
4. Category 3: Crash Cushions and Truck Mounted Attenuators must be certified by FHWA as meeting NCHRP-350 Report test requirements.
    a. The appropriate GREAT CZ, manufactured by Energy Absorption Systems, may be used until they have completed their normal service life.
5. Category 4: Advanced Warning Arrow Panels and portable variable message signs do not have to meet NCHRP-350 Report test requirements.

1.6 TRAFFIC CONTROL PLAN REQUIREMENTS

A. Design Traffic Control Plan resolving discrepancies between the various standards for traffic control in accordance with Section 00727 Control of Work paragraph 1.5 B and the following:
    1. UDOT Standard Traffic Control Drawings 745-2 Series, UDOT Standard Drawing 745-60, 745-60A, 745-60B, and 745-60D for post mounted signs.
    2. Manual on Uniform Traffic Control Devices (MUTCD) Latest Edition

B. Follow the requirements and limitations identified in the Traffic Control Special Provision (if included), Section 00555, Prosecution and Progress, paragraph 1.11, Limitation of Operations, Section 00725, Scope of Work, paragraphs associated with the maintaining of traffic and Section 00820 Legal Relations and Responsibility to Public, paragraph 1.10 “Public Convenience and Safety - Traffic and Pedestrians.”

C. Consider the safe and efficient movement of traffic when lane closures are proposed.

1. Open lanes to traffic wherever and whenever practical.
2. Minimize and restrict lane closures to the locations and times essential for prosecution of work.

D. Provide for concrete barrier and attenuation to satisfy hazard mitigation according to UDOT Standard Drawing 745-2 Detail AA, and 745-2E Detail E-1

E. Provide for delineation and temporary pavement markings and/or removal as needed for traffic control or as required in accordance with this Section, paragraph 1.6, lines H and I.

F. Provide protection for all hazards (ie: bridge parapets, barrier blunt ends, poles, large equipment to include but not limited to cranes, pile drivers etc.) when hazard is within AASHTO clear zone requirements for approach traffic.

G. Use the following format and provide the following documentation:
1. Section I: Description of each phase
   a. List phases, and corresponding bid items and elements of work to be accomplished in each phase.
   b. Accounting for each contract bid item and element of work, reference the traffic control detail designed to provide for the safe and efficient movement of traffic and safety of workers.
   c. All contract bid items and elements of work must be identified and included in the phasing.
2. Section II: CAD generated drawings showing detailed Traffic Control Plan for each phase:
   a. Adapt Standard Drawings and work zone traffic control examples contained in the MUTCD to reflect actual project conditions such as curves, grades, presence of ramps, intersections and accesses.
   b. Use basemap CAD files when supplied by the Department as a basis for the Traffic Control Plan drawings.
   c. Use the same level of detail as in the MUTCD and UDOT Standard Traffic Control Drawings.
   d. Include the anticipated duration of the traffic control setup used in each phase.
   e. Provide for the safe passage of pedestrians and bicyclists through the work zone in accordance with the Americans with Disabilities Act and the MUTCD.

f. Clearly indicate the following:

- Proposed regulatory speed reductions in accordance with this Section, paragraph 3.6
- For all tapers: length of taper, device spacing, lane or shoulder closures, amount of lane shift in accordance with this Section, paragraph 3.3 A
- Length of buffer zone, in accordance with this Section, paragraph.3.3 A
- Device spacing used in tangents in accordance with this Section, paragraph 3.3 B
- Lengths of work zones, lane and shoulder widths and area available for vehicle recovery
- Proposed changes to be made to existing traffic signals including: timing changes, phase changes, etc.
- Sign locations for required and existing signs.
- Existing signs that are to be removed, covered, relocated or otherwise changed from the original configuration.
- Worker parking, work vehicle and equipment access to and from work area, staging and material sites.

3. Section III: Emergency and Special Situations

a. Identify procedures for dealing with emergencies and special situations.

H. Provide temporary pavement markings on newly constructed asphalt pavement and refresh as needed until the final surfacing is placed in accordance with Section 01558: Temporary Pavement Markings, as directed by the Engineer.

I. Completely remove all existing traffic markings that conflict with the Traffic Control Plan, in accordance with Section 02765, paragraph 3.2: Removing Pavement Markings. Do not use paint or other material to cover markings.

1.7 TRAFFIC CONTROL MAINTAINER

A. Certified by the Department or by the American Traffic Safety Services Association (ATSSA) as a Traffic Control Technician. Certifications are available through:

Associated General Contractors
1135 South West Temple
Salt Lake City, Utah.
Tele: 801-363-2753

American Traffic Safety Services Association (ATSSA),
15 Riverside Parkway Suite 100
Fredericksburg, Virginia 22406-1022
Tele: (800) 272-8772
Internet: www.atssa.com

B. Authority:
1. Obtains and uses all labor, equipment, and materials necessary to maintain traffic control.
2. Changes traffic control operations per the traffic control plan.

C. Responsibilities and Duties:
1. Oversees all traffic control operations.
2. Implements the Traffic Control Plan.
3. Remains available 24 hours a day, seven days a week and can be on-site within 30 minutes of notification.
4. Corrects deficiencies immediately upon verbal or written notification from the Engineer or representative.
5. Inspect and document inspections of traffic control on a form acceptable to the Engineer at least four times each day.
   a. Before beginning of shift.
   b. At mid-shift.
   c. Half-hour after evening shift ends.
   d. At the midpoint of the off-shift period.
6. Coordinates project traffic control with emergency services and local law enforcement agencies.
7. Inspect and document inspections of traffic control twice each day when no construction work is being done.
   a. One during day light hours and one during night time hours
   b. Conduct inspections a minimum of 8 hours apart
8. Completes a daily record of traffic control activities using a form acceptable to the Engineer.
9. Submit to the Engineer inspection and activities forms each week on a day and time acceptable to the Engineer.
10. Provide a daily report of all planned traffic control activities to the Engineer by 7:00 AM each day. Provide the report each day during the contract.

1.8 MAINTENANCE OF WORK ZONE TRAFFIC CONTROL

A. Implement and maintain traffic control per the Traffic Control Plan. Implement changes to traffic control required in order to meet UDOT Standard Specifications, Drawings and MUTCD at no additional cost to the Department. Coordinate changes to traffic control and the Traffic Control Plan with the Engineer prior to implementation.

B. Meet all requirements of this Section, paragraph 1.7 when traffic control devices are required to be in place overnight or on weekends.

C. Meet the acceptable classification as identified by *Quality Standards for Work Zone Traffic Control Devices* published by American Traffic Safety Services Association (ATSSA) for traffic control devices.
   1. Wash devices weekly unless conditions warrant more frequent cleaning.

D. Maintain traffic control devices during and after all snow plowing operations at no additional cost to the Department. Clear snow away from all traffic control devices so that the devices function as intended.

1.9 WAGE RATES FOR TRAFFIC CONTROL PERSONNEL (FEDERAL AID JOBS ONLY)

A. Payment of wages must be as stated below during the time the certified Traffic Control Maintainer, or others involved in setting up or maintaining traffic control devices working under the direction of the certified Traffic Control Maintainer, is on the project site and does any of the following work:
   1. Laborer I - for moving traffic control devices by hand; loading or unloading devices on to or off of the truck; and for all hours required to be at the project site except those hours spent in the truck driver classification.
   2. Truck Driver - for all hours spent driving on the project site in the performance of the duties required to maintain the traffic control. The rate of pay is determined by the size of vehicle being driven, Pickup Truck being the smallest.

1.10 PAYMENT PROCEDURES

A. Partial Payments - Based on the percentage of the project completed, excluding the cost of traffic control.

B. Price Adjustments:

1. The Department reduces payment when traffic control is not in compliance with the Traffic Control Plan, or when the contractor fails to meet all requirements cited or referenced in this specification.
   a. The amount per day by which the Contractor's compensation will be reduced is calculated using the daily charge for Calendar Day in the Schedule of Liquidated Damages in Table 1 of Section 00555 or the Contract lump sum bid price for Traffic Control divided by the number of contract days, whichever is greater.
2. A Stop Work order issued due to non-compliance with this specification is not considered to be an authorized suspension of contract time. Contract time will continue to accrue as defined Section 00555, paragraph 1.14 "Determining Contract Time."

C. Include in the bid item "Traffic Control" all materials, equipment, labor, flagging, pilot car, temporary pavement markings and/or removal and workmanship required for the design, implementation and maintenance of the Traffic Control Plan.

D. Provide the Engineer in writing with a detailed analysis showing impacts to traffic control caused by extra work that necessitates modification to the Traffic Control Plan. Negotiate and agree to either a lump sum price for additional Traffic Control or agree to unit prices to be used for additional Traffic Control measures or devices required, prior to performing the extra work.

PART 2 PRODUCTS

2.1 PILOT CAR

A. Equip with a reflectorized sign:

1. Comply with Section 02891: Traffic Signs
2. MUTCD sign G20-4

B. Equip with a minimum two rotating lights or strobe lights.

1. Minimum 100 mm diameter and minimum 1830 mm mounting height
2. Yellow color

2.2 FLAGGER EQUIPMENT AND CLOTHING

A. Comply with to the Department's "Flagger Training Handbook"

B. Comply with Standard Drawings 745-1

C. Clothing:
   1. Flagger vest and hard hat: Orange, red-orange, or flourescent version of these colors with:
      a. Minimum 83870 mm^2 each on the front and back of strong yellow-green reflective tape, or
      b. Minimum of 41935 mm^2 each on the front and back of strong yellow-green non-reflective tape, with 41935 mm^2 white reflective tape placed on both sides of the non-reflective tape on the front and back.
      c. Orange or flourescent orange hard hat with 6450 mm^2 of white or strong yellow-green reflective tape placed around the base of the hard hat and visible to traffic.

2.3 TRAFFIC CONTROL SIGNING AND DEVICES

A. Signs:
   1. Comply with paragraph 1.5
   2. Comply with Section 02891, Traffic Signs
   3. Comply with Standard Drawing 745-1
   4. Comply with Standard Drawings 745-60, 745-60A, 745-60B, and 745-60D when using post mounted signs

B. Channelizing Devices:
   1. Comply with paragraph 1.5
   2. Comply with Standard Drawing 745-1
      a. Comply with Section 02891, paragraph 2.1 E Reflective Sheeting
      b. Use construction orange tubular markers and cone during daylight hours only.

C. Precast Concrete Barrier:
   1. Comply with paragraph1.5
   2. Comply with UDOT Standards Drawing 745-2 Detail AA and 745-2E Detail E-1

3. Use an approved construction zone attenuator or permanent style end sections, as listed in UDOT Guidelines for Attenuators and End Section.
   a. Use a construction zone attenuator when approach ends of temporary precast barrier are within AASHTO clear zone.
      - Use AASHTO Roadside Design Guide to determine proper clear zone distance requirements
      - Install attenuators or end sections as per UDOT Standard Drawings 735-1 series and manufactures recommendations.
4. Do not use a truck mounted attenuator (TMA) to protect temporary precast barrier end for more than 24 hours. Use properly rated TMA as directed in this Section, paragraph 2.3, D.

D. Use properly rated truck mounted attenuator for the posted speed limit prior to construction.
   1. NCHRP-350 Test Level 2 for speeds 45 mph or less
   2. NCHRP-350 Test Level 3 for speeds greater than 45 mph.

2.4 ADVANCE WARNING ARROW PANEL

A. Advance Warning Device:
   1. Meet all standards as specified in the MUTCD, Section 6F.53 Arrow Panels.
   2. Perform all functions as specified in UDOT Standard Drawing 745-1 and the MUTCD

PART 3 EXECUTION

3.1 MODIFICATION OF TRAFFIC CONTROL PLANS

A. Each phase of construction must use an authorized Traffic Control Plan. If a construction phase is proposed that is not covered by the Traffic Control Plan, submit a proposed plan to the Engineer for review.
   1. Submit proposed plans to the Engineer 10 working days before the Traffic Control Plan is to be implemented.
   2. Do not begin work until the new Traffic Control plan is authorized for use, and has been fully implemented.
   3. Implement changes required to meet UDOT Standard Specifications, Standard Drawings and MUTCD at no additional cost to the Department.
      a. Comply with this Section, paragraph 1.4 A 1

3.2 FLAGGING

A. Flaggers must have a current flagging certificate and must present proof of certification upon request by the Department.
   1. Acceptable certifications
      a. UDOT Contractor Certification (Utah Valley State College)
      b. American Traffic Safety Services Association (ATSSA)

3.3 TRAFFIC CONTROL SIGNING AND DEVICES

A. Use posted speed limit prior to construction to compute sign spacing, taper lengths, buffer zones and construction clear zone.
   1. Use plastic drums for lane closure taper devices for speeds 50 mph and greater.
   2. Do not use cone or tubular markers at night

B. Use posted speed during construction to compute the tangent spacing for channelizing devices.

C. Remove all traffic control from site of work when not required within 24 hours.
   1. Remove traffic control devices from the roadway a distance twice that of the Construction Clear Zone (Table 1 Standard Drawing TD 2A) if they will be used within 24 hours of the daily work stoppage and are not required for immediate traffic control.
      a. Obtain written permission from property owner prior to storing traffic control devices on private property.
   2. Cover post mounted signs when directed by Engineer.
      a. Cover signs completely with an opaque and durable covering

3.4 ADVANCE WARNING ARROW PANEL

A. May substitute Type C units for Type B units.
   1. Comply with UDOT Standard Drawing 745-1

B. Do not substitute Type B units for Type C units.

C. Remove Advance Warning Arrow Panel from the site of work when not needed for the control of traffic within a 4 hour period.

3.5 TRAFFIC SIGNALS

A. Use uniformed police officer when construction activities are impacting an operating signalized intersection.

B. Use of flaggers at traffic signals permitted when the signals have been turned to red flash mode.
   1. Each approach is to be controlled by a separate flagger(s).
      a. Flaggers can control only two lanes of approach traffic
         - third lane control permitted when left or right turns bays present

C. Changes to traffic signal operations will be done by the Department.

3.6 CONSTRUCTION ZONE SPEED LIMIT REQUIREMENTS

A. Obtain approval from the Engineer for regulatory speed reductions.
   1. See Standard Drawing 745-2, General Note 9
   2. Use speed reduction only when construction activities impact traffic.
   3. Restore regulatory speed limit at locations where construction activities are not impacting traffic.
   4. See Standard Drawing 745-60, 745-60A, 745-60B, 745-60D for post mounted sign requirements

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 01558

TEMPORARY PAVEMENT MARKINGS

Delete Section 01558 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installation of temporary pavement markings.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control

B. Section 02765: Pavement Marking Paint

C. Section 02842: Delineators.

1.3 REFERENCES

A. ASTM D 4592

B. ASTM D-4956

PART 2 PRODUCTS

2.1 PAVEMENT MARKING PAINT AND GLASS BEADS

A. Refer to Section 02765.

B. Accepted upon approval of the weights and analysis stated on the containers.

2.2 PAVEMENT MARKING TAPE

A. ASTM D 4592, Type I (Removable)

B. Minimum reflective values:
   1. ASTM D 4592

2.3 RAISED PAVEMENT MARKERS

A. Provide plastic raised pavement markers having reflective material with clear cover(s) as needed for the particular application.
   1. Marker body to be manufactured of polyurethane plastic in color specified for required type.
      a. Width 100 mm, height 50 mm, thickness 1.5 mm
   2. Reflective sheeting to be a minimum area of 960 mm^2. Sheeting to meet ASTM D-4956 Type 1 material minimum.
   3. Provide clear polyvinyl chloride covers attached to marker body with heavy duty staples when appropriate for the particular application or work operation.
   4. Marker to be supplied with a method of attaching to pavement surface.

B. Raised Pavement Marker Types
   1. Type Y1, yellow body with yellow reflective sheeting on both sides.
      a. Optional: Type B1, black body with yellow reflective sheeting on both sides.
   2. Type W1, white body with white reflective sheeting on both sides. Optional: Type B2, black body with white reflective sheeting on both sides.

PART 3 EXECUTION

3.1 GENERAL

A. Apply temporary pavement markings along the entire length of any roadway surfaces opened to traffic.
   1. Apply edge markings when and where delineation is removed or nonexistent.
   2. Broken line pavement markings are 1 m long, spaced on a 12 m cycle length.

B. Follow Preparation requirements in Section 02765, Paragraph 3.1.

C. Use channelizing devices, or other delineation as directed by the Engineer, to indicate road user paths in work zones when it is not possible to provide a clear path with temporary pavement markings.

D. Place transverse marking, using pavement marking tape (100 mm x 600 mm), across exposed joint for pavement vertical grade separation greater than 25 mm.
   1. Place markings on a 7.6 m spacing.

3.2 PAVEMENT MARKING PAINT AND GLASS BEADS

A. Apply Pavement Marking Paint at the following rates:
   1. 100 mm solid line at 38.5 to 41.0 m/L.
   2. 100 mm by 1 m broken line at 515 to 545 m/L.

B. Apply glass beads at a minimum 2.7 kg/L of paint, over full length and width of lines and pavement markings.

C. Re-apply Pavement Marking Paint at minimum two week intervals, or at a lesser frequency as directed by the Engineer, in order to maintain markings that provide a clear path during night and twilight periods and wet pavement conditions.

3.3 PAVEMENT MARKING TAPE

A. Apply Pavement Marking Tape in accordance with manufacturer's directions.

B. Maintain or re-apply Pavement Marking Tape in order to maintain markings that provide a clear path during night and twilight periods and wet pavement conditions.

C. Inspect in accordance with Section 01554, Paragraph 1.7, Line C., and replace any loose, missing or damaged pavement markings immediately.

D. Remove the tape immediately before paving.

3.4 RAISED PAVEMENT MARKERS

A. Attach raised pavement marker as per manufactures recommendations.

B. Space raised pavement markers as follows:
   1. Solid line: on 1.5 m centers.
   2. Broken line: two on 1 m centers spaced on a 12 m cycle length.

C. Inspect in accordance with Section 01554, Paragraph 1.7, Line C., and replace any loose, missing or damaged markers immediately.

D. Remove markers immediately before paving.

END OF SECTION

September 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 01561 M

TEMPORARY ENVIRONMENTAL FENCE

Delete line B of paragraph 1.4, "Delivery, Storage, and Handling," and replace with the following:

B. When a fence or its components is to remain in place in areas designated for the vegetation establishment period, it becomes the property of the DEPARTMENT. Refer to Section 02936.

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02056 M

COMMON FILL

January 11, 2000
Add the following to paragraph 1.2 "Related Sections":

D. Section 02324: Compaction.

August 14, 2001
Delete Table 1 in Part 2, article, "Sand," and replace with the following:

Table 1

Sand		
Sieve Size	**Percent Passing (by weight)**	
	Min	**Max**
9.5 mm	100	--
150 mm	--	10

April 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02061 M

SELECT AGGREGATE

(Added Table 1 correction April 11, 2000)

Add the following to paragraph 1.2 “Related Sections”

B. Section 02324: Compaction.

Delete Table 1 and replace with the following:

Table 1

Free Draining Granular Backfill Borrow Gradation	
Sieve Size	**Percent Passing**
37.5 mm	100
25 mm	95 to 100
12.5 mm	25 to 60
4.75 mm	0 to 10

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02075

GEOTEXTILES

Delete Section 02075 entirely and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing geotextiles of the type(s) shown on the drawings, and at other locations as directed by the ENGINEER.

1.2 RELATED SECTIONS

A. Section 01571: Temporary Environmental Controls.

1.3 REFERENCES

A. AASHTO M 288: Geotextile Specifications for Highway Applications.

B. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.

1.4 SUBMITTALS

A. Submit prior to use: Manufacturer's certificate that each fabric complies with requirements of this Section.

1.5 SAMPLING AND TESTING

A. Follow UDOT Minimum Sampling and Testing Requirements. Prior to shipment, test each individual shipment and lot of geotextile. Testing reports will accompany shipment to the job site. Clearly label all rolls as being part of the same production run certified as meeting all material requirements.

1.6 PACKAGING, SHIPPING, AND STORING

A. Protect the geotextile from direct sunlight, chemicals, mud, dirt and debris during shipment and storage. Replace at the Contractor's sole expense, any geotextile damaged or deteriorated during shipping, storage or construction.

B. Labeling and Tagging:
   1. Identify each package by a tag or label securely affixed to the outside of the roll on at least one end.
   2. Provide the following required information on the tag:
      a. Name of the geotextile manufacturer
      b. Brand name of the product, width, length, and package weight of geotextile
      c. Orange UDOT Certification sticker

1.7 ACCEPTANCE

A. DEPARTMENT will reject the geotextile at installation if it has defects, rips, holes, flaws, deterioration, or damage incurred during manufacture, transport, handling or storage.

B. Basis for Rejection: Includes non-compliance with UDOT Minimum Sampling and Testing Requirements.

PART 2 PRODUCTS

2.1 SILT FENCE GEOTEXTILE

A. Refer to Section 01571.

2.2 EROSION CONTROL GEOTEXTILE

A. Furnish as specified in AASHTO M 288.

2.3 DRAINAGE GEOTEXTILE

A. Furnish non-woven drainage geotextile as specified in AASHTO M 288 with in-situ soil designations as shown on the drawings or as indicated by the ENGINEER.

2.4 SEPARATION GEOTEXTILE

A. Furnish as specified in AASHTO M 288.

2.5 STABILIZATION GEOTEXTILE

A. Furnish as specified in AASHTO M 288.

2.6 WEED BARRIER GEOTEXTILE

A. Furnish non-woven weed barrier geotextile with elongation less than 50 percent for all weed barrier applications as specified in AASHTO M 288.

2.7 POSTS FOR SILT FENCE

A. Refer to Section 01571, Part 2, paragraph, "Silt Fence."

PART 3 EXECUTION

3.1 GENERAL

A. Place geotextile on areas that are smooth, and free of projections or depressions. Do not drag the geotextile across the subgrade; but roll out as smoothly as possible in the direction of vehicle travel.

B. Do not operate construction equipment or traffic directly on geotextile.

C. When placed for construction, cover the geotextile with indicated cover material as soon as possible. Do not leave uncovered for more than 5 days.

D. Place cover material on the geotextile in a manner that the geotextile is not torn, punctured, or shifted. Use a minimum 150 mm thick cover layer, or twice the maximum aggregate size (whichever is thicker). End-dumping cover material directly on the geotextile is not permitted, except as a starter course.

E. Limit construction vehicles in size and mass so rutting in the initial layer above the geotextile is not more than 75 mm deep, or half the layer thickness (whichever is lesser). Turning of vehicles on the first layer is not permitted.

3.2 INSTALLING SILT FENCE GEOTEXTILE

A. Refer to Section 01571, Part 3, paragraph: Installation.

3.3 INSTALLING EROSION CONTROL GEOTEXTILE

A. Install at locations shown on the drawings.

B. Unless otherwise specified, overlap the geotextile a minimum of 0.6 m at all longitudinal and transverse joints, or sew the geotextile. For sewing requirements, refer to this Section, paragraph, "Sewing."

C. If overlapped, place the geotextile so that the upstream sheet overlaps the downstream sheets.

D. For placement on slopes, overlap each sheet over the next downhill sheet.

E. Anchor the geotextile using key trenches or aprons at the crests and toes of the slope.

F. Pins, usually 450 mm in length may be helpful in securing the geotextile during installation.

G. Repair: Place patch over damaged area and extend 0.9 m beyond the perimeter of the tear or damage.

3.4 INSTALLING DRAINAGE GEOTEXTILE FOR SUBSURFACE DRAINAGE

A. Excavate trench to size and depth indicated.

B. Cut geotextile to width required and place in trench. Prevent damage to geotextile.

C. Overlap geotextile 300 mm or the full width of the trench, whichever is less, at the top of the trench.

D. Overlap successive sheets of geotextile a minimum of 300 mm in the direction of flow.

E. Place fill beginning with the sheet(s) overlapped above subsequent sheet(s), to hold geotextile in place.

F. Repair any damage to geotextile by placing patches extending 0.9 m in all directions beyond the damaged area.

3.5 INSTALLING SEPARATION GEOTEXTILE

A. Install for pavement sections or other applications at locations shown on the drawings.

B. Unless otherwise specified, overlap the geotextile a minimum of 0.3 m at all longitudinal and transverse joints, or sew the geotextile. For sewing requirements, refer to this Section, paragraph, "Sewing."

C. Repair: Place patch over damaged area and extend 0.9 m beyond the perimeter of the tear or damage.

D. Place fill, beginning with the sheet(s) overlapped above subsequent sheet(s), to hold geotextile in place.

E. Pins, usually 450 mm in length, may be helpful in securing the geotextile during installation.

3.6 INSTALLING STABILIZATION GEOTEXTILE

A. Install Stabilization Geotextile at locations shown on the drawings, or as designated by the Engineer.

B. Unless otherwise specified, overlap the geotextile a minimum of 0.6 m at all longitudinal and transverse joints, or sew the geotextile. For sewing requirements, refer to this Section, paragraph, "Sewing."

C. For placement on slopes, overlap each sheet over the next downhill sheet.

D. Repair: Place patch over damaged area and extend 0.9 m beyond the perimeter of the tear or damage.

E. Place fill, beginning with the sheet(s) overlapped above subsequent sheet(s), to hold geotextile in place.

F. Pins, usually 450 mm in length, may be helpful in securing the geotextile during installation.

3.7 INSTALLING WEED BARRIER GEOTEXTILE

A. Preparation:
   1. Remove sharp objects, large stones and undesirable vegetation.
   2. If placing geotextile over existing bed, cut an "X" over each plant and push geotextile under plant base. If placing over new bed, roll geotextile over soil and cut an "X" for each plant hole. Fold excess geotextile under and cover with specified landscaping materials.

B. Surface Cover: Provide a minimum of 100 mm of cover on all areas on the geotextile unless otherwise specified by ENGINEER. If using large landscape rock, increase thickness of cover material over geotextile up to 3 times the diameter of the largest rock material based on ENGINEER's recommendations. Do not leave any portion of geotextile exposed to direct sunlight.

C. Repair: Repair immediately. Clear the damaged area plus an additional 0.9 m and apply geotextile patch.

D. Maintenance: Maintain surfaces and supply additional landscape materials where necessary, including areas affected by erosion.

3.8 SEWING

A. Perform sewing (seaming) as specified in AASHTO M 288, Section A1-4.

END OF SECTION

June 13, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02225

ASPHALT SURFACING REMOVAL (STRUCTURES)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove existing asphalt surfacing materials from deck and approach slabs.

PART 2 PRODUCTS

2.1 REMOVAL EQUIPMENT

A. Use removal equipment capable of removing a uniform thickness of asphalt on the deck and the approach slabs without damaging the underlying asphalt, waterproofing membrane, and concrete surfaces.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove any existing waterproofing membrane from the deck and/or concrete approach slabs.

3.2 PARTIAL DEPTH REMOVAL

A. Remove a uniform thickness of asphalt from the deck and approach slabs without damaging the underlying asphalt, waterproofing membrane, or concrete surfaces.
   1. Refer to the plans for the asphalt surfacing removal depth.
   2. Allow no traffic on the asphalt surface after partial depth removal. Return traffic only after placing the final surfacing.

B. Use equipment that weighs less than 20 500 kg.

END OF SECTION

April 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02226

REMOVE CONCRETE SLOPE PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove portions of the existing slope protection and the cutoff wall where required.

PART 2 PRODUCTS Not used

PART 3 EXECUTION

3.1 PREPARATION

A. The Engineer will designate the existing portions of the slope protection for removal from the plan details.

3.2 REMOVAL

A. At the designated areas, saw cut the existing slope protection to full depth where necessary.

B. Do not damage or affect in any way the portions of concrete slope protection that are to remain.

3.3 DISPOSAL

A. Dispose of the removed material in an environmentally safe area.

END OF SECTION

March 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02317 M

STRUCTURAL EXCAVATION

Add the following to Part 1 General:

1.3 PAYMENT PROCEDURES

A. DEPARTMENT will make no separate payment for Structural Excavation. Include in associated bid items.

February 8, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02324 M

COMPACTION

Delete line A of paragraph 1.1 and replace with the following:

1.1 SECTION INCLUDES

A. Compaction of fill material for embankment foundations, areas through cuts, embankments, dikes, backfill, and other materials.

Delete paragraph 1.2 and replace with the following:

1.2 REFERENCES

A. AASHTO T 99: Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop. (Method D)

B. AASHTO T 180: Moisture-Density Relations of Soils Using a 4.54 kg (10 lb.) Rammer and a 457 mm (18 in.) Drop. (Method D)

C. AASHTO T 238: Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).

D. AASHTO T 239: Moisture Content of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth).

June 12, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02455

DRIVEN PILES

Delete Section 02455 entirely and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials, equipment and procedures for driving steel piles.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

1.3 REFERENCES

A. AASHTO M 31M: Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

B. AASHTO M 183M: Structural Steel.

C. ASTM A 36: Carbon Structural Steel

D. ASTM A 252: Welded and Seamless Steel Pipe Piles

E. ANSI/AASHTO/AWS D 1.1

1.4 SUBMITTALS

A. Complete and submit the "Pile and Driving Equipment Data" form located at the end of this Section.

1. The DEPARTMENT uses this information to perform a pile driving wave equation analysis.

2. Within 14 calendar days after submitting the form, the ENGINEER will provide either:
   a. Approval to continue
   b. Notification of inadequate equipment.
3. Mobilize pile driver to the site only after the ENGINEER indicates that acceptable results of the wave equation analysis have been obtained.
4. Remove pile hammer and other related equipment found to be inadequate for the project pile driving conditions; and re-mobilize another hammer at no cost to the DEPARTMENT.
5. Provide accurate test information regarding the yield stress values for each batch (heat) of piles to be used on the project, when requested by the ENGINEER.

PART 2 PRODUCTS

2.1 PIPE PILE SHELLS

A. Use new pipe pile shells having wall thickness as shown on plans.

B. Meet requirements for ASTM A 252 steel, for either Grade 2 (normal strength) or Grade 3 (high strength) steel, or for other minimum yield stress value(s) shown on the plans.

2.2 "H" PILES

A. As specified on the plans.

B. Follow ASTM A 36.

2.3 PORTLAND CEMENT CONCRETE

A. Class A Concrete following Section 03055.

2.4 REINFORCING STEEL

A. Meet AASHTO M 31 M, Grade 420.

B. Refer to Section 03211.

2.5 PILE DRIVER

A. Equip pile driver following manufacturer's recommendations.

B. Leads:
   1. Used with all types of hammers.
   2. Be free moving.
   3. Hold in the required position with guys, stiff braces, or both. Hold the pile parallel to the leads.
   4. Accommodate the maximum length of the pile segment, and extend to the lowest point that the hammer must reach. Obtain approval from the ENGINEER before using followers.

C. Driving Head: Fits the top of pile and provides full bearing.

D. Hammer
   1. With fully-operable adjustable settings.
   2. Rated energy as much or greater than the value indicated on the foundation plans.
   3. Install a new hammer cushion before beginning pile driving.
      a. Inspect the hammer cushion with the ENGINEER present after completing 100 hours of pile driving.
      b. Replace the cushion when it loses 25 percent or more of its original thickness.

PART 3 EXECUTION

3.1 PREPARATION

A. Complete all foundation excavation before driving piles. Dewater excavation a minimum of 1 m below bottom of footing at all times during pile driving.

B. Compare designated position of piles with the locations of existing piles from previous construction, existing utilities, old foundations, and other potential conflicts. Notify the ENGINEER of any conflicts. The ENGINEER will designate new pile locations as required to resolve conflicts with locations of existing piles or other conflicts.

3.2 DYNAMIC ANALYSIS

A. Notify the ENGINEER at least 2 working days before pile driving is to commence on the project, and at least 2 working days before piles are to be driven on all subsequent abutment, bent, or pier foundations.

B. The DEPARTMENT will perform dynamic testing using a Pile Driving Analyzer (PDA), during the driving of the initial pile at each abutment and bent location. Additional piles may be monitored by the DEPARTMENT if driving conditions warrant.

C. Cooperate fully with the DEPARTMENT in the conducting of PDA including, but not limited to, the following:

1. Provide adequate space and conditions for the PDA rig and equipment.
2. Climb the driver leads as necessary to attach, check and remove PDA gauges; or provide a platform at least 1.2 m square with a 1.2 m high safety rail, equipped to be raised to the top of the pile located in the leads, to allow DEPARTMENT personnel to safely attach and remove the gauges.
3. Begin installation of instrumentation after placing the pile in the leads. Allow approximately one hour per pile for installation of dynamic measuring equipment. Allow one additional hour for installation of measuring equipment after splicing, if splicing is performed.
4. Reduce the energy of the hammer and/or make other adjustments as necessary, if the stress exceeds the specified limit.
5. Drive piles to the required resistance as determined by the DEPARTMENT to obtain the specified ultimate loads, unless otherwise indicated by the DEPARTMENT.
6. Where required by the DEPARTMENT, re-strike the PDA-tested pile after a sufficient time period (generally 24 hours or more after the initial driving of the pile). Do not perform re-strikes using a cold hammer. If a re-strike is to be performed after the hammer has not been used for over 2 hours, operate the hammer first on another pile for at least 200 blows before performing the PDA re-strike.

D. The DEPARTMENT must approve the PDA results before pile driving proceeds for the remaining piles. The DEPARTMENT may revise the pile driving criteria during the dynamic test pile driving period, including re-establishing required pile tip elevations.

E. Allow two working days for Case Pile Wave Analysis Program (CAPWAP) results to be completed from the PDA testing. Suspend pile driving on the subject pile foundation until the DEPARTMENT gives notice that sufficient capacity results have been obtained.

3.3 INSTALLATION

A. Pre-drill if the designated pile tip elevation cannot be reached by the approved pile driver. Do not drill holes greater in diameter than the diameter or other maximum dimension of the pile.

B. Keep driven piles within 150 mm of the designated position, and keep exposed portion of the pile within 20 mm/m from vertical (or from direction otherwise shown for battered piles). If either requirement is not met, contact the ENGINEER to determine the appropriate resolution.

C. Drive additional piles at locations designated by the ENGINEER when replacing damaged piles and/or piles driven out of position and/or alignment as specified above.

D. Drive down piles that were raised because of driving adjacent piles.

E. Remove all loose and displaced materials from around the completed piles leaving clean, solid surfaces to receive the concrete.

F. Pile Splicing:
   1. Butt weld the entire pile cross section using full penetration welds as per ANSI/AASHTO/AWS D.1.1.
   2. Use no more than one spliced section less than 2 m, and splice no other section less than 9 m for any pile.
   3. Inspect the driven pile section before splicing any pile section to determine if it has been distorted from its original shape, or otherwise damaged from pile driving operations. Remove the damaged portion where distortion/damage has occurred, before splicing the next segment.

G. Cutting and capping piles:

1. Remove all damaged material from the top of the pile.
2. Keep the sides of piles at least 225 mm away from the nearest edge of footing.
3. Cut off piles with clean, straight-line cuts to the designated elevation at a right angle to the pile axis. Level all irregularities before placing concrete pile cap.

H. Embed the tops of piles in the concrete pile cap as shown on the plans.

END OF SECTION

A "Pile and Driving Equipment Data" form follows

Sheet # _____

Pile and Driving Equipment Data

Project No: _____
Project Name: _____ County: _____
Drawing No: _____
General Contractor: _____
Pile Driving Contractor/Subcontractor: _____
Phone: _____ FAX: _____
(Piles driven by, foreman): _____
Date Submitted: _____

Hammer Components		**Hammer**	Manufacturer: _____ Model: _____ Type: _____ Serial No: _____ Manufacturer's Maximum Rated Energy: _____(J) Stroke at Maximum Rated Energy: _____(m) Range in Operating Energy: _____ to _____(J) Range in Operating Stroke: _____ to _____(m) Modifications: _____
		Ram	Ram Weight: _____ (kg) Ram Length: _____(m) (for diesel hammers)
		Anvil	Ram Cross Sectional Area: _____(sq mm) (With diesel hammers) Anvil Weight: _____(kg)
		Hammer Cushion	Material #1 / Material #2 Name: _____ _____ Area: _____ _____(mm^2) No. of Plates: _____ _____ Thickness: _____ _____ (mm) Mod. of Elasticity - E: _____ _____ (kPa) Coeff. of Restitution - e: _____ _____
		Pile Cap	Helmet Bonnet Anvil Block Weight: _____ (kg) Drive Head
		Pile Cushion **(Only for Concrete or Timber Piles)**	Material: _____ Area: _____ (mm^2) No. of Sheets: _____ Thickness/Sheet: _____(mm) Total Thickness of Pile Cushion: _____ (mm) Mod. of Elasticity - E: _____ (kPa) Coeff. of Restitution - e: _____
Pile		**Pile**	Diameter: _____ (mm) Wall Thickness: _____ (mm) Taper (if any): _____ Length in Leads: _____ (m) Ordered Length: _____ (m) Required Ultimate Capacity: _____(kN) Description of Splice: _____ Tip Treatment/Plate Description: _____

Use Separate Data Sheet for Each Proposed Hammer and Unique Driving Condition

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02466 M

DRILLED CAISSONS

Delete line B.5 of paragraph 2.1, Portland Cement Concrete, and replace with the following:

5. Keep slump between 100 mm and 200 mm when tested at the truck.

Delete line B of paragraph 3.2, Placing Concrete, and replace with the following:

B. Prevent concrete from striking the steel reinforcing cage during free-fall. Refer to Section 03310 paragraph 3.5 line E.7.

June 12, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02610

PIPE CULVERTS

Delete Section 02610 entirely and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for installing pipe culvert.

B. Class, type, size, and thickness designations.

C. Coating for pipe culvert.

1.2 RELATED SECTIONS

A. Section 00820: Legal Relations and Responsibility to Public.

B. Section 02317: Structural Excavation.

C. Section 02330: Embankment.

D. Section 03055: Portland Cement Concrete.

E. Section 03310: Structural Concrete.

1.3 REFERENCES

A. AASHTO M 36M: Corrugated Steel Pipe, Metallic-Coated, for Sewers and Drains.

B. AASHTO M 55: Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.

C. AASHTO M 86M: Concrete Sewer, Storm Drain, and Culvert Pipe.

D. AASHTO M 170: Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

E. AASHTO M 190: Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches.

F. AASHTO M 196M: Corrugated Aluminum Pipe for Sewers and Drains.

G. AASHTO M 197M: Aluminum Alloy Sheet for Corrugated Aluminum Pipe.

H. AASHTO M 198M: Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

I. AASHTO 207: Reinforced Concrete Elliptical Culvert, Storm Drain and Sewer Pipe.

J. AASHTO M 243: Field Applied Coating of Corrugated Metal Structural Plate for Pipe, Pipe Arches, and Arches.

K. AASHTO M 245M: Corrugated Steel Pipe, Polymer Precoated, for Sewers and Drains.

L. AASHTO M 246M: Steel Sheet, Metallic-Coated and Polymer Precoated for Corrugated Steel Pipe.

M. AASHTO M 274M: Steel Sheet, Aluminum - Coated (Type 2), For Corrugated Steel Pipe.

N. AASHTO M 294M: Corrugated Polyethylene Pipe, 300- to 1200-mm Diameter.

O. AASHTO M 304M: Polyvinyl Chloride (PVC) Profile Wall Drain Pipe and Fittings Based on Controlled Inside Diameter.

P. AASHTO Standard Specifications for Bridge Construction.

Q. ASTM A 849: Post-Applied Coatings, Pavings, and Linings for Corrugated Steel Sewer and Drainage Pipe.

R. ASTM C 923M: Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.

S. ASTM D 3212: Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.

T. ASTM F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

PART 2 PRODUCTS

2.1 PIPE CULVERT CLASSES

A. Pipe Culvert Classes:

1. Class A: Pipe used in mostly non-reactive soils, and which require no special materials, treatment, or coating.
2. Class B: Pipe used in moderately reactive and corrosive soils.
3. Class C: Pipe used in soils which are highly reactive and corrosive.
4. Class D: Untreated structural plate pipe used in mostly non-reactive and non-corrosive soils.
5. Class E: Structural plate pipe used in highly reactive and corrosive soils.

B. Pipe Culvert Class Substitutions: May be made at no additional cost to the DEPARTMENT.

1. Class B and C may be substituted for Class A.
2. Class C may be substituted for Class B or A.
3. Class E may be substituted for Class D.

C. Refer to Table 1.

Table 1 AASHTO Reference Specifications for Pipe Culverts

Pipe Culvert Type		Pipe Culvert Class				
		A	B	C	D	E
Substitutions: Class B and C may be substituted for Class A, Class C may be substituted for Class B or A, Class E may be substituted for Class C.						
1.0	**Corrugated Pipe Culverts and Pipe Arch Culverts:**					
1.1 1.1(a)	Corrugated steel pipe. Corrugated steel pipe arch. (See Footnote 1)	M 36M	M 36M Asphalt Coating (Type A) M 190M OR Polymeric Coating 0 Fm (inside) / 250 Fm (outside) M 245M & M 246M ASTM A 849 OR Aluminized Type II Steel M 274M (See Footnote 2)	M 36M Asphalt Coating (Type A) M 190M OR Polymeric Coating 250 Fm (inside)/250 Fm (outside) M 245M & M 246M ASTM A 849	N/A	N/A
1.2 1.2 (a)	Corrugated aluminum pipe. Corrugated aluminum pipe arch. (See Footnote 1)	M 196M M 197M	M 196M M 197M	M 196M M 197M	N/A	N/A
1.3	Corrugated polyethylene (HDPE) pipe	M 294M Cell class # 335420C ASTM D 3350	M 294M Cell class # 335420C ASTM D 3350	M 294M Cell class # 335420C ASTM D 3350	N/A	N/A
2.0	**Smooth-Lined Pipe Culverts and Pipe Arch Culverts:**					
2.1	Concrete lined corrugated steel pipe (Use Type V cement. Refer to Section 03055)	M 36M	M 36M Asphalt Coating (Type A) M 190M OR Polymeric Coating 250 Fm (inside) /250 Fm (outside) M 245M & M 246M ASTM A 849	M 36M Asphalt Coating (Type A) M 190M OR Polymeric Coating 250 Fm (inside) /250 Fm (outside) M 245M & M 246M ASTM A 849	N/A	N/A
2.2	Smooth lined polyethylene pipe.	M 294M Cell Class # 334433C and 335434C ASTM D3350	M 294M Cell Class # 334433C and 335434C ASTM D3350	M 294M Cell Class # 334433C and 335434C ASTM D3350	N/A	N/A

2.3	Smooth lined Poly Vinyl Chloride (PVC) pipe	M 304M Cell Class # 12454C ASTM T 1784	M 304M Cell Class # 1245C ASTM T 1784	M 304M Cell Class # 1245C ASTM T 1784	N/A	N/A
2.4 2.4 A	Asphalt smooth lined corrugated steel pipe Pipe arch	M 36M	M 36M Asphalt Coating (Type D) M 190M	M 36M Asphalt Coating (Type D) M 190M	N/A	N/A
2.5 2.5 a	Spiral rib steel pipe Spiral rib steel pipe arch	M 36M	M 36 M Asphalt Coating (Type A) M 190M OR Polymeric Coating 0Fm (inside) / 250 Fm (outside) M 245M and M 246M, ASTM A 849 OR Aluminized Type II Steel M 274M (See Footnote 2)	M 36 M Asphalt Coating (Type A) M 190M OR Polymeric Coating 250 Fm (inside)/250 Fm (outside) M 245M and M 246M ASTM A 849	N/A	N/A
2.6	Spiral rib aluminum pipe and pipe arch	M 196& and M 197M	M 196& and M 197M	M 196& and M 197M	N/A	N/A
2.7	Reinforced concrete pipe	M 170M Type II Cement	M 170M Type II Cement	M 170M Type V Cement	N/A	N/A
2.8	Non-reinforced concrete pipe	M 170M Type II Cement	M 170M Type II Cement	M 86M Type V Cement	N/A	N/A
2.9	Elliptical reinforced concrete pipe	M 207M Type II Cement	M 207M Type II Cement	M 207M Type V Cement	N/A	N/A
3.0	**Structural Plate Pipe and Pipe Arch Culverts**					
3.1	Structural steel plate pipe culverts and pipe arch	N/A	N/A	N/A	M 167M	M 167M M 243M
3.2	Aluminum alloy structural plate pipe culverts and pipe arch	N/A	N/A	N/A	M 219M	M 219M

Footnotes:

(1) Minimum corner radii conforming to the details shown on the standard drawings.

(2) Acceptable soil conditions, Class B, Aluminized Type II steel are 1.6 mm minimum thickness of metal acceptable where pH is greater than 5.5 and less than 8.5 and soil resistivity is greater than 1500 ohm-centimeters.

2.2 PIPE CULVERT TYPES

A. Pipe, Pipe Arch, Structural Plate Pipe and Structural Plate Pipe Arch Culvert Types: Refer to Table 1.

2.3 RELATED PRODUCTS

A. Asphalt Coating: Furnish Material Class M-Mastic, either asphalt or tar base, cold applied. ASTM A 849.

1. Asphalt base mastic design criteria:
   - a. Functions as a cool-applied waterproofing membrane.
   - b. Provides a protective coating to aluminum or steel highly resistant to corrosion and chemical fumes.
   - c. Is not affected by freezing temperatures and does not flow in hot weather.
   - d. Has high cohesive strength and readily hardens in to a tough elastic seal after application.
   - e. Is mixed until the mineral stabilizers and fillers are uniformly dispersed. Follow AASHTO M 243 M.

2.4 PIPE SELECTION

A. At the preconstruction conference, declare choice of pipe, type, diameter and thickness to be used.

B. Use the same type and strength of concrete pipe or thickness of steel, aluminum, polyethylene or polyvinyl chloride (PVC) pipe for the entire run of pipe.

C. Use the maximum height of cover to determine the strength or thickness. Refer to Standard Drawings 605-1, 605-2, and 605-3.

D. Do not use aluminum pipe culvert when a paved invert is required, unless protective measure are taken. Follow 3.7 - C.

E. Corrugated and smooth-lined polyethylene pipes and PVC pipes: Use only 300 mm to 900 mm diameter.

F. Precast, non-reinforced concrete pipe: Use only 450 mm to 900 mm diameter.

G. Do not allow pipes of different types of metal to contact each other. Use matching materials to make direct extensions of existing pipes.

H. Do not use pipe containing longitudinal lap seams if watertight pipe or watertight joints are called for.

I. Do not use thermoplastic pipe manufactured without UV inhibitors approved by the Materials Engineer in applications subject to direct sunlight.

PART 3 EXECUTION

3.1 PREPARATION

A. Excavating, Trenching, Bedding and Backfill:
   1. Refer to Section 02317.
   2. Refer to Standard Drawings 605-4, 605-5, and 605-8.
   3. Comply with Utah Occupation Safety and Health regulations when excavating and trenching. Note safety restrictions for trenches deeper than 1.2 meters. Follow Section 00820.
   4. Use Type I bedding unless Type II or Type III is required due to foundation conditions.

3.2 INSTALLATION

A. Lay culvert starting at the downstream end.

B. Keep the bottom of the culvert in contact with the bedding throughout its length.

C. When indicated on the drawings, camber pipe culverts upward from a chord through the inlet and outlet inverts an ordinate amount equal to one percent of the pipe length. Develop camber on a parabolic curve. If the mid-point elevation on the parabolic curve as designed exceeds the elevation of the inlet invert, reduce the amount of camber or increase the pipe culvert gradient.

D. Place bell or socket end of culvert facing upstream.

E. Place culverts fabricated with longitudinal laps or seams so that such seams are located approximately 45 degrees away from the invert or crown.

F. Place paved invert or partially lined culvert so that the centerline of the paved segment matches the flow line.

G. Place elliptical culvert with the major axis within 5 degrees of a vertical plane through the longitudinal axis of the culverts.

H. Place outside circumferential laps of flexible corrugated (annular corrugations) culvert facing upstream.

I. Close the joints to meet the specified joint integrity in accordance with manufacturer's recommendations.

J. Install pipe to conform to AASHTO Standard Specifications for Highway Bridges:
   1. Section 26 for Corrugated Metal Pipe
   2. Section 27 for Concrete Pipe
   3. Section 30 for Thermoplastic Pipe

3.3 JOINTS OR COUPLING BANDS FOR CULVERTS

A. General:
   1. All joints must sustain 20 kPa minimum pressure.
   2. Connection of culvert to concrete headwalls, catch basins, etc. must also comply with manufacturer's recommended installation practices.

B. Concrete Culverts:
   1. Meet AASHTO M 198M.

C. Metal Pipe:
   1. Use standard joints or coupling bands unless special joints or special coupling bands are called for on the plans. Refer to Standard Drawing 605-6.
   2. Conform to AASHTO Standard Specifications for Highway Bridges and AASHTO M 36M or AASHTO M 245M with the following modifications:
      a. Use connecting bands of the same class as the pipe. Maintain a minimum thickness of 1.6 mm for the connecting bands.
      b. Use bands with projections (dimple bands) only in extension of the existing pipes where annular corrugations do not exist.
      c. The ends of helically corrugated pipe must be re-rolled to form at least two full annular corrugations each before being joined.
      d. Use flat bands only when approved in writing by the ENGINEER.
      e. Follow Standard Drawing 605-6.

D. Joints for Polyethylene (HDPE) Pipe Culverts: Unless otherwise specified, use standard joints conforming to Section 7 "Requirements," and Section 9 "Test Methods" of AASHTO M 294M.

E. Joints for PVC Pipe Culverts: Show no leakage when tested in accordance with ASTM D3212.
   1. Meet ASTM F 477 for gaskets.

3.4 WATERTIGHT CULVERTS AND JOINTS

A. Provide watertight joints as follows:
   1. Pass AASHTO M 86M paragraph 10.6 test requirements by sustaining a 70 kPa minimum pressure for a 10 minute period with no leakage observed.

B. Use one of the following water tight culverts:
   1. Reinforced and non-reinforced concrete pipe. Meet AASHTO M 198M for watertight rubber gaskets. Do not use elliptical pipe. Meet ASTM C 443.
   2. Corrugated metal pipe culvert (O-ring gasket placed in lock seam).
   3. Helical rib metal pipe (O-ring gasket placed in lock seam).

3.5 SMOOTH LINING FOR CORRUGATED STEEL PIPE AND PIPE ARCH CULVERTS

A. Clean all surfaces to be lined including removal of all oil and grease from the metal. Allow the surface to dry before proceeding.

B. Concrete Lining: Follow ASTM A 849, Subsections 5 and 9.

C. Asphalt Lining: Follow Table 1.

3.6 PIPE AND PIPE ARCH CULVERTS

A. Use materials described in Table 1.

B. Remove moisture, dirt, oil, un-bonded or incompatible paint, grease residual oil, alkalies, or other foreign matter from the surface to be coated.

C. Spray or brush-coat all aluminum culvert contacting concrete with an asphalt mastic or tar base material to a minimum thickness of 1.25 mm.

3.7 STRUCTURAL PLATE PIPE AND PLATE PIPE ARCH CULVERTS

A. Use materials described in Table 1.

B. Repair or replace all damaged plates or coatings before installation.

C. Installation: Follow Standard Drawings 605-4, and 605-5.
Embankment: Refer to Section 02330.

D. Assembly:
1. Give the ENGINEER a copy of the detail plan showing the position of each plate and the assembly order.
2. Follow the manufacturer's instructions.
3. Clearly mark each modified plate, designating its position in the finished structure.
4. Place outside circumferential pipe-laps facing upstream.
5. Attain approved seam fit-up. All bolts must be in place and have a torque ranging from 70 N"m to 140 N"m for aluminum pipe and 140 N"m to 410 N"m for steel pipe.
6. Form structural plates so that the finished pipe is elliptical in shape with the vertical diameter approximately 5 percent greater than the nominal diameter.

E. Asphalt Coating (structural plate pipe, and plate pipe arch, and arches):
1. Thoroughly clean all plates to be coated. Remove any oil or grease from the surface of the plates. Keep plates clean and dry prior to coating.
2. Apply coating to dry plates:
   a. Spray or brush-coat the entire exterior surface of the culverts with an approved post-applied mastic coating to a minimum 2 mm wet thickness. Follow AASHTO M 243.
   b. Spray or brush-coat the inside invert for 1/4 of the circumference of round pipe and the full span width of pipe arch with the same compound.
   c. Spray or brush coat all metal surfaces in contact with the ground at the time of erection before assembly. The remaining surfaces may be treated after erection.
3. Apply uniformly to a minimum thickness of 1.5 mm dry thickness to structural plate for pipe, pipe arches, or arches on inside and outside surfaces measured on the crest of the corrugations.
4. Furnish as follows, according to the application used:
   a. Spraying consistency: Spray with an air gun without the use of additional thinners when temperatures are 4 degrees C and above.
   b. Troweling consistency: Apply with a knife or trowel.
   c. Brushing consistency: Apply with an ordinary roofing brush.

3.8 INVERT PROTECTION

A. Paved Invert:

1. Use corrugated steel pipe or pipe arch and structural steel plate pipe or pipe arch culverts.
2. Complete backfill and embankment over the pipe before placing paved invert material.
3. Use 10-gage wire fabric with wire spaced at 150 mm centers. AASHTO M 55.
4. Arc-weld the wire mesh reinforcement to the corrugation at not more than 0.6 m centers.
5. Place concrete at least 50 mm above the crest of the corrugations, at least 1/4 the width of the circumference of round pipe, or the span width of arch pipe. Refer to Section 03055.
6. Finish the concrete to a floated surface finish. Follow Section 03310.
7. After curing, coat the joint between the culvert and concrete with liquid asphalt at a rate of 0.4 L/m^2 of residual asphalt. Coat 150 mm above and below the joints.

3.9 QUALITY CONTROL

A. Provide adequate cover or protection for all culvert to protect them during project construction. Replace all damaged culverts before acceptance by UDOT.

B. The following constitute poor workmanship and any one is cause for rejection:

1. Irregular or distorted shape (not as provided or designed)
2. Dents or bends
3. Damaged, broken, or scaled coating
4. Loose bolts or nuts
5. Uneven laps
6. Improper fitting joints
7. Any damage which compromises the functionality and design life of the pipe.

C. Coatings:

1. Furnish a Certification of Compliance from the manufacturer.
2. DEPARTMENT will take a representative sample from each lot furnished to conduct verification testing.

D. Joints: Furnish a Certificate of Compliance from the manufacturer of the type specified.

END OF SECTION

April 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02624

APPROACH SLAB CATCH BASIN

PART I GENERAL

1.1 SECTION INCLUDES

A. Construct a drainage catch basin at the approach of an existing structure.

1.2 RELATED SECTIONS

A. Section 02610: Pipe Culvert

B. Section 03055: Portland Cement Concrete

C. Section 03211: Reinforcing Steel and Welded Wire

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 270M: Structural Steel for Bridges.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Class AA(AE). Refer to Section 03055, Part 2.

B. Cement: Refer to Section 03055, Part 2.

C. Reinforcing Steel (Coated): Refer to Section 03211, Part 2.

D. Structural Steel: Galvanize after fabrication.
   1. AASHTO M 270M, Grade 250.
   2. AASHTO M 111.

E. Precast Concrete Catch Basin: Avoid when the plans indicate that the catch basins are to be constructed within an existing concrete approach slab.

PART 3 EXECUTION

3.1 PREPARATION

A. Concrete Removal:
   1. Make saw cuts 25 mm deep to define the work areas.
   2. Remove concrete using 90 pound class hand-operated jackhammers or smaller.

B. Reinforcing Steel:
   1. Cut steel encountered during concrete removal operations so that the final catch basin opening is unencumbered as shown on the plans.
   2. To tie the new facility into the existing approach slab: Expose a minimum of 250 mm of reinforcing steel in both the bottom and upper mats of approach slab steel on at least three sides of the catch basin.

C. Excavation:
   1. Excavate sufficient material to construct the catch basin to the required size and depth.

3.2 CONSTRUCTION

A. Construct catch basin according to plan dimensions and details.

B. Adjust catch basin location for better drainage performance where necessary as directed by the ENGINEER.

C. Provide for proper outlet connection to the 300 mm corrugated polyethylene pipe in the side of the box. Refer to Section 02610.

END OF SECTION

April 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02625

APPROACH SLAB DRAIN FRAME MODIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Provide a frame riser to raise the existing drain grate to match the grade of the asphalt surfacing.

1.2 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 270M: Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched and Tempered Alloy Structural Steel Plates for Bridges.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Structural steel plates. AASHTO M 270M, Grade 250.

B. Galvanize the frame riser after fabrication as specified. AASHTO M 111.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify plan dimension for the existing grate system before fabrication of the new frame riser.

3.2 INSTALLATION

A. Construct the frame riser according to the plan design.

B. Place a new frame riser before placing asphalt surfacing. Hand compact the asphalt in the areas surrounding the frame of the drain.

C. Position the grate properly to receive the water flow. For square frames, line up grate ribs with water flow.

3.3 CLEANING

A. Clean any existing or construction debris and trash from the drain basin and grate ribs.

END OF SECTION

June 13, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02626

DECK DRAIN MODIFICATION OR CLOSURE

PART I GENERAL

1.1 SECTION INCLUDES

A. Modify and/or close existing drains, and install new drains at specified locations.

1.2 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 270M: Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched and Tempered Alloy Structural Steel Plates for Bridges.

PART 2 PRODUCTS

2.1 STRUCTURAL STEEL

A. Galvanize the frame riser after fabrication as specified. AASHTO M 270M, Grade 250. AASHTO M 111.

B. Structural steel plates: AASHTO 270M, Grade 270.

PART 3 EXECUTION

3.1 PREPARATION

A. Verify plan dimension for the existing grate system before fabrication of the new frame riser.

3.2 INSTALLATION

A. Deck Drain Modification:
   1. Construct the frame riser according to the plan design.
   2. Close the deck drains as shown in the plans under "Deck Drain Closure Detail" prior to placing new asphalt surfacing.
   3. Place a new frame riser before placing Hot Mix Asphalt. Hand compact the asphalt in the areas surrounding the frame of the drain.
   4. Position the grate properly to receive the water flow. For square frames, line up grate ribs with water flow.
   5. Properly secure the extended pipes to the satisfaction of the ENGINEER.

B. Deck Drain Closure: Close the deck drains as shown in the plans under "Deck Drain Closure Detail" prior to placing new asphalt surfacing.

3.3 CLEANING

A. Clean any asphalt concrete from between the grate ribs, when necessary.

B. Clean any existing or construction debris and trash from the drain basin.

END OF SECTION

January 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02635

GRATES, SOLID COVERS, FRAMES, AND MANHOLE STEPS

PART I GENERAL

1.1 SECTION INCLUDES

A. Furnish and install grates, solid covers, frames, and manhole steps.

1.2 RELATED SECTIONS

A. Section 03310: Structural Concrete.

B. Section 05120: Structural Steel.

1.3 REFERENCES

A. AASHTO M 105: Grey Iron Castings.

B. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

C. AASHTO M 199: Precast Reinforced Concrete Manhole Sections.

D. AASHTO M 270: Structural Steel for Bridges.

E. ASTM A 536: Ductile Iron Castings.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. As specified in AASHTO M270.
2. Hot-dip galvanize structural steel after fabrication. AASHTO M 111.

B. Cast Grey Iron: As specified in AASHTO M 105.

C. Ductile Iron: As specified in ASTM A 536.

D. Precast Grade Ring: As specified in AASHTO M 199.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install as specified by the manufacturer and the following standard specifications:

Item To Be Installed	Standard Drawing
Diversion Box Solid Cover and Frame, Type A	1562
Diversion Box Solid cover and Frame, Type B	1562
Diversion Box Solid Cover and Frame, Type C	1562
Solid Cover and Frame	1567
Manhole Frame and Grated Cover	1701
Manhole Frame and Solid Cover	1702
Rectangular Grate and Frame (Standard Grating)	1703
Rectangular Grate and Frame (Bicycle-Safe Grating)	1703
Solid Cover and Frame	1705
Manhole Steps	1706

October 10, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02708 M

HOT MIX ASPHALT - QC/QA

Delete line A of paragraph 2.2 “Aggregate,” and replace with the following:

A. Refer to Section 02741, Part 2.

Delete line A of paragraph 2.5 “Superpave Volumetric Mix Design Requirements,” and replace with the following:

A. Comply with the requirements of Section 02741, Part 2, paragraph: Job-Mix Design Requirements.

June 13, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02721 M

UNTREATED BASE COURSE (UTBC)

Delete Line F and Table 2 from paragraph 1.6, “Acceptance.”

September 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02741

HMA (HOT MIX ASPHALT)

Delete Sections 02708, 02741 & 02742 entirely and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products and procedures for laying, and compacting a surface course of one or more layers of HMA comprised of aggregate, asphalt binder, lime and other additives.

B. Mix materials at a central mixing plant.

1.2 RELATED SECTIONS

A. Section 00725: Scope of Work

B. Section 01452: Profilograph

C. Section 02745: Asphalt Material

D. Section 02746: Hydrated Lime

E. Section 02748: Prime Coat/Tack Coat

F. Section 02961: Rotomilling

G. Section 02963: Profile Rotomilling

H. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects)

1.3 REFERENCES

A. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing

B. AASHTO T 19: Bulk Density ("Unit Weights") and Voids in Aggregate

C. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates

D. AASHTO T 30: Mechanical Analysis of Extracted Aggregate

E. AASHTO T 84: Specific Gravity and Absorption of Fine Aggregate

F. AASHTO T 89: Determining the Liquid Limit of Soils

G. AASHTO T 90: Determining the Plastic Limit and Plasticity Index of Soils

H. AASHTO T 96: Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

I. AASHTO T 104: Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

J. AASHTO T 112: Clay Lumps and Friable Particles in Aggregate

K. AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens

L. AASHTO T 168: Sampling Bituminous Paving Mixtures

M. AASHTO T 176: Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test

N. AASHTO T 195: Determining Degree of Particle Coating of Bituminous-Aggregate Mixtures

O. AASHTO T 209: Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

P. AASHTO T 255: Total Evaporable Moisture Content of Aggregate by Drying

Q. AASHTO T 283: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage (Modified by UDOT Materials Manual of Instruction Part 8 Test Procedure 8-957)

R. AASHTO T 304: Uncompacted Void Content of Fine Aggregate

S. AASHTO T 308: Determining the Asphalt Binder Content of Hot-Mix Asphalt (HMA) by the Ignition Method

T. AASHTO TP 4: Method for Preparing and Determining the Density of Hot-Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

U. Asphalt Institute SP-1, SP-2

V. AASHTO PP 28: Practice for Superpave Volumetric Design for Hot-Mix Asphalt (HMA)

W. ASTM D 2950: Density of Bituminous Concrete in Place by Nuclear Methods

X. ASTM D 3549: Thickness or Height of Compacted Bituminous Paving Mixture Specimens

Y. ASTM D 3665: Random Sampling of Construction Materials

Z. ASTM D 3666: Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Materials

AA. ASTM D 4561: Quality Control Systems for Organizations Producing and Applying Bituminous Paving Materials

BB. ASTM D 4791: Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate

CC. ASTM D 5506: Standard Practice for Organizations Engaged in the Certification of Personnel Testing and Inspecting Bituminous Paving Materials

DD. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate

EE. ASTM E 178: Practice for Dealing with Outlying Observations

FF. ASTM E 1274: Measuring Pavement Roughness Using a Profilograph

GG. ASTM E 950: Measuring the Longitudinal Profile of Traveled Surfaces with an Accelerometer Established Inertial Profiling Reference

HH. Modified GDT-115: Georgia Loaded Wheel

II. UDOT Materials Manual of Instruction Part 8-209: Asphalt Binder Management Plan

JJ. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design

KK. UDOT Materials Manual of Instruction Part 8-957: Resistance of Compacted Bituminous Mixture to Moisture Induced Damage

1.4 ACCEPTANCE

A. HMA (Hot Mix Asphalt), Method of Measurement and Basis of Payment in the Supplemental Specifications (Bid Book).

B. A lot equals the number of megagrams of HMA placed during each production day.

C. The ENGINEER conducts the acceptance testing for asphalt binder content, gradation, VMA, density, and thickness. AASHTO T 30, T 308, PP 28, T 166, ASTM D 3549

D. Obtain samples for density and thickness.
   1. Divide the lot into five sublots of approximately equal sizes.
   2. Obtain ten cores per lot randomly as instructed, and in the presence of the ENGINEER within two days after the pavement is placed.
   3. Comply with AASHTO T 166.
   4. If the random location for cores falls within 0.3 meter of the edge of the overall pavement section (outer part of shoulders), then move transversely to a point 0.3 meter from the edge of the pavement.
   5. Fill core holes with an acceptable asphalt mixture and compact.
   6. The DEPARTMENT will take immediate possession of the cores from the CONTRACTOR and will provide density acceptance results within two working days after taking possession.

E. Density: The target density for determining acceptance and incentive/disincentive is 93.5 percent of maximum Rice density for projects where design overlay thickness is greater than 50 mm. **For projects where design overly thickness is 50 mm or less, target density for determining acceptance and incentive/disincentive is 92.5 percent of maximum Rice density.**
   AASHTO T 209.
   1. Obtain a minimum of two density determinations on a random basis for each sublot. ASTM D 3665.

2. When samples for gradation, asphalt binder content and VMA from lots are combined according to Part 3, paragraph 3.9, in order to obtain an appropriate sample size for evaluation, a lot for density determination is defined as the combined production days.

F. Thickness: Base acceptance on the average thickness of a lot. A thickness lot equals a density lot. Divide a thickness lot into five sublots equal to density sublots. Thickness acceptance for thin lift projects (50 mm or less) consists of checking thickness regularly with a depth probe during placement and taking corrective action as necessary.

1. Take a minimum of two randomly selected thickness tests within each sublot.
2. The same core samples taken for density may be used for thickness verification.
3. The DEPARTMENT accepts a lot when:
   a. The average thickness of all sublots is not more than 12 mm greater nor 6 mm less than the total thickness specified.
   b. No individual sublot shows a deficient thickness of more than 9 mm.
   c. Place additional materials where lots or sublots are deficient in thickness. The minimum depth of compacted surface for correcting deficient thickness is 3 times the nominal maximum aggregate size.
   d. The Department pays for the quantity of additional material to bring the surface to design grade.
   e. The Department does not pay for the quantity of additional material above the design grade due to the minimum paving thickness required.
   f. The ENGINEER may allow excess thickness to remain in place or may order its removal. Remove and replace the entire depth of the course, if it is necessary to remove portions of the course.
   g. The Department pays for 50 percent of the mix in excess of the +12 mm tolerance when excess thickness is allowed to remain in place.
   h. The thickness tolerances established above do not apply to leveling courses, overlays, and cushion courses. However, check final surfaces in stage construction.

G. Smoothness Tests

1. Determine pavement lane smoothness factor using a Profilograph as described in Section 01452, “Profilograph.” Calibrate, certify and verify the profilograph prior to use.

H. Cease production when any two out of three consecutive lots have a net disincentive or the air voids averaged for each lot are not between 3 and 5 percent for any 2 out of 3 consecutive lots.

1. Before production continues, submit a corrective action plan to the ENGINEER indicating the changes in production procedures that will be implemented to correct the deficiencies.

I. The Department pays incentive/disincentive on the assessed quantities of HMA according to Incentive/Disincentive Table 1 for gradation, asphalt binder content and density, Table 2 for VMA. Base the incentive/disincentive on Percent Within Limit (PT) computation using Tables 3, 4, and 5. Use lowest single value combined for gradation (each of the sieves) and asphalt binder content.

1. Meet PT of 88 or greater for density for eligibility for incentive in gradation/asphalt binder content and VMA. The Department will not pay incentive for gradation/asphalt binder content and VMA if Contractor does not meet this condition.

J. The Department rejects the lot if the Percent Within Limits (PT) for any individual measurement is less than 60 percent.

1. Submit an engineering analysis within one week, if requesting a rejected lot remain in place.
   a. Include in the analysis the data and engineering principles indicating why the pavement should remain in place.
   b. The Engineer, Region Materials Engineer, and Region Construction Engineer review the analysis for acceptance, denial or revision. If the analysis is denied, remove the rejected material from the project within 72 hours, and replace it with acceptable material.
   c. If rotomilling is required agree on the removal time period.
2. A rejected lot allowed to remain in place will have a $15.00/Mg deduction applied.

K. To reduce over-testing of small quantity production days, i.e. ramps, bridgework, etc., the ENGINEER may, in concurrence with the CONTRACTOR, choose to combine production from several days to form a single lot.

Table 1 Incentive/Disincentive for Gradation, Asphalt Binder Content and Density			
Gradation/Asphalt Binder Content		**Density**	
PT Based on Min. Four Samples	**Incentive/Disincentive (Dollars/Megagram)**	**PT Based on Min. Ten Samples**	**Incentive/Disincentive (Dollars/Megagram)**
> 99	0.91	> 99	0.91
96-99	0.74	96-99	0.74
92-95	0.41	92-95	0.41
88-91	0.07	88-91	0.07
84-87	-0.26	84-87	-0.26
80-83	-0.60	80-83	-0.60
76-79	-0.93	76-79	-0.93
72-75	-1.27	72-75	-1.27
68-71	-1.60	68-71	-1.60
64-67	-1.93	64-67	-1.93
60-63	-2.27	60-63	-2.27
<60	Reject	<60	Reject

Table 2 Incentive/Disincentive for VMA	
PT Based on Minimum Three Samples	**Incentive/Disincentive Dollars/Megagram**
> 99	0.54
96-99	0.43
92-95	0.20
88-91	-0.03
84-87	-0.26
80-83	-0.48
76-79	-0.71
72-75	-0.94
68-71	-1.17
64-67	-1.40
60-63	-1.62
<60	Reject

Table 3 Upper and Lower Limit Determination	
Parameter	**UL and LL**
19.0 mm sieve for 25.0 mm HMA 12.5 mm sieve for 19.0 mm HMA 9.5 mm sieve for 12.5 mm HMA 4.75 mm sieve for 9.5 mm HMA	Target Value ± 6.0%
2.36 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Binder Content	Target Value ± 0.35%
VMA Range	11.5-14.5 for 25.0 mm HMA 12.5-15.5 for 19.0 mm HMA 13.5-16.5 for 12.5 mm HMA 14.5-17.5 for 9.5 mm HMA
Density	Lower Limit: Target Value - 2.0% Upper Limit: Target Value + 3.0%

Table 4 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
<60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 5 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt binder content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 3)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 3)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 4 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 4 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Incentive/Disincentive	Determined by entering Table 1 and 2 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

PART 2 PRODUCTS

2.1 ASPHALT BINDER

A. Refer to Special Provision 02742S, Project Specific Surfacing Requirements.

B. Asphalt material: Refer to Section 02745.

C. Sampling procedure: UDOT Materials Manual of Instruction Part 8-209

D. Asphalt Binder Management Plan: UDOT Materials Manual of Instruction Part 8-209

2.2 AGGREGATE

A. Refer to the Minimum Test Requirements.

B. Crusher processed virgin aggregate material consisting of crushed stone, gravel, or slag. Conform to Section 02969, "Optional Use of Reclaimed Asphalt Pavement (PG Binder Projects)," for recycled mixes.

C. Use the following requirements, including Table 6, to determine the suitability of the aggregate.
   1. Coarse aggregates:
      a. Retained on 4.75 mm sieve.
   2. Fine aggregates:
      a. Clean, hard grained, and angular.
      b. Passing the 4.75 mm sieve.

Table 6 Aggregate Properties - HMA			
Test Method	**Test No.**	**Category 1**	**Category 2**
One Fractured Face	ASTM D 5821	95% min.	85% min. (25.0 mm and 19.0 mm), and 90 % min. (12.5 mm and 9.5 mm)
Two Fractured Face	ASTM D 5821	90% min.	80% min. (25.0 mm and 19.0 mm), and 90 % min. (12.5 mm and 9.5 mm)
Fine Aggregate Angularity	AASHTO T 304	45 min.	45 min.
Flat and Elongated 1 to 3 ratio	ASTM D 4791 (Based on 9.5 mm and above)	20 % max.	20 % max.
L.A. Wear	AASHTO T 96	35 % max.	40 % max.
Sand Equivalent	AASHTO T 176 (Pre-wet method)	60 min.	45 min.
Plasticity Index	AASHTO T 89 and T 90	0	0
Unit Weight	AASHTO T 19	min. 1200 kg/m^3	min. 1200 kg/m^3
Soundness (sodium sulfate)	AASHTO T 104	16 % max. loss with five cycles	16 % max. loss with five cycles
Clay Lumps and Friable Particles	AASHTO T 112	2 % max	2 % max.
Natural Fines	N/A	0	10 % max.
Category 1: National Highway System and Truck Routes - Table 11. Category 2: All Other Routes			

D. Meet gradation requirements in Table 7.

Table 7 Aggregate Gradations (Percent Passing by Dry Mass of Aggregate)					
Sieve Size (mm)		**25.0**	**19.0**	**12.5**	**9.5**
Control Sieves	**37.5**	100.0	-	-	-
	25	90.0 - 100.0	100.0	-	-
	19	<90	90.0 - 100.0	100.0	-
	12.5	-	<90	90.0 - 100.0	100.0
	9.5	-	-	<90	90.0 - 100.0
	4.75	-	-	-	< 90
	2.36	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0
	0.075	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0
Caution Zone Boundaries **(Information only)**	**4.75**	39.5	-	-	-
	2.36	26.8 - 30.8	34.6	39.1	47.2
	1.18	18.1 - 24.1	22.3 - 28.3	25.6 - 31.6	31.6 - 37.6
	0.6	13.6 - 17.6	16.7 - 20.7	19.1 - 23.1	23.5 - 27.5
	0.3	11.4	13.7	15.5	18.7

2.3 HYDRATED LIME

A. Meet the requirements of Section 02746.

2.4 JOB-MIX DESIGN

A. Satisfy all the requirements for Superpave Volumetric Mix Design according to Asphalt Institute, SP-1, and SP-2, AASHTO PP 28 and the following:
   1. Moisture Susceptibility (Lottman), AASHTO T 283, modified by UDOT Materials Manual of Instruction Part 8-957
   2. Rut Resistance (Asphalt Pavement Analyzer) (Rut Test), Modified GDT-115.
   3. Use a laboratory accredited by AASHTO Materials Reference Laboratory (AMRL) in the use of the Superpave Gyratory Compactor. AASHTO TP 4.
   4. Use a FHWA-protocol approved Superpave Gyratory Compactor.
   5. Meet all volumetric mix design requirements for the selected target gradation.

B. Submit the Volumetric Mix Design data for verification at least 10 working days before beginning paving. Do not begin paving until verification is complete.
   1. Include all information regarding selection of design aggregate structure showing the target values of percent passing on all sieves listed in Table 7, and the design asphalt binder content.
   2. Provide information that aggregate proposed for use meet the requirements of Table 6.
   3. Supply QC data for target job mix gradation selection. Use those target values for price adjustments.
   4. After the design is complete, run 4 sets of 2 Gyratory specimens at the design asphalt binder content to verify the optimum asphalt and all other design requirements.

C. Submit Lottman test data using Method A lime slurry for all sources. Submit both A and B lime slurry data for new sources with no historic data.
   1. Meet minimum Tensile Strength Ratio (TSR) of 80 percent.
   2. Comply with UDOT Materials Manual 8-957 and AASHTO T 283.

D. Designate asphalt binder supplier.

E. Use gyratory mixing and compaction temperatures supplied by the Engineer.

F. The Department Region Materials Lab verifies the Volumetric Mix Design. UDOT Materials Manual of Instruction Part 8-960: Guidelines for Superpave Volumetric Mix Design.

2.5 SUPERPAVE VOLUMETRIC MIX DESIGN

A. Comply with the following requirements for Superpave volumetric mix design:

Table 8
Superpave Volumetric Mix Design - HMA
Number of Gyrations Table

20 Years Design ESALS (Million)	Compaction Parameters			Voids Filled with Asphalt (VFA) (%)
	$N_{initial}$ /% of G_{mm}*	N_{design} /% of G_{mm}*	N_{max} /% of G_{mm}*	
0.3	6/# 91.5	50/96	75/ # 98	70 - 80 **
0.3 to <3	7/# 90.5	75/96	115/ # 98	65 - 78
3 to < 30	8/# 89	100/96	160/ # 98	65 - 75
$30	9/ # 89	125/96	205/ # 98	65 - 75

* G_{mm}: Maximum specific gravity of Mix. (Rice Method)
** 67 percent specified lower limit VFA for 25.0 mm nominal maximum size mixture.

Table 9 Superpave Volumetric Mix Design Requirements	
HMA design mixing and compaction temperatures	Provided by the ENGINEER
Voids in Mineral Aggregate (VMA) at N_{design} AASHTO PP 28.9.2, using G_{sb} at SSD. Equation based on percent of total mix.	12.0 percent - 14.0 percent for 25.0 mm. 13.0 percent - 15.0 percent for 19.0 mm. 14.0 percent - 16.0 percent for 12.5 mm. 15.0 percent - 17.0 percent for 9.5 mm
Pavement Analyzer - Modified GDT-115 (Rut test at high temperature of UDOT PG Asphalt Map).	< 5.00 mm

B. Prepare and submit 2 sets (5 samples each) of ignition oven calibration samples.
   1. DEPARTMENT will use these samples to determine the correction factors for the Region and Field lab ignition oven.
   2. Submit samples a minimum of three working days prior to paving.

2.6 CONTRACTOR INITIATED CHANGES IN JOB-MIX DESIGN

A. Submit all requests in writing prior to incorporating changes into production.

B. Submit a field volumetric mix design if changes occur in either or both the target gradation value, or the design asphalt binder content.
   1. Field volumetric mix design to verify volumetric properties consists of 3 sets of 2 gyratory specimens run at the new target gradation and/or asphalt binder content.
   2. If the field volumetric mix design does not meet the volumetric requirements, submit a new laboratory volumetric mix design from an AMRL laboratory accredited in AASHTO TP 4. Allow at least 4 working days for verification.

C. Submit a new laboratory volumetric mix design if changes occur in the aggregate source, asphalt binder source or grade.

D. The ENGINEER reviews, and the Region Materials Engineer verifies the submittal. AASHTO PP 28

E. The DEPARTMENT performs up to 2 free volumetric mix design verifications (initial plus one Contractor initiated change) for each project and will charge $2000 for each additional CONTRACTOR initiated change in the target design values.

PART 3 EXECUTION

3.1 ADDING HYDRATED LIME

A. Method A, Lime Slurry; or Method B, Lime Slurry Marination: Refer to Section 02746.
   1. Incorporate minimum hydrated lime by dry weight of aggregate (1 percent for Method A and 1½ percent for Method B) into all mixtures.

3.2 HMA

A. Dry aggregate to an average moisture content of not more than 0.2 percent by weight. AASHTO T 255. Adjust burners to avoid damage or soot contamination of the aggregate.

B. Coat with asphalt binder 100 percent of the particles passing and 98 percent of the particles retained on the 4.75 mm sieve.
   1. AASHTO T 195.
   2. Discontinue operation and make necessary corrections if material is not properly coated.

C. Maintain temperature of the HMA between established limits.
   1. Do not overheat the material or cause thermal damage to the asphalt binder.
   2. DEPARTMENT will reject and CONTRACTOR will remove materials heated over the established limits.

3.3 HMA PLANT

A. Provide:
   1. Positive means to determine the moisture content of aggregate.
   2. Positive means to sample all material components.
   3. Sensors to measure the temperature of the HMA at discharge.
   4. The ability to maintain discharge temperature of the mix in accordance with the mix design.

B. Asphalt Binder Storage Tanks:
   1. Provide calibrated tanks so the quantity of material remaining in the tank can be determined at any time.
   2. Provide a positive means of sampling the asphalt binder from the tanks.

3.4 SURFACE PREPARATION

A. Locate, reference, and protect all utility covers, monuments, curb and gutter, and other components affected by the paving operations.

B. Remove all moisture, dirt, sand, leaves, and other objectionable material from the prepared surface before placing the mix.

C. Complete spot leveling 48 hours before placing pavement courses.
   1. Place, spread, and compact leveling mix on portions of the existing surface.
   2. Fill and compact any localized potholes more than 25 mm deep.

D. Allow sufficient cure time for prime coat/tack coat prior to placing HMA. Refer to Section 02748.

3.5 SURFACE PLACEMENT

A. When full-width or echelon paving is impractical and more than one pass is required, provide a 1:3 (vertical to horizontal) sloped edge adjacent to the next lane to be paved.

B. Adjust the production of the mixing plant and material delivery until a steady paver speed is maintained.

C. Offset longitudinal joints 150 mm to 300 mm in succeeding courses.
   1. Place top course joint within 300 mm of the centerline or lane line.
   2. If the previous pass has cooled below 80 degrees C, tack the longitudinal edge before placing the adjacent pass.

D. Offset transverse construction joints at least 2 m longitudinally to avoid a vertical joint through more than one course.

E. Do not allow construction vehicles, general traffic, or rollers to pass over the uncompacted end or edge of freshly placed mix until the mat temperature drops to a point where damage or differential compaction will not occur.

F. Taper the end of a course subjected to traffic at approximately 1:50 (vertical to horizontal).
   1. Make a transverse joint by saw or wheel cutting and removing the portion of the pass that contains the tapered end.
   2. Tack the contact surfaces before fresh mix is placed against the compacted mix.

G. Use a motor grader, spreader box, or other approved spreading methods for projects under 150 m^2, irregular areas, or for miscellaneous construction such as detours, sidewalks, and leveling courses.

3.6 COMPACTION

A. In addition to normal rolling, use a small compactor or vibratory roller at structures.

B. Operate in a transverse direction next to the back wall and approach slab.

3.7 LIMITATIONS

A. Do not place HMA on frozen base or subbase.

B. Use a UDOT approved release agent for all equipment and hand tools used to mix, haul, and place the HMA. Refer to UDOT Qualified Products Listing.

C. Do not place HMA during adverse climatic conditions, i.e. precipitation, or when roadway surface is icy or wet.

D. Place HMA between April 15 and October 15, and when the air temperature in the shade and the roadway surface temperature is above 10EC.
   1. The Department will determine if is feasible to place HMA outside the above limits. Obtain written approval from the ENGINEER

3.8 CONTRACTOR QUALITY CONTROL

This Section does not apply to projects of 20,000 MG or less and projects where design overlay thickness is 50 mm or less.

A. General
   1. Reference the following standards for qualification, control, and guidelines:
      a. ASTM D 3666.
      b. ASTM D 4561.
      c. ASTM D 5506.
   2. Include the following tests in ASTM D 5506, Part 2, "Referenced Documents," for the following:
      a. AASHTO T 308
      b. AASHTO PP 28, TP 4
      c. AASHTO T 283 Modified by UDOT Materials Manual of Instruction Part 8-957.
      d. ASTM E 1274.

3. Establish and maintain a quality control system which will provide assurance that materials and completed construction conform to contract requirements.
4. Identify the Quality Control Manager by name. The Quality Control Manager will implement and maintain the Quality Control Plan.
5. Provide the ENGINEER a certification stating that all the testing equipment to be used is properly calibrated and will meet the specifications applicable for the specified test procedures. Provide evidence that Technicians are WAQTC certified. The ENGINEER may require the CONTRACTOR's technician to perform testing of samples to demonstrate an acceptable level of performance.

B. QUALITY CONTROL PLAN (QCP)

1. Provide and maintain a Quality Control Plan covering all personnel, equipment, supplies, and facilities necessary to obtain samples, perform and document tests, and otherwise provide a quality product.
2. Submit the written QCP to the ENGINEER at least 10 days before beginning operations, or at the Preconstruction Conference.
3. The DEPARTMENT will make no partial payments for materials that are subject to specific quality control requirements without a QCP.
4. The CONTRACTOR or independent organization may operate the QCP. However, the CONTRACTOR is responsible for the QCP's administration, including compliance with the QCP and any modifications.
5. Address the following minimum items:
   a. Quality control organization chart and area of responsibility and authority of each individual.
   b. Names and qualifications of personnel as required by this Section, paragraph: Quality Control Organization Personnel Requirements.
   c. Provide a description of outside organizations and their services (such as testing laboratories etc.) if employed.
   d. Tests required to be performed, the frequency of testing, sampling locations, and location of the testing facilities.
   e. Documentation of test procedures verifying that tests are conducted in accordance with the testing plan, and that proper corrective actions are taken when required.
   f. Procedures for verifying that testing equipment is available, complies with specified standards, and is calibrated against certified standards.
   g. Procedures for verifying that tests are conducted in accordance with the appropriate ASTM and AASHTO standards.
   h. Procedures for submitting test results to the ENGINEER daily.

6. QCP elements: address all elements that affect the quality of the HMA including:
    a. Mix Design
    b. Aggregate Grading
    c. Quality of Materials
    d. Stockpile Management
    e. Proportioning
    f. Mixing
    g. Placing and Finishing
    h. Sampling and Testing Procedures
    i. Joints
    j. Compaction
    k. Surface smoothness

C. QUALITY CONTROL ORGANIZATION
1. Implement the QCP by
    a. Establishing a separate Quality Control Organization.
    b. Developing an organization chart to show all quality control personnel and how these personnel integrate with other management, production, and construction functions and personnel.
2. Identify all quality control staff on the organization chart by name and function, and indicate the total staff required to implement all elements of the quality control programs, including inspection and testing functions for different items of work.
3. If an outside organization or laboratory is used to implement all or part of the QCP, the personnel assigned are subject to the qualification requirements of this Section. Indicate on the organization chart which personnel are contractor employees and which are provided by an outside organization.

D. QUALITY CONTROL ORGANIZATION PERSONNEL REQUIREMENTS
1. As outlined in ASTM D 3666, Part 7, with the following modifications. Quality Control Manager:
    a. Institutes any and all actions necessary to successfully operate the QCP in compliance with specifications.
    b. Reports directly to a responsible officer in the CONTRACTOR's organization.
    c. May supervise the QCP on more than one project provided that the Quality Control Manager can be at the job site within one hour after being notified of a problem.

2. Certification of Personnel. As outlined in ASTM D 5506 with the following changes:
   a. Provide a sufficient number of quality control technicians to adequately implement the QCP. These personnel will be either engineers or engineering technicians certified by WAQTC.
3. Quality Control Technicians:
   a. Report directly to the Quality Control Manager.
   b. Inspect all plant equipment used in proportioning and mixing to verify proper calibration and operating condition.
   c. Perform quality control tests necessary to adjust and control mix proportioning in accordance with the job mix formula.
   d. Inspect all equipment used in placing, finishing, and compaction to verify proper operating condition.
   e. Inspect all construction operations to verify conformance with the specifications.
   f. Perform all quality control testing as required by this Section, paragraph: Quality Control Testing.
   g. Detail the criteria to be used in initiating correcting unsatisfactory production processes and construction practices.

E. QUALITY CONTROL TESTING LABORATORY
1. Reference ASTM D 4561 with the following additions:
   a. Provide a fully equipped asphalt laboratory located within 30 minutes travel time of the plant or job site.
   b. Keep laboratory facilities clean and all equipment maintained in proper working condition.
   c. Permit the ENGINEER unrestricted access to inspect the CONTRACTOR's quality control testing laboratory facility and witness quality control activities. The DEPARTMENT advises in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies or testing personnel and procedures.
   d. Suspend work when test results indicate materials are out of specification tolerances. Resume only when the deficiencies are corrected.
      - Perform quality audits under this standard.
      - Refer to UDOT QA Manual.
2. Sampling:
   a. Use a statistically based procedure of random sampling.
   b. The Engineer has the right to witness all sampling.

3. Noncompliance:
   a. When quality control activities do not comply with either the CONTRACTOR's Quality Control Program or the Contract provisions, or where the CONTRACTOR fails to properly operate and maintain an effective Quality Control Program, the ENGINEER may:
      - Order the CONTRACTOR to replace ineffective or unqualified personnel.
      - Carry out the functions and operation of the CONTRACTOR's approved Quality Control Program.
      - Deduct costs incurred by the DEPARTMENT to operate the program or otherwise remedy the noncompliance from the total amount due the CONTRACTOR.

F. QUALITY CONTROL TESTING
1. Perform all quality control tests necessary to control the production and construction processes applicable to these specifications and listed in the QCP.
2. Establish a testing program to control as a minimum: asphalt binder content, aggregate gradation, VMA, temperatures, aggregate moisture, field compaction, and surface smoothness.
3. Monitoring: The DEPARTMENT reserves the right to monitor any or all QC testing.
4. Follow the requirements of Table 10, and conduct any additional testing to control the process.

Table 10 Quality Control Testing for HMA	
Testing Method/ Acceptance Documentation	**Testing Frequency**
AASHTO T 308 **Asphalt binder content**: by the ignition method	Minimum 4 tests per lot **
AASHTO T 30 **Gradation**: Mechanical analysis of the remains of the Ignition test.	Minimum 4 tests per lot
AASHTO T 255 **Moisture content**: of aggregate used in production by drying	Minimum One test per lot
Temperature for: dryer, bitumen in the storage tank, mixture at the plant, and mixture at the job site.	Record at least four times per lot
ASTM D 2950 **In-place Density Monitoring** Conduct all testing necessary to meet density requirements.	Minimum 10 density determinations per lot
AASHTO TP 4, PP 28 **Field Gyratory Specimens** Verify mix design parameters meet Job-mix requirements, and adjust mix as needed to meet parameters. Mold field gyratory specimens at mix design temperatures determined by the ENGINEER.	Minimum of one determination (two Gyratory specimens each) of VMA and Air Voids for each lot.

** A lot is defined in Section 02741, Part 1, paragraph 1.4

G. CONTROL CHARTS

1. Maintain daily linear control charts both for mean and range. Include in charts aggregate gradation, asphalt binder content, stockpile gradation, VMA, Density and in-place air voids.
2. Post control charts daily in a location satisfactory to the Engineer. As a minimum, identify:
   a. Project number
   b. Contract item number
   c. Test number
   d. Each test parameter

e. Test results

3. Use the control charts as part of a process control system for identifying potential problems and assignable causes before they occur. If the projected data during production indicates a problem and no corrective action is taken, the ENGINEER may suspend production or acceptance of the material.

H. QUALITY CONTROL REPORTS

1. Maintain records and submit daily reports of quality control activities.

3.9 AGENCY ACCEPTANCE TESTING

A. The DEPARTMENT will:

1. Divide each lot into four sublots based on the scheduled production day.
2. Take random samples behind the paver before any further compaction, and determine random numbers/locations from a random numbers table. ASTM D 3665, AASHTO T 168.
3. Inform the CONTRACTOR of the time and place for the sample not more than 15 minutes prior to the sampling.
4. Conduct the following tests:
   a. Asphalt Binder Content : One per sublot using ignition oven. AASHTO T 308
   b. Aggregate gradation: One test per sublot on the residue of the ignition oven tests. AASHTO T 30.
   c. VMA: 3 tests per lot. AASHTO TP 4
5. Perform three Rice tests for each lot. Use the average for the lot to determine density of cores taken by the CONTRACTOR. Refer to Section 02741, Part 1, paragraph 1.4.
6. Determine thickness of cores taken by the CONTRACTOR. Refer to Section 02741, Part 1, paragraph 1.4.
7. Add the lot to the previous day's production if the minimum number of samples cannot be obtained for the final day's production and evaluate with the appropriate sample size.
8. Add the lot to the next day's production if the minimum number of samples cannot be obtained, and evaluate with the appropriate sample size.
9. Retest the lot if an individual test from a sublot is deemed an outlier based on ASTM E 178.

3.10 DISPUTE RESOLUTION

A. Request a review of acceptance tests with the ENGINEER if disagreeing with the Department's test results.
   1. Submit all QC test results.
   2. Submit any other pertinent information, including an engineering analysis, if available.
   3. The ENGINEER will evaluate the above information and respond with a decision within three working days.

NATIONAL HIGHWAY SYSTEM AND TRUCK ROUTES

Table 11 National Highway System and Truck Routes Category 1		
Interstate Routes	**Beginning**	**Ending**
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 - Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I -15 - North Salt Lake
US Routes		
US-6	Nevada State Line	Jct US-50 - Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US -40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 - Holden
US -89	Arizona State Line	Jct I-70 - Sevier
US -89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 - Lehi
US-89	Jct I-15 - Draper, Exit 295	Jct SR-269 - 5th and 6th South
US-89	Jct I-15 - Farmington	Jct I-80 - Uintah
US-89	Jct I-84 - Uintah	Jct SR-134 - North Ogden
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Jct US-89 - Logan
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-666	Jct US-191 - Monticello	Colorado State Line

Table 11 National Highway System and Truck Routes Category 1		
State Routes	**Beginning**	**Ending**
SR-9 - Zions Park		
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 - Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-26 - Riverdale Road	Uct I-15 - Exit 342	Jct US-89 - Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 20th and 21st Odgen	Jct I-15 - Exit 344	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct 1-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance - Wilberg Coal Mine
SR-71 - 7th and 9th East Street Salt Lake City	Jct SR0-209 - 90th South Street	Jct SR-186 - 4th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi
SR-79 - 12th Street Ogden	Jct I-15 - Exit 347	Jct SR-203 - Harrison Blvd.
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21st South Expressway
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 - Draper	Jct I-80 - Salt Lake Intl Airport
SR-171 - 33rd and 35th South Salt Lake City	Jct SR-172 - 56th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street Salt Lake City	Jct 6200 South - Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood

Table 11 National Highway System and Truck Routes Category 1		
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12th Street
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90th and 96th South
SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 East, Exit 5
SR-266 - 45th & 47th South Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South Salt Lake City	Jct I-215, Exit 310	Jct SR-71 - 7th East Street

END OF SECTION

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02744 M

HOT MIX ASPHALT - PROCUREMENT

Delete line A.2 of paragraph 1.4, Acceptance, and replace with the following:

2. CONTRACTOR truck: sample at roadway in the presence of the ENGINEER.

December 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02745

ASPHALT MATERIAL

Delete Section 02745 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Asphalt materials.

1.2 PAYMENT PROCEDURES

A. Price adjustments for asphaltic cement and liquid asphalt (chip-seal emulsions and/or cut-backs):
   1. Standard department procedures governs price adjustments made where asphalt material does not conform to the specifications
      a. If the price adjustment exceeds 30 percent, the Engineer may order the removal of any or all the defective asphalt material.
      b. The pay factor for such material is 0.50 when allowed to remain in place.

B. Price adjustments for Performance Graded Asphalt Binder (PGAB):
   1. Standard department PGAB management plan governs price reductions or removal of material where they binder does not conform to the specifications.

1.3 REFERENCES

A. AASHTO M 81: Cut-Back Asphalt (Rapid-Curing Type).

B. AASHTO M 82: Cut-Back Asphalt (Medium-Curing Type).

C. AASHTO M 140: Emulsified Asphalt.

D. AASHTO M 208: Cationic Emulsified Asphalt.

E. AASHTO M 226: Viscosity Graded Asphalt Cement.

F. AASHTO MP 1: Performance Graded Asphalt Cement.

G. AASHTO T 44: Solubility of Bituminous Materials.

H. AASHTO T 49: Penetration of Bituminous Materials.

I. AASHTO T 50: Float Test for Bituminous Materials.

J. AASHTO T 51: Ductility of Bituminous Materials.

K. AASHTO T 59: Testing Emulsified Asphalt.

L. AASHTO T 201: Kinematic Viscosity of Asphalts.

M. AASHTO T 228: Specific Gravity of Semi-Solid Bituminous Materials.

N. AASHTO T 240: Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test).

O. AASHTO T 300: Force Ductility of Bituminous Materials.

P. AASHTO T 301: Elastic Recovery Test of Bituminous Materials by Means of a Ductilometer.

Q. ASTM D 92: Flash and Fire Points by Cleveland Open Cup.

R. ASTM D 1190: Concrete Joint Sealer, Hot-Applied Elastic Type.

S. ASTM D 2007: Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method.

T. ASTM D 2026: Cutback Asphalt (Slow-Curing Type).

U. ASTM D 3405: Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

V. ASTM D 4402: Viscosity Determinations of Unfilled Asphalts Using the Brookfield Thermosel Apparatus.

W. ASTM D 5167: Melting of Hot-Applied Joint and Crack Sealant and Filler for Evaluation.

X. ASTM D 5329: Sealants and Fillers, Hot-Applied, For Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements.

Y. ASTM D 5801: Toughness and Tenacity of Bituminous Materials.

1.4 SUBMITTALS

A. For each shipment of material, supply a vendor-prepared bill of lading showing the following information:
   1. Type and grade of material
   2. Type and amount of additives, used, if applicable
   3. Destination
   4. Consignee's name
   5. Date of Shipment
   6. Railroad car or truck identification
   7. Project number
   8. Loading temperature
   9. Net weight in metric units (or net liters corrected to 16 degrees C, when requested)
   10. Specific gravity
   11. Bill of lading number
   12. Manufacturer of asphalt material

1.5 DELIVERY, STORAGE AND HANDLING

A. Each shipment of asphalt material must:
   1. Be uniform in appearance and consistency.
   2. Show no foaming when heated to the specified loading temperature.

B. Do not supply shipments contaminated with other asphalt types or grades than those specified.

1.6 GRADE OF MATERIAL

A. The Engineer determines the grade of material to be used based on the supply source designated by the Contractor when the bid proposal lists more than one grade of asphalt material.

PART 2 PRODUCTS

2.1 PERFORMANCE GRADED ASPHALT BINDER (PGAB)

A. Supply PGABs under the Approved Supplier Certification (ASC) System. Refer to UDOT Asphalt Binder Quality Management Plan.

B. As specified in AASHTO MP 1, with the following modifications:

1. Delete superscript (f) for all specified grades having algebraic differences of 92 degrees C or greater between the high and low design temperatures.
2. Add Direct Tension Test for all specified grades having algebraic differences of 92 degrees C or greater between the high and low design temperatures.
   a. Failure Strain, minimum of 1.5 percent at 1.0 mm/min.
   b. Failure Stress, minimum of 4.0 Mpa
3. Delete G*/sin delta requirement for the original binder on all specified grades having algebraic differences of 92 degrees C or greater between the high and low design temperatures.
4. Add G* and phase angle (delta) requirements for the original binder on all specified grades having an algebraic difference of 92 degrees C between the high and low design temperatures.
   a. G* (complex modulus), 1.3 kPa, minimum
   b. Phase angle (delta), 74 degrees , maximum
5. Add G* and phase angle (delta) requirements for the original binder on all specified grades having an algebraic difference of 98 degrees C or greater between the high and low design temperatures.
   a. G* (complex modulus), 1.3 kPa, minimum
   b. Phase angle (delta), 71 degrees, maximum
6. Add Toughness and Tenacity Test for all specified grades having algebraic differences of 92 degrees C or greater between the high and low design temperatures.
   a. Meet a minimum of 75 lb-in 50 lb-in respectively for each test specimen.

2.2 ASPHALTIC CEMENT, LIQUID ASPHALTS, REJUVENATING AGENTS

A. As specified in AASHTO M 226, Table 2 with the following modifications:
1. Delete and replace ductility at 77EF(25EC) with ductility at 39.2EF(4EC) with values as detailed below.

AC - 2.5	AC - 5	AC - 10	AC - 20
50+	25+	15+	5+

`

B. As specified for cationic and anionic emulsified asphalt.
1. All standard Slow Setting (SS, CSS), Medium Setting (MS, CMS), and Rapid Setting (RS, CRS) grades; inclusive of all High-Float designations (HF).
2. Supply under the Approved Supplier Certification System (ASC).
3. Meet AASHTO M 208 and M 140.

C. Conform to the requirements of:
   1. Table 1: Cationic Rapid Setting Emulsified Polymerized Asphalt (CRS-2P); or
   2. Table 2: Latex Modified Cationic Rapid Setting Emulsified Asphalt (LMCRS-2); or
   3. Table 3: Cationic Medium Setting Emulsified Asphalt (CMS-2S); or
   4. Table 4: High Float Medium Setting Emulsified Polymerized Asphalt (HRMS-2SP); or
   5. Table 5: High Float Rapid Setting Emulsified Polymerized Asphalt (HFRS-2P); or
   6. Table 6: Cationic Rapid Setting Emulsified Asphalt (CRS-2A, B).

D. Curing cut-back asphalt:
   1. As specified for slow curing (SC) in ASTM D 2026.
   2. As specified for medium curing (MC) in AASHTO M 82.
   3. As specified for rapid curing (RC) in AASHTO M 81.

E. Conform to requirements for Emulsified Asphalt Pavement Rejuvenating Agent:
   1. Table 7: Type B
   2. Table 8: Type B Modified
   3. Table 9: Type C
   4. Table 10: Type D

Table 1

Cationic Rapid Setting Emulsified Polymerized Asphalt (CRS-2P)			
Tests	**AASHTO Test Method**	**Min.**	**Max.**
Emulsion			
Viscosity , SFS, 140EF(60EC), sec (Project-site Acceptance/Rejection Limits)	T59	100	400
Settlement (a) 5 days, percent	T 59		5
Storage Stability Test (b) 1 d, 24 h, percent	T 59		
Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, percent	T 59	40	
Particle Charge Test	T 59	Positive	
Sieve Test, percent	T 59		0.10
Distillation			
Oil distillate, by vol of emulsion, percent			0
Residue (d), percent		68	
Residue from Distillation Test			
Penetration, 77EF(25EC), 100 g, 5 s, dmm	T 49	80	150
Ductility, 39.2EF(4EC), 5 cm/min, cm Toughness, lb-in Tenacity, lb-in	T 51 ASTM D5801 ASTM D5801	35 75 50	
Solubility in trichloroethylene, percent	T 44	97.5	

(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
(b) The 24-hour (1-day) storage stability test may be used instead of the five-day settlement test.
(c) The demulsibility test is made within 30 days from date of shipment.
(d) Distillation is determined by AASHTO T 59, with modifications to include a 350 ± 5 EF(177±3EC) maximum temperature to be held for 15 minutes.

Modify the asphalt cement prior to emulsification.

Table 2

Latex Modified Cationic Rapid Setting Emulsified Asphalt (LMCRS-2)			
Tests	**AASHTO Test Method**	**Min.**	**Max.**
Emulsion			
Viscosity, SFS, 122 EF(50 EC), Sec (Project Site Acceptance/Rejection Limits)	T59	75	300
Settlement (a) 5 days, percent	T 59		5
Storage Stability Test (b) 1 d, 24 h, percent	T 59		1
Demulsibility (c) 35 ml, 0.8% sodium dioctyl Sulfosucinate, percent	T 59	40	
Particle Charge Test	T 59	Positive	
Sieve Test, percent	T 59		0.3
Distillation			
Oil distillate, by vol of emulsion, percent			0
Residue (d), percent		65	
Residue from Distillation Test			
Penetration, 77EF(25EC), 100 g, 5 s, dmm	T 49	80	150
Ductility, 39.2 EF(4 EC), 5 cm/min, cm	T51	35	
Toughness, lb-in	ASTM D5801	75	
Tenacity, lb-in	ASTM D5801	50	

(a) The test requirement for settlement may be waived when the emulsified asphalt is used in less than a five-day time; or the purchaser may require that the settlement test be run from the time the sample is received until it is used, if the elapsed time is less than 5 days.
(b) May use the 24-hour (1-day) storage stability test instead of the five-day settlement test.
(c) Make the demulsibility test within 30 days from date of shipment.
(d) Determine distillation by AASHTO T 59,with modifications to include a 350 ± 5 EF(177±3EC) maximum temperature to be held for 15 minutes.

Co-mill latex and asphalt during emulsification

Table 3

Cationic Medium Setting Emulsified Asphalt (CMS-2S)		
Tests	**AASHTO Test Method**	**Specification**
Emulsion		
Viscosity, SSF, 122EF(50EC), sec.	T 59	50 - 450
Percent residue	T 59	60 min
One-day storage stability, percent	T 59	1 max
Sieve, percent	T 59	0.10 max
Particle charge	T 59	Positive
Oil Distillate, percent by volume of emulsion	T 59	5-15
Residue		
Penetration, 77EF(25EC), 100g, 5 sec, dmm	T 59	100-250
Solubility, percent	T 59	97.5 min.

Table 4

High Float Medium Setting Emulsified Polymerized Asphalt (HFMS-2P) (a)			
Tests	**AASHTO Test method**	**Min.**	**Max.**
Emulsion			
Viscosity , SSF ,122EF(50EC), sec (Project Site Acceptance/Rejection Limits)	T 59	50	450
Storage Stability Test (a) 1 d, 24 h, percent	T 59		0.1
Sieve Test, percent	T 59		0.1
Distillation			
Oil distillate, by vol of emulsion, percent	T 59	1	7
Residue (c), percent	T 59	65	
Residue from Distillation Test			
Penetration, 77EF(25EC), 100 g, 5 s, dmm	T 49	70	300
Float Test, 140EF(60EC), sec	T 50	1200	300
Solubility in trichloroethylene, percent	T 44	97.5	
Elastic Recovery, 77EF(25EC), percent	T 301	50	

(a) Supply an HFMS-2SP (anionic, polymerized, high-float) as an emulsified blend of polymerized asphalt cement, water, and emulsifiers. Polymerize the asphalt cement with a minimum of 3.0% polymer by weight of the asphalt cement prior to emulsification. After standing undisturbed for a minimum of 24 hours, the emulsion shall be smooth and homogeneous throughout with no white, milky separation, pumpable, and suitable for application through a distributor.
(b) May use the 24-hour (1-day) storage stability test instead of the five-day settlement test.
(c) Determine the distillation by AASHTO T 59, with modifications to include a 350 ± 5 EF(177±3EC) maximum temperature to be held for 15 minutes.

Table 5

High Float Rapid Setting Emulsified Polymerized Asphalt (HFRS-2P) (a)			
Tests	**AASHTO Test method**	**Min.**	**Max.**
Emulsion			
Viscosity , SFS @ 122EF(50EC), sec (Project Site Acceptance/Rejection Limits)	T 59	50	450
Storage Stability Test (a) 1 d, 24 h, percent	T 59		1
Demulsibility (b) 0.02 N Ca Cl_2, percent	T 59	40	
Sieve Test, percent	T 59		0.1
Distillation			
Oil distillate, by vol of emulsion, percent	T 59		3
Residue (c), percent	T 59	65	
Residue from Distillation Test			
Penetration, 77EF(25EC), 100 g, 5 s, dmm	T 49	70	150
Float Test, 140EF(60EC), sec	T 50	1200	
Solubility in trichloroethylene, percent	T 44	97.5	
Elastic Recovery, 77EF(25EC), percent	T 301	58	

(a) Supply an HFMS-2SP (anionic, polymerized, high-float) as an emulsified blend of polymerized asphalt cement, water, and emulsifiers. Polymerize the asphalt cement with a minimum of 3.0% polymer by weight of the asphalt cement prior to emulsification. After standing undisturbed for a minimum of 24 hours, the emulsion shall be smooth and homogeneous throughout with no white, milky separation, pumpable, and suitable for application through a distributor.
(b) May use the 24-hour (1-day) storage stability test instead of the five-day settlement test.
(c) Determine the distillation by AASHTO T 59, with modifications to include a 350 ± 5 EF(177±3EC) maximum temperature to be held for 15 minutes.

Table 6

Cationic Rapid Setting Emulsified Asphalt (CRS-2A,B)			
Tests	**AASHTO Test Method**	**Min**	**Max**
Emulsion			
Viscosity, SSF, 122EF(50EC), sec (Project Site Rejection/Acceptance Limits)	T 59	140	400
Storage stability test, 24 h, percent	T 59		1
Demulsibility, 35 mL 0.8 percent Sodium Dioctyl Sulfosucinate, percent	T 59	40	
Particle charge test	T 59	Positive	
Sieve test, percent	T 59		0.10
Distillation			
Oil distillate, by volume of emulsion, percent	T 59		0
Residue, percent	T 59	65	
Use PG58-22 and PG64-22 as base asphalt cement for CRS-2A, B, respectively. Specification for high temperature performance: original and RTFO G*/sinδ within 3 EC of grade.			

Table 7

Emulsified Type B Asphalt Pavement Rejuvenating Agent Concentrate		
Tests	**Test Method**	**Limits**
Viscosity, SSF, 77EF(25EC), sec	AASHTO T 59	25-150
Residue, percent W	AASHTO T 59 (mod) (a)	62 Min.
Sieve Test, percent W	AASHTO T 59	0.10 Max.
5-day Settlement	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Residue from Distillation (a)		
Viscosity @ 140EF(60EC), mm^2/s	AASHTO T 201	2500-7500
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	98 Min.
Flash Point, COC	ASTM D 92	204 EC, Min.
Asphaltenes, percent W	ASTM D 2007	15 Max.
Saturates, percent W	ASTM D 2007	30 Max.
Aromatics, percent W	ASTM D 2007	25 Min.
Polar Compounds, percent W	ASTM D 2007	25 Min.

(a) Determine the distillation by AASHTO T-59 with modifications to include a 300 ± 5 EF(149±3EC) maximum temperature to be held for 15 minutes.

(b) Test pumping stability by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 77EF(25EC) through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.

Type B: an emulsion of lube oil and/or lube oil extract blended with petroleum asphalt.

Table 8

Emulsified Type B Modified Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SSF, 77EF(25EC), sec	AASHTO T 59	50-200
Residue by distillation or Evaporation (a), percent W	AASHTO T 59	62 Min.
Sieve Test, percent W	AASHTO T 59	0.20 Max.
5-day Settlement, percent W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
Pumping Stability (b)		Pass
Residue from Distillation (a)		
Viscosity (c)275EF(135 EC), cP	ASTM D 4402	150 - 300
Penetration, 77EF(25EC), dmm	AASHTO T 49	180 Min.
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	98 Min.
Flash Point, COC, EF(EC)	AASHTO T 48	400(204) Min.
Asphaltenes, percent W	ASTM D 2007	20-40
Saturates, percent% W	ASTM D 2007	20 Max.
Polar Compounds, percent W	ASTM D 2007	25 Min.
Aromatics, percent W	ASTM D 2007	20 Min.
PC/S Ratio	ASTM D 2007	1.5 Min.

(a) Determine the distillation by AASHTO T-59 with modifications to include a 300±5EF(149 ± 3EC) maximum temperature to be held for 15 minutes.

(b) Pumping stability is tested by pumping 475 ml of Type B diluted 1 part concentrate to 1 part water, at 77EF(25 EC) through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.

(c) Brookfield Thermocel Apparatus-LV model at 6 rpm with a #28 spindle at 2-98 torque.

As required by the Asphalt Emulsion Quality Management system (Materials Manual Part 8-208), the supplier certifies that the base stock contains a minimum of 15 % by weight of Gilsonite Ore. Use the HCL precipitation method as a qualitative test to detect the presence of Gilsonite.

Table 9

Emulsified Type C Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity,SFS,77EF(25EC), sec	AASHTO T 59	10-100
Residue (a), percent W (Type C supplied ready to use 1:1 or 2:1.	AASHTO T 59 (a)	30 Min. 1:1 40 Min. 2:1
Sieve Test, percent W (b)		0.10 Max.
5-day Settlement, percent W	AASHTO T 59	5.0 Max.
Particle Charge	AASHTO T 59	Positive
pH (May be used if particle charge test is inconclusive)		2.0 - 7.0
Pumping Stability (c)		Pass
Tests of Residue from Distillation (a)		
Viscosity, 275EF(135EC), mm^2/s	AASHTO T 201	475-1500
Solubility in 1,1,1 Trichloroethylene, percent	AASHTO T 44	97.5 Min.
RTFO mass loss, percent W	AASHTO T 240	2.5 Max.
Specific Gravity	AASHTO T 228	0.98 Min.
Flash Point, COC	AASHTO T 48	232 EC, Min.
Asphaltenes, percent W	ASTM D 2007	25 Min., 45 Max.
Saturates, percent W	ASTM D 2007	10 Max.
Polar Compounds, percent W	ASTM D 2007	30 Min.
Aromatics, percent W	ASTM D 2007	15 Min.

(a) Determine the distillation by AASHTO T-59 with modifications to include a 300± 5EF(149 ± 3EC) maximum temperature to be held for 15 minutes.

(b) Test method identical to AASHTO T 59 except that distilled water is used in place of 2 % sodium oleate solution.

(c) Test pumping stability by pumping 475 ml of Type diluted 1 part concentrate to 1 part water, at 77EF(25EC) through a 1/4 inch gear pump operating at 1750 rpm for 10 minutes with no significant separation or coagulation in pumped material.

As required by the Asphalt Emulsion Quality Management system (Materials Manual Part 8-208), the supplier certifies that the base stock contains a minimum of 10 % by weight of Gilsonite ore. Use the HCL precipitation method as a qualitative test to detect the presence of Gilsonite.

Table 10

Emulsified Type D Asphalt Pavement Rejuvenating Agent Concentrate		
Property	**Test Method**	**Limits**
Viscosity, SFS, 77EF(25EC), sec	AASHTO T 59	30-90
Residue, (a) percent W	AASHTO T 59 (mod) (a)	65
Sieve Test, percent W	AASHTO T 59	0.10 Max.
pH		2.0 - 5.0
Residue from Distillation (c)		
Viscosity, 140EF(60EC), cm^2/s	AASHTO T 201	300-1200
Viscosity, 275EF(135EC), mm^2/s	AASHTO T 201	300 Min.
Modified Torsional Recovery (b)	CA 332 (Mod)	40 % Min.
Toughness, 77EF(25EC), in-lb	ASTM D 5801	8 Min.
Tenacity, 77EF(25EC), in-lb	ASTM D 5801	5.3 Min.
Asphaltenes, percent W	ASTM D 2007	16 Max.
Saturates, percent W	ASTM D 2007	20 Max.

(a) California test method #331 for recovery of residue.
(b) Torsional recovery measurement to include first 30 seconds.
(c) Determine the distillation by AASHTO T-59 with modifications to include a 300±5EF(149 ± 3EC) maximum temperature to be held for 15 minutes.

2.3 HOT-POUR CRACK SEALANT FOR BITUMINOUS CONCRETE

A. Combine a homogenous blend of materials to produce a sealant meeting properties and tests in Table 11.

B. Packaging and Marking: Supply sealant pre-blended, pre-reacted, and pre-packaged in lined boxes weighing no more than 30 lb.
   1. Use a dissolvable lining that will completely melt and become part of the sealant upon subsequent re-melting.
   2. Deliver the sealant in the manufacturer's original sealed container.
   3. Clearly mark each container with the manufacturer's name, trade name of sealant, batch or lot number, and recommended safe heating and application temperatures.

Table 11

Hot-Pour Bituminous Concrete Crack Sealant			
Application Properties:			
Workability:	Pour readily and penetrate 0.25 in and wider cracks for the entire application temperature range recommended by the manufacturer.		
Curing:	No tracking caused by normal traffic after 45 minutes from application.		
Asphalt Compatibility: ASTM D 5329, Sec 14.	No failure in adhesion. No formation of an oily ooze at the interface between the sealant and the bituminous concrete or softening or other harmful effects on the bituminous concrete.		
Material Handling:	Follow the manufacturer's safe heating and application temperatures.		
Test Method	**Property**	**Minimum**	**Maximum**
AASHTO T51	Ductility, modified, 1cm/min, 39.2EF(4EC),cm	30	
UDOT method 967	Cold Temperature Flexibility	no cracks	
AASHTO T 300 (a)	Force-Ductility, lbf		4
ASTM D 5329	Flow 140EF(60EC), 5 hrs 75 E angle, mm		3
ASTM D 3405 (b)	Tensile-Adhesion, modified	300%	
AASHTO T 228	Specific Gravity, 60EF(15.6EC)		1.140
ASTM D 5329	Cone Penetration, 77EF(25EC), 150 g, 5 sec., dmm		90
ASTM D 5329	Resilience, 77EF(25EC), 20 sec., percent	30	
ASTM D 4402	Viscosity, 380EF(193.3EC), SC4-27 spindle, 20 rpm, cP		2500
ASTM D 5329	Bond as per ASTM D 1190, Section 6.4		Pass
(a) Maximum of 4 lbf during the specified elongation of 30 cm @ 1 cm/min , 39.2EF(4 EC). (b) Use ASTM D 3405, Section 6.4.1. Delete bond and substitute tensile-adhesion test in accordance to D 5329.			

PART 3 EXECUTION Not used.

END OF SECTION

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02746 M

HYDRATED LIME

Add the following to PART 1 GENERAL

1.3 QUALITY ASSURANCE

A. Prequalification: Hydrated Lime, through UDOT's Quality Management Plan for Hydrated Lime.

February 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02752 M

PORTLAND CEMENT CONCRETE PAVEMENT

February 13, 2001
Delete line B of paragraph 1.3 "References" and replace with the following:

B. AASHTO M 157: Ready-Mixed Concrete.

March 14, 2000
Delete paragraph 1.5 and replace with the following:

1.5 PROJECT CONDITIONS/LIMITATIONS

A. **Seasonal:** Do not pave from October 15 to April 15. Submit cold weather concrete plan to the ENGINEER for written approval to pave outside these limits.

B. **Hot and Cold Weather:** Refer to Section 03055, Part 3.

C. **Night Operations:** Provide proper lighting from one half-hour after sunset to one half-hour before sunrise following Section 00555, paragraph 1.11, Limitation of Operations.

Delete paragraph 2.4 and replace with the following:

2.4 ADMIXTURES

A. Air-entraining Agents
   1. Select from the Qualified Products list maintained by the UDOT Materials and Research Division
   2. When concrete is central-mixed and transported in non-agitating haul units, incorporate synthetic/non-vinsol resin air entraining admixtures.
   3. When central-mixed with agitating haul units or transit-mixed, conform to the material standard found in AASHTO M 154.
      a. Thoroughly mix all entraining agents before use.
      b. Constantly agitate any agent that settles during batching.

February 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02753

FULL DEPTH SLAB REPLACEMENT FOR CONCRETE PAVEMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove panel or partial panel full depth of existing pavement.

B. Clean, grade and reconsolidate base.

C. Install dowels and/or tie bars.

D. Furnish and replace repair material, and cure repair material.

1.2 REFERENCES

A. American Concrete Institute (ACI) 309: Guide for Consolidation of Concrete.

1.3 RELATED SECTIONS

A. Section 02752: Portland Cement Concrete Pavement.

B. Section 03055: Portland Cement Concrete.

C. Section 03152l: Concrete Joint Control.

D. Section 03310: Structural Concrete.

E. Section 03390: Concrete Curing

PART 2 PRODUCTS

2.1 FULL DEPTH CONCRETE PAVEMENT REPAIR MATERIAL

A. Follow Section 02752, Part 2, except that it is acceptable to the use High Range Water Reducers. (Super Plasticizers).

B. Provide concrete mix design for verification following Section 02752.

C. With written permission from the Engineer, Contractor may accelerate the rate of concrete strength gain to match the field placement schedule.

PART 3 EXECUTION

3.1 PREPARATION

A. Remove panel, panels, or panel section.
   1. Determine the extent/dimensions of the repair from the plan sheets, or as directed by the Engineer. Adhere to the requirements of Standard Drawing 450-2B.
   2. Complete removal, make full depth cuts around the perimeter of the rectangular section to be removed. Minimize saw over cuts.
   3. Remove panels by lift-out method. Use chains and lift pins to facilitate removal and minimize disturbance of the base material.
   4. Repair damage caused by the Contractor's operations to adjacent slabs and underlying base courses.
   5. Remove all loose particles of old Portland Cement Concrete (PCC) prior to placing new PCC.

B. Reconstruct base to grade, and compact to standard specifications.

C. Form any side that does not have an adjacent panel. Form to match existing panels, providing a vertical edge.

D. Place dowel and/or tie bars.
   1. Place bars in locations as per the 450 Series Standard Drawings. Use tie-bars or smooth dowels where indicated on standard drawings.
   2. Stockpile bars in an area where they are kept clean and free from damage.
   3. Drill holes mid-depth of the slab without causing damage to the remaining pavement section and orient holes such that bar placement tolerances can be met. Use gang drills, unless otherwise approved by the Engineer.

4. Clean holes of dust, grease and other contaminants.
5. Inject epoxy gel, Type II bonding compound into the back of the drilled hole.
    a. Use approved material on the UDOT Qualified Products Listing (QPL).
    b. Provide sufficient quantity of bonding compound to completely fill the void between the bar and the outer limits of the drilled hole.
    c. Use retention rings to prevent the bonding compound from flowing out of the hole.
6. Align bars horizontally and vertically to meet requirements of the standard drawings.
7. Repair any bar coating damage with appropriate repair material.
8. Coat protruding portion of dowel bar with lubricant consisting of paraffin wax, lithium grease or other semi-solid, inert lubricant approved by the Engineer.
9. Set bonding compound and stabilize bar prior to mix placement. Remove and replace loose bars, at the Contractor's expense, prior to placing concrete mix.

E. Prepare existing joints for placement.
1. Maintain existing pavement joint layout.
2. Place a bond breaker, approved by the Engineer, on the existing pavement edges that compose existing joints, either transverse or horizontal.
3. Saw joint on the same line if repairs straddle an existing joint line. Perform sawing in accordance with Section 03390.

3.2 PLACING CONCRETE

A. Place concrete in compliance with Section 03310, Part 3, paragraph "Placing Concrete."

B. Consolidate the mix with a mechanical vibrator in accordance with ACI 309 guidelines. Do not over-consolidate. Do not use hand vibrators to move mix.

C. Discard any unused mix after 30 minutes from the time mixing was completed for accelerated strength gain rate mix designs. Place normal mixes in accordance with Section 03055, Part 3, paragraph, "Limitations - General," lines A through B.

D. Weather Limitations - Place, cure and protect in accordance with Section 02752, Part 1, paragraph "Project Conditions/Limitations."

3.3 CONCRETE FINISHING

A. Finish patch to +/- 3 mm of existing profile.
   1. Correct patch profiles in excess of 3 mm higher than the existing pavement profile through surface grinding or removal and replacement.
   2. Correct patch profiles in excess of 3 mm lower than the existing pavement profile through removal and replacement of the patch.
   3. Contractor pays for any corrections to the finish of the patch.

B. Do not tool joints that are to be saw-cut and sealed.

C. Texture the surface to match the existing pavement.

3.3 CURING CONCRETES

A. Cure the slab surface before it begins to dry with material meeting the requirements of Section 03152. Uniformly spray the surface at a minimum rate of 1.2 liters per square meter.

B. Do not open to traffic until compressive strength tests show that a minimum of 21.0 MPa has been reached.

C. Cut all previously existing joints to original dimensions.

D. Fill all sawing overcuts with approved Repair Epoxy on the UDOT Qualified Products Listing (QPL).

E. Replacement slab must perform under traffic at specified time of opening without failure.

F. Contractor pays for removing and replacing any defective panels. Refer to Section 02752, Part 3, paragraph “Defective Pavement Panels.”

3.4 PROTECTION

A. Protect the individual placements with approved barricades.

END OF SECTION

March 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02755

CONCRETE SLAB JACKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Raise and support a failed section of concrete pavement back to an acceptable grade for a suitable ride by injection of product.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

1.3 REFERENCES

A. ASTM C 618: Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement Concrete.

B. ASTM C 1107: Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

C. ASTM D 790: Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

D. ASTM D 1621: Compressive Properties of Rigid Cellular Plastics.

E. ASTM D 1622: Apparent Density of Rigid Cellular Plastics.

1.4 QUALITY ASSURANCE

A. Obtain approval of injection material properties prior to placement from the Engineer.

B. Provide copies of invoices from mix suppliers to the Engineer.

1.5 WARRANTY

A. Supplier warrants all materials and workmanship for a period of one year against shrinkage or deterioration.

B. Supplier replaces by re-injection or slab replacement any material that fails during the warranty period.

1.6 PAYMENT PROCEDURES

A. Accepted liquid quantities measured using a calibrated meter paid for at the contract unit price per cubic meter.

PART 2 PRODUCTS

2.1 HIGH DENSITY POLYURETHANE

A. Water based formulation of expanding high-density polyurethane used for raising slabs.

1. Sets to full compressive strength within 15 minutes after injection.

PROPERTY	ASTM	LIMITS
Density	D 1622	Min 60 kg/m3 - Max 68 kg/m3
Tensile Strength	D 790*	Min. 690 KPa
Elongation	N/A	Max. 5.1%
Compressive Strength at Yield Point	D 1621	Min. 620 Kpa

*Use the value of flexural strength or flexural yield as tensile strength.

2.2 PORTLAND CEMENT DRY MIX DESIGN

A. Use standard mix design for jacking and grouting slabs with voids less than 750 mm as follows:

1. 1 part (by volume) Portland Cement Type I or II, refer to ASTM C 1107.
2. 3 parts (by volume) pozzolan (natural or artificial), refer to ASTM C 618 Type F.

B. Use optional mix design for jacking and grouting slabs with voids greater than 750 mm as follows:

1. 1 part (by volume) Portland Cement Type I or II, refer to ASTM C 1107.
2. 1 parts (by volume) pozzolan (natural or artificial), refer to ASTM C 618 Type F.
3. 2 parts (by volume) clean sand.

C. Obtain Engineer's approval for any deviation from dry mix proportions of mix design including addition of liquefier and/or water reducing agents.

D. Adjust water content to meet local conditions

2.3 EQUIPMENT

A. Equipment capable of supplying a homogenous product at the appropriate rate.

B. Certified scales or measuring devices to measure delivered product and to proportion product components.

C. Concrete drill or saw capable of producing circular holes of adequate size for the application type.

D. Elevation measuring devices with an accuracy of 3 mm.

E. Concrete saw capable of cutting joints between failed and non-failed slabs.

PART 3 EXECUTION

3.1 PREPARATION

A. Establish a finish target profile of pavement using elevation measuring device or string lines.

B. Saw-cut joints between failed and non-failed slabs as necessary to prevent damage to non-failed slabs.

3.2 INSTALLATION

A. Drill holes as determined in roadway slab.

B. Inject product to evenly raise slab to finished grade profile.

C. Fill injection holes with at least 100 mm of non-shrink grout.

D. Final grade after jacking must be within ±3 mm of finished grade profile.

END OF SECTION

December 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02761

LONGITUDINAL RUMBLE STRIP

Delete Section 02761 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for constructing longitudinal rumble strip on the final roadway surface.

1.2 ABBREVIATIONS

A. HMAP - Hot Mix Asphalt Pavement

B. PCCP - Portland Cement Concrete Pavement

PART 2 PRODUCTS

2.1 EQUIPMENT - HMAP/ PCCP GRINDER

A. Construct longitudinal rumble strip with equipment using a rotary type cutting head, capable of obtaining the required groove width in a single pass while moving in the same direction as the flow of traffic.
   1. Use equipment with cutting head(s) having independent suspension from the power unit to allow the head to self align with the slope of the shoulder.
   2. Use cutting head(s) with sufficient number of blades to provide a smooth surface (approximately 1.6 mm between peaks or valleys).

B. Apply asphalt flush coat at a uniform rate of 0.45 L/m^2 diluted two parts concentrate to one part water by the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Construct longitudinal rumble strip to the dimensions and spacing as shown on Standard Drawings 460-1 and 460-2.
   1. Establish lane widths of 3.6 m prior to the installation of longitudinal rumble strip.
   2. Construct longitudinal rumble strip prior to the placement of Chip Seal Coat, if required.

B. Provide a positive means of controlling the alignment.
   1. Alignment of the edge of the pattern will be randomly verified by the Engineer.

C. Construct a 150 m long test section to demonstrate that the equipment, personnel and methods of operation are capable of producing acceptable results.
   1. Do not proceed with work until it is demonstrated that the required dimensions, alignment and smoothness can be achieved without tearing or otherwise damaging the pavement.
   2. Repair or replace pavement as determined by the Engineer if the test section is unacceptable.

D. Remove resulting debris prior to opening the adjacent lane to traffic.
   1. Dispose of material in accordance with all Federal, State and Local regulations and in a manner acceptable to the Engineer.

END OF SECTION

January 8, 2002

SUPPLEMENT SPECIFICATION

SECTION 02765

PAVEMENT MARKING PAINT

Delete Section 02765 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish VOC Compliant Solvent Based or Acrylic Water Based pavement marking paint meeting Federal Specification TTP-115 F for Low Volatile Organic Compounds (VOC) of .15 kg/L.

B. Apply to asphaltic or concrete pavement as edge lines, center lines, broken lines, guide lines, symbols and other related markings.

C. Remove pavement markings.

1.2 REFERENCES

A. AASHTO M 247: Glass Beads Used in Traffic Paint.

B. ASTM D 562: Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using the Stormer-Type Viscometer.

C. ASTM D 711: No-Pick-Up Time of Traffic Paint.

D. ASTM D 2205: Selection of Tests for Traffic Paints

E. ASTM D 2743: Uniformity of Traffic Paint Vehicle Solids by Spectroscopy and Gas Chromatography.

F. ASTM D 3723: Pigment Content of Water-Emulsion Paints

G. ASTM D 3960: Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

H. ASTM D 4451: Pigment Content of Paints

I. ASTM D 5381: X-Ray Fluorescence (XRF) Spectroscopy of Pigments and Extenders.

J. Federal Standards 595B, 37875, 33538, and 11105.

1.3 ACCEPTANCE

A. UDOT ENGINEER:
1. Randomly samples pavement marking paint and submits to Central Chemistry Lab for acceptance.
2. Randomly generates the location of each test and removes all loose or excess beads from the line prior to testing.
3. Visually inspects each line to verify bead adhesion and compliance with specified line dimensions requirements.
4. Verifies that the paint and beads are being applied within specified tolerances a minimum of once each production day.
5. Verify quantities used by measuring both paint and bead tanks prior to and after application.

B. Repaint any line or symbol failing to meet bead adherence and dimensional requirements.

C. Repaint any line or symbol failing to meet the minimum application requirements for paint or beads.

PART 2 PRODUCTS

2.1 PAINT

A. Choose an approved pavement marking paint from the UDOT Research Division "Accepted Products Listing." Follow Federal Standards 595B, 37875, 33538, and 11105. Meet the following requirements for VOC Compliant Solvent Based Paint or Acrylic Water Based Paint:

CIELAB (L*a*b*) D65/10E		
White	**Yellow**	**Red**
L* 91.9 to 95.6	L* 70.0 to 72.7	L* 31.4 to 33.4
a* -1.8 to -2.1	a* 22.5 to 24.8	a* 51.6 to 52.6
b* 3.8 to 2.2	b* 89.7 to 73.9	b* 34.1 to 35.1

1. No-track time: Not more than 5 minutes when tested according to ASTM D 711.
2. Volatile Organic Compounds Content: Less than .15 kg/L ASTM D 3960.
3. Free of lead, chromium, or other related heavy metals ASTM D 5381.
4. Pigment: Percent by weight: Acrylic Water Based minimum of 62.0 ± 2.0 VOC Compliant Solvent minimum of 52.0. ASTM D 3723.
5. Total Solids: Percent by weight: Acrylic Water Based minimum of 77.0 VOC Compliant Solvent minimum of 70.0. ASTM D 2205.
6. Acrylic water based paint must contain a minimum of 40%, by weight, 100% acrylic cross-linkable emulsion as determined by infrared analysis and other chemical analysis available to UDOT ASTM D 2205 and UDOT Manual of Instruction Section 996.
7. VOC compliant solvent based paint must contain 37.5%, by weight, copolymer alkyd-resin ASTM D 2205.
8. ASTM D 562, ASTM D 2743, ASTM D 4451 and ASTM D 5381: Tests used to verify paint samples meet "Accepted Products Listing".

2.2 GLASS SPHERE (BEADS) USED IN PAVEMENT MARKING PAINT

A. Specific Properties:
   1. Meet AASHTO M 247.
   2. Meet type II, uniform gradation.

PART 3 EXECUTION

3.1 PREPARATION

A. Line Control.
   1. Establish control points at 30 m intervals on tangent and at 15.25 m intervals on curves.
   2. Maintain the line within 50 mm of the established control points and mark the roadway between control points as needed.
      a. Remove paint that is not placed within tolerance of the established control points and replace at no expense to the Department. Refer to paragraph 3.4

B. Remove dirt, loose aggregate and other foreign material and follow manufacturer's recommendations for surface preparation.

3.2 APPLICATION

A. Pavement Marking Paint: Apply at the following rates:
   1. 100 mm Solid Line: From 21 to 28 m/L
   2. 100 mm Broken Line: From 87 to 113 m/L
   3. 200 mm Solid Line: From 11 to 14 m/L

B. Replace pavement markings that are less than 14 wet mils in thickness.

C. No payment for pavement markings placed in excess of 18 wet mils in thickness.

D. Painted Legends and Symbols 1 liter per 2.5 square meters

E. Glass Sphere (Beads): Apply a minimum of 1 kg/L of paint, the full length and width of line and pavement markings.

F. Begin striping operations no later than 24 hours after ordered by the Engineer.

G. At time of application apply lines and pavement markings only when the air and pavement temperature are:
   1. 5 degrees C and rising for VOC Compliant Solvent Based Paint.
   2. 10 degrees C and rising for Acrylic Water Based Paint.

H. Comply with Traffic Control Drawing 745-2J

3.3 CONTRACTOR QUALITY CONTROL

A. Application Rate: Verify that the paint and beads are being applied within specified tolerances prior to striping.

3.4 REMOVE PAVEMENT MARKINGS

A. Use one of these removal methods:
   1. Grinding
   2. High pressure water spray
   3. Sand blasting
   4. Shot blasting.

B. Use equipment specifically designed for removal of pavement marking material.

END OF SECTION

January 8, 2002

SUPPLEMENT SPECIFICATION

SECTION 02768

PAVEMENT MARKING MATERIALS

(Warranty Specification)

Delete Section 02768 and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Methods and materials for installing pavement marking materials including Pavement Marking Tape, Solvent-Free and Lead-Free Epoxy, Methyl-Methacrylate, and Thermoplastic legends.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control.

1.3 SUBMITTALS

A. Manufacturer Warranty:
   1. Provide a full warranty covering 100 percent of the pavement marking materials.
      a. Manufacturer is responsible for quality control of the materials, proper placement by the Contractor or subcontractor, and all other factors that affect the service life of the materials.
      b. In the event of a performance failure, remove and/or replace 100 percent of the markings for all failed sections at no cost to Department.
      c. Failed sections are defined in this Section, Part 2 for each pavement marking material.

B. Warranty Bond:
   1. The manufacturer will provide a warranty bond for the total bid price of the material. The total bid price will be calculated by using the quantity of pavement marking material listed in the engineers estimate and the average unit bid price for said material obtained from the Construction Division's "Project Development Business System" (PDBS).

2. Warranty period covers the specified service life of the materials, and begins after all pavement markings are installed and accepted.
3. Submit proof of bond to the Engineer before placing the material.

C. Traffic Control: Refer to Section 01554.

1.4 DELIVERY, STORAGE, AND HANDLING

A. In accordance with manufacturer's recommendations.

B. Provide Material Safety Data Sheets (MSDS) upon delivery of material.

1.5 MANUFACTURER SERVICE REQUIREMENT

A. Provide technical support to the Contractor during the placement of the marking materials, including information about handling, storage, placement and other training that may preserve the quality of the installed markings.

1.6 SERVICE LIFE TESTING

A. Department will perform service life testing.

B. Performance measures: Retro-reflectivity, color contrast and stability, and durability under all traffic volumes and wear conditions, unless stated otherwise.

C. Retro-reflectivity is measured using a Federally approved instrument (30 m geometry).

D. When performing Service Life Testing, take readings on clean surface areas free of debris.

PART 2 PRODUCTS

2.1 PAVEMENT MARKING TAPE

A. Preformed adhesive tape with a raised profile for longitudinal lines on all pavement surfaces.

B. Preformed adhesive tape with a flat or raised profile for legends and symbols on all pavement surfaces.

C. Minimum service life for the following applications, under all traffic volumes and wear conditions:

1. Longitudinal lines: 48 months.
2. Legends and symbols: 18 months.

D. Performance Measures: Retro-reflectivity, Color Contrast/stability, and Durability.
1. Minimum Retro-reflectivity:
   a. White Longitudinal Lines: 125 millicandelas.
   b. Yellow Longitudinal Lines:125 millicandelas.
   c. Legends and Symbols:125 millicandelas.
2. Minimum Color Contrast and Stability: For white markings, provide a minimum yellowness index of 30 when measured with a portable colorimeter (XYZ C/2).
3. Minimum Durability Level: 90 percent of the longitudinal line on any 300 m segment or 90 percent of the legend and symbol, must be present.
4. Failure to meet any of the specified performance measures on at least 90 percent of the longitudinal line, in any 300 m segment, or 90 percent of a legend or symbol is considered a complete failure of that marking. Replace under the warranty terms.

2.2 SOLVENT-FREE EPOXY

A. 100 percent lead free, 2 component (resin and hardener) epoxy system for longitudinal lines, legends and symbols and for all pavement surfaces.

B. Minimum service life for the following applications, under all traffic volumes and wear conditions:
1. Type 1 - Fast Dry:
   a. Longitudinal: Center, skip, and edge lines: 24 months.
   b. Legends and symbols: 12 months.
2. Type 2 - Slow Dry
   a. Longitudinal: Center, skip, and edge lines: 48 months.
   b. Legends and symbols: 24 months.

C. Performance Measures: Retro-reflectivity, Color Contrast/stability, and Durability.
1. Minimum Retro-reflectivity:
   a. White Longitudinal Lines: 125 millicandelas.
   b. Yellow Longitudinal Lines: 125 millicandelas.
   c. Legends and Symbols: 125 millicandelas.
2. Minimum Color Stability: Yellowness Index of White Paint on concrete or asphalt surfaces: 30 or less.
3. Minimum Durability Level: 90 percent of the longitudinal line on any 300 m segment or 90 percent of the legend and symbol, must be present.

4. Failure to meet any of the specified performance measures on at least 90 percent of the longitudinal line, in any 300 m segment, or 90 percent of a legend or symbol is considered a complete failure of that marking. Replace under the warranty terms.

D. Retain a one pint sample from each lot or batch used.
   1. 24 months for Type I
   2. 48 months for Type II.

E. Repaint pavement markings that are below 16 wet mils in thickness.
   1. Contractor will not be paid for materials placed in excess of 20 wet mils in thickness.

F. Use beads according to manufacturer's recommendations

2.3 METHYL METHACRYLATE

A. 2 component pavement marking system compliant with federal VOC regulations used for longitudinal lines, legends and symbols and for use on all pavement surfaces.

B. Profiled, Non Profiled, Inlaid, Inverted Profile w/bump, Inverted Profile w/o bump, Spray.

C. Minimum service life for the following applications, under all traffic volumes and wear conditions:
   1. Longitudinal lines: 48 months.
   2. Legends and Symbols: 18 months.

D. Performance Measures: Retro-reflectivity and Durability.
   1. Minimum retro-reflectivity:
      a. White Longitudinal markings: 125 millicandelas.
      b. Yellow Longitudinal markings: 125 millicandelas.
      c. Legends and Symbols : 125 millicandelas.
   2. Minimum Durability Level: 90 percent of the longitudinal line on any 300 m segment or 90 percent of the legend and symbol, must be present.
   3. Failure to meet any of the specified performance measures on at least 90 percent of the longitudinal line, in any 300 m foot segment, or 90 percent of a legend or symbol is considered a complete failure of that marking. Replace under the warranty terms.

E. Remove and replace pavement marking that is below 80 wet mils in thickness.
   1. Contractor will not be paid for materials placed in excess of one hundred wet mils in thickness.

F. Use beads according to manufacturer's recommendations.

2.4 THERMOPLASTIC

A. Used for legends and symbols only on all pavement surfaces.

B. Heat-fused preformed and Hot Melt pavement marking materials.

C. Minimum Service Life for Legends and Symbols, under all traffic volumes and wear conditions:
   1. Legends and Symbols: 24 months.

D. Performance Measures: Retro-reflectivity and Durability.
   1. Minimum Level of Retro-reflectivity: 125 millicandelas.
   2. Minimum Durability: 90 percent of each legend or symbol must be present.
   3. Failure to meet any of the specified performance measures on at least 90 percent of the legend or symbol is considered a complete failure of that legend or symbol. Replace under the warranty terms.

E. Hot-Melt Thermoplastic: Remove and replace legends and symbols that are below 80 wet mils in thickness.
   1. Contractor will not be paid for materials placed in excess of 100 wet mils in thickness.

PART 3 EXECUTION

3.1 PREPARATION

A. Conduct other surface preparations in accordance with manufacturer's recommendations.

3.2 APPLICATION

A. Apply Pavement Marking Materials according to manufacturers's specifications.

END OF SECTION

January 8, 2002

SUPPLEMENT SPECIFICATION

SECTION 02785

CHIP SEAL COAT

Delete Section 02785 "Seal Coat" from the Standard Specifications and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for applying liquid or emulsified asphalt on a cleaned surface followed with an application of cover material and bituminous flush coat.

B. Cover materials.

1.2 RELATED SECTIONS

A. Section 01558: Temporary Pavement Markings.

B. Section 01455: Materials Quality Requirements.

1.3 REFERENCES

A. AASHTO M 140: Emulsified Asphalt.

B. AASHTO T 11: Materials Finer Than 75 Fm (No. 200) Sieve in Mineral Aggregates by Washing.

C. AASHTO T 19: Unit Weight and Voids in Aggregate.

D. AASHTO T 27: Sieve Analysis of Fine and Coarse Aggregates.

E. AASHTO T 40: Sampling Bituminous Materials.

F. AASHTO T 96: Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine.

G. AASHTO T 104: Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

H. AASHTO T 278: Surface Frictional Properties Using the British Pendulum Tester.

I. AASHTO T 279: Accelerated Polishing of Aggregates Using the British Wheel.

J. ASTM D 4791: Flat Particles elongated Particles or Flat and Elongated particles in Coarse Aggregate.

K. ASTM D 5821: Determining the Percentage of Fractured Particles in Coarse Aggregate.

L. UDOT 945: Dynamic Stripping Test of Bitumen-Aggregate Mixtures.

PART 2 PRODUCTS

2.1 PERFORMANCE GRADED PG BINDER

A. PG58-22 following Section 02745.

B. PG64-22 following Section 02745.

2.2 ANIONIC EMULSIONS

A. RS-2 following AASHTO M 140.

2.3 CATIONIC EMULSIONS

A. CRS-2A following Section 02745.

B. CRS-2B following Section 02745.

C. CRS-2P following Section 02745.

D. LMCRS-2 following Section 02745.

2.4 HIGH FLOAT EMULSIONS

A. HFRS-2P following Section 02745

B. HFMS-2 following AASHTO M 140

C. HFMS-2P following Section 02745

2.5 FLUSH COAT

A. Use one of the following emulsions, following section 02745, diluted two parts concentrate to one part water by the Manufacturer, and as agreed upon by the ENGINEER:
   1. CSS-1
   2. CSS-1h
   3. SS-1
   4. SS-1h
   5. HFMS-2P

2.6 COVER MATERIAL

A. Use crusher processed virgin aggregate consisting of natural stone, gravel, or slag meeting the requirements of Table 1.

Table 1
Chip Seal Cover Material Properties

Unit Weight	AASHTO T 19	1600kg/m^3, max
One Fractured Face	ASTM D 5821	95%, min.
Two Fractured Face	ASTM D 5821	90%, min.
LA wear, see Note 1	AASHTO T 96	30% max.
Soundness	AASHTO T 104	10 % max.
Flats & Elongates, 1:3 ratio	ASTM D 4791	5% max.
Stripping, see Note 1	Materials MOI 8-945	10 % max.
Polishing, see Note 1	AASHTO T 278, T 279	31 min.
Note 1: The Department has the right to waive this requirement if the aggregates have proven acceptable through successful past performance as determined by the Engineer.		

B. Grade with the following limits to meet the specified test standard in AASHTO T 27 and T 11

Table 2

Sieve Size	Percent Passing		
	Type A	**Type B**	**Type C**
12.5 mm	100		100
9.5 mm	85-100		70-90
4.75 mm	0-20	100	0-5
2.36 mm	0-5	85-100	0-3
1.18 mm		10-25	
300 Fm		0-5	
75 Fm	0-1	0-2	0-1

2.7 BLOTTER MATERIAL

A. Refer to Section 02748, Paragraph 2.1, B.

2.8 TEMPORARY PAVEMENT MARKERS

A. Refer to Section 01558.

2.9 SOURCE QUALITY ACCEPTANCE- CHIP SEAL COAT ASPHALT EMULSION

A. Refer to Minimum Sampling and Testing Requirements Section 02745

1. Provide a separate oil sampler meeting the requirements of AASHTO T 40 for each delivered truck and trailer not equipped with sampling valves that meet AASHTO T 40. Do not place any chip seal coat emulsion from equipment not meeting this requirement.
2. Take the samples in the presence of Department personnel using their sample bottles.
3. Clean and dry the oil sampler after each use following applicable environmental regulations.
4. Do not place chip seal coat emulsion until the respective viscosity test meets the specification following Section 02745.

2.10 SOURCE QUALITY CONTROL - COVER MATERIAL

A. DEPARTMENT will sample at a frequency according to Table 3.

Table 3

Stockpiles - Samples and Tests	
Lot Quantity Megagram	**Number of Samples**
Lot $ 2300	5
1400 < Lot < 2300	4
Lot # 1400	3

B. The DEPARTMENT will sample for acceptance either at the source of supply or at the project stockpile. If material previously accepted at the supply source is suspect when delivered to the project, the Department will retest following Section 01455, paragraph 1.6, "Samples, Tests, and Referenced Cited Specifications."

Table 4

Cover Material (Type A, B, and C) Acceptance Schedule For Gradation (Percent passing)				
Sieve Gradation Size	Pay Factor*	Acceptance Band Type A	Acceptance Band Type B	Acceptance Band Type C
	Cover Material	Average of Tests	Average of Tests	Average of Tests
12.5 mm	1.00 0.95 0.90 0.85 Reject	100.0 99.0 98.0 97.0 < 96.9		100.0 99.0 98.0 97.0 <96.9
9.5 mm	1.00 0.95 0.90 0.85 Reject	85.0 - 100 84.0 - 84.9 83.0 - 83.9 82.0 - 82.9 < 81.9		70.0 - 90.0 69.5 - 91.5 69.2 - 92.0 68.0 - 92.0 <67.9 and >92.1
4.75 mm	1.00 0.95 0.90 0.85 Reject	0 - 20 20.1 - 21 21.1 - 22 22.1 - 23 > 23.1	100.0 99.0 98.0 97.0 < 96.9	0 - 5.0 5.1 - 5.5 5.6 - 6.0 6.1 - 7.0 > 7.1
2.36 mm	1.00 0.95 0.90 0.85 Reject	0 - 5 5.1 - 5.5 5.6 - 6.0 6.1 - 7.0 > 7.1	85.0 - 100 84.0 - 84.9 83.0 - 83.9 82.0 - 82.9 < 81.9	0.0 - 3.0 3.1 - 3.5 3.6 - 4.0 4.1 - 5.0 > 5.1
1.18 mm	1.00 0.95 0.90 0.85 Reject		10.0 - 25.0 9.5 - 25.5 9.0 - 26.0 8.5 - 26.5 < 8.4 and > 26.6	
300 Fm	1.00 0.95 0.90 0.85 Reject		0.0 - 5.0 5.1 - 5.5 5.6 - 6.0 6.1 - 7.0 > 7.1	
75 Fm	1.00 0.75 0.50 Reject	0.0 - 1.0 1.1 - 1.5 1.6 - 2.0 >2.1	0.0 - 2.0 2.1 - 2.5 2.6 - 3.0 > 3.1	0.0 - 1.0 1.1 - 1.5 1.6 - 2.0 >2.1

* use the lowest individual pay factor for combined gradation

PART 3 EXECUTION

3.1 PREPARATION

A. Clean the surface of all dirt, sand, dust, and other objectionable material to the satisfaction of the Engineer.

B. Protect all structures from being spattered or marred including guardrail, guide posts, concrete barriers, parapet walls, etc.

3.2 LIMITATIONS

A. Complete all work, excluding bituminous flush coat , between May 15 and August 31.

B. Do not place any chip seal coat if the Engineer determines that excess moisture is present in the pavement structure.

C. Lay seal coat when the pavement surface temperature is:
   1. 21°C in the shade and rising.
   2. Pavement temperature is less than 58° C.

D. Apply bituminous flush coat material, no later than 7 days after the application of the cover material , or as directed by the Engineer.

E. Apply bituminous flush coat material when the air temperature in the shade is 10° C and rising.

F. Do not apply bituminous flush coat material during fog, rain, or other adverse conditions.

G. Complete all chip seal operations, including sweeping during day light hours.

3.3 COVER MATERIAL STOCKPILE

A. Construct on a clean area to minimize contamination

B. Construct to facilitate uniform dampening. Avoid excess moisture

3.4 TEMPORARY PAVEMENT MARKER APPLICATION

A. Refer to Section 01558, Temporary Pavement Markings.

3.5 ASPHALT MATERIAL /COVER MATERIAL APPLICATION

A. Use a distributor equipped with a hydrostatic system capable of maintaining a tolerance of ± 0.14 L/m^2. Spray the application at a rate sufficient to obtain 60 to 70 percent chip embedment after the completion of rolling operations as determined by the Engineer. Application rates may vary throughout the project depending on existing conditions.

1. Equipment is subject to inspection and approval by the Engineer.

B. Apply the asphalt emulsion at a minimum temperature of 63° C.

C. Provide blotter material meeting the requirements of Section 02748 and application equipment approved by the Engineer at the Project location prior to beginning seal coat work.

D. Place building paper adjacent to the transverse construction joint prior to starting each spraying operation. Maintain the control valve to act instantaneously, both in start-up and cut-off.

E. Locate longitudinal joints within 150 mm of the traffic lane line location or within 300 mm of the center of a traffic lane. Construct the meet lines with no skips or voids between adjacent passes. Avoid a double thickness of cover material.

F. Spread the cover material maintaining a tolerance of ± 0.5 kg/m^2.
1. Equipment is subject to inspection and approval by the Engineer.

G. Calibrate the spreader at the beginning of each day and as often as required.

Approximate Spread Rates

Unit Weight kg/m^3	Application Rate kg/m^2
960-1040	9.25
1040-1120	10.00
1120-1200	10.75
1200-1280	11.25
1280-1360	12.00
1360-1440	12.75
1440-1520	13.50
1520-1600	14.00

3.6 SURFACE ROLLING

A. Use a minimum of two pneumatic-tire rollers in a longitudinal direction to roll surface after the cover material has been spread.

B. Use a minimum of three passes to seat the cover material.

1. A pass is defined as traveling in one direction only. Two passes would be rolling up and back.

C. Control bleeding with blotter material and as directed by the Engineer.

D. Set the roller speed to prevent bouncing or skidding. Reduce roller speeds during directional changes to prevent tearing of the surface. Repair all damage done to the seal coat by the rollers.

E. Synchronize the speed of the distributor and chip spreader with that of the rolling operation.

F. Sweep excess cover material off the roadway after the emulsion has set. Remove excess cover material to the satisfaction of the Engineer before opening the roadway to traffic.

3.7 BITUMINOUS FLUSH COAT APPLICATION

A. Clean the surface of all dirt, sand, dust, lose chips, and other objectionable material to the satisfaction of the Engineer.

B. Apply the bituminous flush coat at a rate of 0.50 L/m^2. Keep traffic off the flushed surface until the bituminous material has set sufficiently to prevent tracking or pick-up.

C. Provide vendors bill of lading certifying the material was diluted in accordance to line A of paragraph 2.5, "Flush Coat." The Department may sample and test this material for specification compliance.

3.8 TRAFFIC CONTROL

A. Refer to Section 01554.

END OF SECTION

October 10, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02786 M

PLANT MIX SEAL COAT

Delete line A of Paragraph 1.1 “Section Includes,” and replace with the following:

A. Materials and procedures for constructing plant mix seal coat.

June 12, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02812 M

PRESSURIZED IRRIGATION SYSTEMS

Editorial Correction: The items in article 2.15, “Wire,” should be numbered 1 and 2.

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02822 M

RIGHT OF WAY FENCE AND GATE

Delete line B of paragraph 1.2 “References,” and replace with the following:

B. AASHTO M 232 Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

June 12, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02825 M

CATTLE GUARD

Delete paragraph 1.1 and replace with the following:

1.1 SECTION INCLUDES

A. Materials and procedures for installing Precast Cattle Guard.

Delete paragraph 2.4, and replace with the following:

2.4 AGGREGATE

A. Granular Backfill Borrow. Refer to Section 02056.

Delete line C of paragraph 3.1 and replace with the following:

C. Cover properly excavated foundation with 0.610 m of granular backfill borrow.
   1. Hand screed to the required grade utilizing properly place screed rails.
   2. Refer to Standards Drawing 760-1B.

D. Place the Precast Concrete Cattle Guard on the granular backfill borrow.

E. Construct welded end guard unit following Standard Drawing 760-1A.

December 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02841 M

TRAFFIC BARRIERS

Delete line D.2 of paragraph 2.8, "Pre-cast Concrete Barrier," and replace with the following:

2. They are cured and sealed according to specification.

February 8, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02843 M

ATTENUATION/END TREATMENT

Delete line B of paragraph 1.1.

Delete PART 2 PRODUCTS, and replace with the following:

PART 2 PRODUCTS

2.1 ATTENUATION/END SECTION

A. Select from the current approved products list, UDOT Guidelines for Attenuators/ End Sections.
   1. Specify date by special provision.
   2. Maintained by the Division of Traffic and Safety.
   3. Also available through the UDOT Internet home page, accessed through Engineering Services "Specifications, Drawings, and Plans," Web page.

B. Types:
   1. **Attenuator Type A**:
      a. To protect fixed hazards greater than 1.5 m wide within 5 m of traveled way, with less than 30.5 m of longitudinal space in front of the hazard.
      b. For use to protect concrete barrier ends, bridge parapets or piers, and other hazards as a stand alone system.
      c. A transition element is required to protect single or double faced guardrail ends.
      d. These systems may be used on shoulders or in medians where a recover area behind system and hazard is unattainable.
      e. These systems should be used in areas where minimal impacts are anticipated, one impact every three or more years.
   2. **Attenuator Type B:**
      a. To protect fixed hazards less than 1 m wide within 5 m of traveled way, with less than 30.5 m of longitudinal space in front of the hazard.
      b. For use to protect concrete barrier ends, bridge parapets or piers, and other hazards as a stand alone system.

c. A transition element is required to protect single or double faced guardrail ends.

d. May be used on shoulders or in medians, where a recover area behind the system and hazard is unattainable.

e. Should be used in areas where minimal impacts are anticipated, one impact every three or more years.

3. **Attenuator Type C**:

a. To protect fixed objects 1 m wide or less within 5 m of traveled way, and longitudinal space in front of the hazard greater than 30.5 m.

b. For use with single or double faced guardrail, transition element required for concrete barrier or bridge parapet.

c. May be used on shoulders. Shoulder application requires a recovery area of 22m x 6m.

d. May be used on medians. Median application requires a recover area of no less than 22m x 6 m on both sides of the system.

e. Should be used in area where minimal impacts are anticipated, one impact every three or more years.

4. **Attenuator Type D**:

a. To protect fixed hazards within 5 m of traveled way.

b. For use to protect concrete barrier ends, bridge parapets or piers, or other hazards as a stand alone system.

c. A transition element is required for use with single and double face guardrail.

d. May be used on shoulders or in medians.

e. Should be used in areas where one impact per year is anticipated or when repair history indicates two or more impacts over a three year period.

5. **Attenuator Type E - Sand Barrel Arrays:**

a. To protect fixed hazards outside 5 m of traveled way and there is an unlimited amount of space.

b. Can be configured to meet most width requirements.

c. For use to protect concrete barrier ends, bridge parapets or piers, or other hazards as a stand alone system.

6. **End Section Type F:**

a. To protect concrete barrier or bridge parapets with less than 38 m of longitudinal space in front of the hazard.

7. **End Section Type G:**

a. To protect the approach end of single face w-beam guardrail.

b. Should be used to protect concrete barrier or bridge parapet with unlimited longitudinal space (> 38 m) in front of the hazard when proper transition element is installed.

c. Should be used when a system running tangent to the roadway is desired.

8. **End Section Type H:**

a. To protect the approach end of single face w-beam guardrail.

b. Should be used to protect concrete barrier or bridge parapet with unlimited longitudinal space (> 38 m) in front of the hazard when proper transition element is installed.

c. These systems should be used when a system requiring a flare away from the roadway is desired.

Delete line D of paragraph 3.1 Installation, and replace with the following:

D. Grade approaches to the system to 1:10 or flatter, for a minimum of 15.25 meters prior to front and sides of the systems.

1. System will not be installed with curb and gutter.
2. Refer to UDOT Guidelines for Attenuators/End Sections for further detail.

December 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02861 M

PRECAST RETAINING/NOISE WALL

March 14, 2000

Delete line C of paragraph 2.1, "Materials for Precast Noise Wall and Retaining Walls," and replace with the following:

C. Reinforcing Steel: Coated Grade 400. Refer to Section 03211, Part 2.;

December 12, 2000

Delete line A.1 and A.2 of paragraph 1.5 "Handling, Shipping, and Storage," and replace with the following:

1. They meet the 28-day compressive strength.
2. They are cured and sealed according to specification.

Delete line C.2 of paragraph 2.4 "Concrete Posts, and replace with the following:

2. They are cured and sealed according to specification.

Delete line E.2 of paragraph 2.5, "Precast Concrete Panels, and replace with the following:

2. They are cured and sealed according to specification.

December 11, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02891 M

TRAFFIC SIGNS

Add the following to 1.3 "References":

D. ASTM A153: Zinc Coating (Hot-Dip) on Iron and Steel Hardware

E. ASTM A500: Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes

F. ASTM A513: Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing

G. ASTM A653: Steel, Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process

H. ASTM A1011: Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

Delete line D of paragraph 2.1 "Materials" and replace with the following:

D. Posts
   1. Timber Sign Post (P1)
      a. Follow Section 06055

   2. Tubular Steel Sign Post (P2)
      a. Post: ASTM A513
      b. Finish: Galvanize ASTM A653
      c. Shape: As shown, wall thickness 0.080
      d. Color: Powder coated as required

3. Square Steel Sign Post (P3)
   a. Post: ASTM A1011Grade 50
   b. Finish: Galvanize ASTM A653
   c. Shape: 12 gauge or 10 gauge steel
   d. Color: Powder coated as required

4. Slip Base Tubular Steel Sign Post (P4)
   a. Post ASTM A500 Grade C; 46,000 psi minimum yield
   b. Finish: Galvanize ASTM A153 B
   c. Shape: As shown; schedule 80
   d. Color: Powder coated as required

5. Steel Sign Post (P5)
   a. Follow Section 05120

December 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02892 M

TRAFFIC SIGNAL

February 8, 2000

Add the following to paragraph 1.1, Section Includes:

B. Materials and procedures for installing traffic counting loop detectors.

Delete line A.1 R_d of paragraph 1.5, Acceptance Testing, and replace with the following:

R_d = Resistance of Loop = $P.T.R_c$ (See Loop Resistance Table below)

Delete line A of paragraph 3.6, Install Detector Loops, and replace with the following:

A. Follow Standard Drawings 745-55L and 745-55N.

December 12, 2000

Delete line D of paragraph 3.1 "Preparation," and replace with the following:

D. Attach brackets with a banding machine with stainless steel bands. Do not drill holes in poles except as shown on the plans. Follow Standard Drawings 745-55J and 745-55A2.

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02912 M

TOPSOIL

Delete paragraph 1.4, Submittals.

Delete paragraph 2.1, and replace with the following:

2.1 CONTRACTOR FURNISHED TOPSOIL

A. Determine PH, EC, and SAR with a saturated soil paste or 1:1 soil/water testing method. Meet the following:
   1. PH: 6.0 to 8.0
   2. EC (Electrical Conductivity): less than 4 ds/m.
   3. SAR (Sodium Adsorption Ratio): Less than 10.

B. Organic Matter:
   1. 1 to 20 percent.
   2. Determined by the release upon combustion, Walkley-Black or modified Walkley-Black testing method. AASHTO T 194.

C. Textural Classification:
   1. Loam, sandy loam, silt loam or sandy clay loam not exceeding the following percentiles. Refer to Textural Triangle National Soils Handbook, Part 603-5.

Soil component	Percentile Range
Sand	20 to 70
Silt	20 to 70
Clay	10 to 30

   2. Determine particle size by the hydrometer testing method.

D. Topsoil free of:
   1. Subsoils (no B or C horizon soils)
   2. Coarse sand and gravel
   3. Stiff clay, hard clods, or hard pan soils
   4. Rock larger than 75 mm in any dimension
   5. Trash, litter, or refuse.
   6. Noxious weeds and weed seeds.

E. Topsoil may contain a maximum of 5 percent rock smaller than 75 mm.

Delete lines A and B of paragraph 2.2, Source Quality Control - Contractor Furnished Topsoil, and replace with the following:

A. Soil Samples
   1. Obtain soil samples while the Engineer is present. Provide no less than 0.25 kg per soil sample.
   2. Obtain samples from a thin slice of soil cut from the side of a freshly dug hole or by using a soil auger or sampling tube.
   3. Mix the several small samples taken from various places around the source together to produce a composite sample.
   4. More than one composite sample may be required if the topsoil horizon changes significantly across the source.
   5. Store samples in a clean container at room temperature and out of direct sunlight.
   6. Label the location and date on each sample container.
   7. Provide additional soil samples for verification if requested by the Engineer.

B. Soil testing: ENGINEER will submit soil samples to an approved independent soil testing laboratory capable of performing the tests listed in paragraph 2.1 of this section. A partial list of acceptable testing laboratories includes:

Brigham Young University
Soil and Plant Analysis Laboratory
255 WIDB
Provo, UT 84602
(801) 378-2760

USU Extension - Soil Lab
University Hill
Logan, Utah 84322-4820
(435) 797-2233

Delete paragraphs:

3.1 General Requirements
3.2 Contractor Furnished Topsoil
3.3 Department Furnished Topsoil
3.4 Spread Stockpiled Topsoil

and replace with the following:

3.1 GENERAL REQUIREMENTS

A. Complete final grading, trench settling and surface preparation before placing topsoil.

B. On steep cut slopes steeper than 1:2 and higher than five meters that require the placement of topsoil, place and spread topsoil as the slope is being constructed. Finish according to paragraph 3.4.C and D.

C. On the remaining topsoiled areas not covered under this paragraph, line B, CONTRACTOR is responsible for providing a suitable topsoil surface just before seeding. Suitable topsoil surface is:
   1. Non-compacted surface that is finished according to this Section, paragraph 3.4, lines C and D.
   2. Weed free.
   3. Finish grade provides a uniform surface with smooth transitions between grade changes and disturbed areas.

D. Do not strip or handle wet topsoil.

E. Establish finish grade at 25 mm below the top of all walks, curbs, mow strips and other hard surfaces for areas receiving seed or turf seed and 40 mm for areas receiving turf sod.

3.2 STRIP AND STOCKPILE TOPSOIL

A. Strip the topsoil
   1. Only from areas identified on the plans or approved by ENGINEER.
   2. To a depth approved by the ENGINEER.

B. Remove and dispose of any roots larger than 50 mm in diameter or 300 mm in length.

C. Stockpile stripped topsoil:
   1. At locations acceptable to the ENGINEER.
   2. So that placement or activity around the stockpile does not damage or impact any existing trees, shrubs or environmentally sensitive areas. Obtain appropriate clearances if such impacts are unavoidable.

D. Grade to minimize erosion on and around the stockpiles.

3.3 SPREAD STOCKPILED AND CONTRACTOR FURNISHED TOPSOIL

A. Clear area to receive topsoil of all trash, debris, weeds, and rock 75 mm or larger, and dispose of objectionable material in an approved manner.

B. Place and spread the stockpiled topsoil over the prepared slopes to the plan depths.

C. On slopes 1:3 and flatter, disc or harrow the placed topsoil along the contour, or cat-track the slopes to create continuous cleat tracks that run parallel with the contours.

D. On slopes steeper than 1:3, cat-track the slopes to create continuous cleat tracks that run parallel with the contours.

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 02922 M

SEED, TURF SEED, AND TURF SOD

Delete line C of paragraph 2.1, Seed and Turf Seed, and replace with the following:

C. Obtain seed from lots that have been tested by a state certified seed testing laboratory. (Association of Seed Analyst (AOSA) or Society of Commercial Seed Technologists (SCST).
   1. Seed germination test older than 18 months for grass seed, and 9 months for forb, shrub, or tree seed are not acceptable.
   2. Based on the amount or type of seed required on a project, UDOT may require additional testing by the Department of Agriculture.

Delete lines D and E of paragraph 3.3, Drill Method, and replace with the following:

D. Using the drill manufacturer's directions, and in the presence of the ENGINEER, calibrate the drill to apply seed at the rate indicated in the seeding schedule.

March 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02961

ROTOMILLING

Delete Section 02961 in its entirety and replace with the following:

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mill the existing bituminous surface at the location and to the depth specified in the plans.

1.2 RELATED SECTIONS

A. Section 01355: Environmental Protection.

B. Section 02968: Optional Use of Reclaimed Asphalt Pavement.

C. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Grade Project Only)

PART 2 PRODUCTS

2.1 MATERIALS

A. Use the milled material obtained from the rotomill process passing a 50 mm sieve as optional use of Reclaimed Asphalt Pavement (RAP) as per Section 02968 or Section 02969.

2.2 EQUIPMENT

A. Use power-operated track propelled planing machine or grinder:
   1. Capable of milling to plan cross slope.
   2. Self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut.
   3. Maximum of 15 mm between the cutting teeth on the mandrel.

B. Use appropriate cleaning equipment capable of sweeping and picking up millings to clean up after milling operation.

PART 3 EXECUTION

3.1 PREPARATION

A. The Engineer will measure and record rotomilling depths, taking two (2) random measurements every 300 meters of each pass of the milling machine.

B. Rotomill existing bituminous pavement surface to the width and depth shown on the plans to an accuracy of ± 6 mm of plan depth, measured from original surface to the top of the ridge. The Engineer may adjust the depth of the milling operation to remove unacceptable material or to improve ride.

C. Clean rotomilled surface after milling operation and prior to opening to traffic. Meet environmental regulations as per Section 01355 for cleaning process.

D. Remove and replace, or repair damage by the Contractor's operation outside of the widths and depths shown in the plans. Repair at Contractor's expense. Damage to traffic due to loose material on milled surface repaired at Contractor's expense.

E. Maintain grade control using 15 meter ski, wire guide, or other approved grade control methods to control the profile grade of the rotomill.

F. Load the reclaimed material from milling operation into a truck in one operation. Remove and clean all millings from the surface daily. Control dust created by the cutting action.

G. Milled material is the property of the Contractor, unless specified otherwise by the Engineer.

H. Dispose of the milled material in a manner approved by the Engineer and in accordance to Section 01355.

I. Rotomill the area directly surrounding manholes, catch basins, water meters, water valves or any other permanent fixtures to the specified depth.

END OF SECTION

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02962

IN-PLACE COLD RECYCLED ASPHALTIC BASE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mill existing asphalt material to required depth and width.

B. Mix with emulsified asphalt, quick lime slurry, and water if required, and relay.

1.2 RELATED SECTIONS

A. Section 02745: Asphalt Material.

1.3 REFERENCES

A. AASHTO T 26: Quality of Water to be Used in Concrete.

B. AASHTO T 166: Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens.

C. AASHTO T 245: Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.

D. ASTM C 110: Standard Test Methods for Physical Testing of Quicklime, Hydrated Lime, and Limestone.

E. ASTM C 977: Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization.

1.4 SUBMITTALS

A. Submit mix design for ENGINEER's approval prior to commencing recycling operations.

B. Provide a Manufacturer's Certificate of Compliance for Quick Lime.

1.5 ACCEPTANCE

A. The Department will run five compaction tests on each test lot.
   1. A test lot is defined as the amount of cold recycled material placed during one full day's production.
   2. Each density test will consist of the mean of three in-place nuclear wet density tests. Follow ASTM D 2950.
   3. Establish the target density by obtaining a sample of loose material from the roadway just ahead of the rolling operation.
      a. Heat sample in oven at 60 degrees C for 2 hours maximum.
      b. Compact mix immediately using standard 50 blow Marshall procedure. Follow AASHTO T 245.
      c. The target for roadway compaction is 96 percent of the mean of 3 Marshall briquettes for each test lot. Follow AASHTO T 166.

B. The ENGINEER will verify the surface with a 3 meter straightedge at selected sites. Correct surface variations in excess of 10 mm by removing or adding material.

PART 2 PRODUCTS

2.1 MATERIALS

A. In-Place Cold Recycled Asphaltic Base gradation:

Sieve Size	Percent Passing
31.75 mm	100

B. Use asphalt emulsion as shown on the plans. Refer to Section 02745.

C. Use high calcium pebble quick lime (Hot hydrated lime slurry). Conform physical requirements to ASTM C 977. Use test method ASTM C 110.

D. Use potable water for the quick lime slurry. Follow AASHTO T 26.

E. Use a quick lime slurry that has a minimum dry solids content of 35 percent by weight and that is a pumpable suspension of solids in water.

2.2 EQUIPMENT

A. Use self-propelled equipment with sufficient power, traction and stability to maintain an accurate depth of cut.

B. Use equipment that will process full depth and lane width in one pass, with screening and crushing capability.

C. Use a machine capable of mixing the pulverized material, emulsified binding agent, and quick lime slurry to a homogeneous mixture.

D. Provide lime slurry equipment that accurately proportions quick lime and water, mixes these ingredients to obtain proper slaking, and maintains a uniform, homogenous slurry. Agitate slurry sufficiently to prevent separation while transporting. Add the lime slurry to the pulverized surfacing by a spray bar at the cutting head on the mill. Accurately meter the slurry into the recycled materials.

E. Use a mixing machine capable of placing the mixed material into a windrow or directly into the hopper of a paver.

F. Separate machinery may be used for mixing.

G. Use a positive displacement pump capable of accurately metering the required quantity of additive down to a minimum rate of 15.4 liters per minute.

H. Use a mixing machine that has a meter capable of measuring the flow and total delivery of the additive.

I. When a pick-up machine is used to feed the paver, it must be capable of picking up the entire windrow.

J. Use 30 ton minimum pneumatic rollers.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean or clear away all debris and vegetation within 300 mm of pavement edge.

3.2 RECLAIMED MATERIALS

A. Mill pavement to required depth and width.

B. Control dust created by the cutting action.

C. Crush or screen the reclaimed material to pass a 37.5 mm sieve.

D. Reclaimed material must be free of organic materials, soil, or other foreign substances.

3.3 PLACEMENT

A. Place the mixed material with a self-propelled bituminous paver.

B. Use watering device to prevent materials from adhering to the tires for breakdown or intermediate rolling.

C. Add water to milled material as necessary to facilitate uniform mixing.

D. Continue breakdown rolling until roller walks out and no displacement is noted.

E. Use steel wheel rollers in static or vibratory mode as required for final rolling.

F. Do not place any cold recycled material if the ENGINEER determines that excess moisture is present in the pavement structure.

3.4 LIMITATIONS

A. Do not disturb underlying crushed aggregate base.

B. Do not heat screen.

C. Do not park roller or leave idle on uncompacted recycled surface.

D. Perform recycling operations when ambient temperature exceeds 10 degrees C in the shade and pavement temperature exceeds 21 degrees C. Stop recycling operations when weather is foggy or rainy.

E. Prohibit traffic on compacted recycled material for 2 hours after compacting is completed. Remove all loose aggregates by power brooming before allowing traffic on the compacted recycled material.

END OF SECTION

March 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 02963

PROFILE ROTOMILLING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Mill the existing bituminous surface at the location and to the profile and cross-slope specified in the plans.

1.2 RELATED SECTIONS

A. Section 01355: Environmental Protection.

B. Section 02968: Optional Use of Reclaimed Asphalt Pavement.

C. Section 02969: Optional Use of Reclaimed Asphalt Pavement (PG Grade Project Only)

PART 2 PRODUCTS

2.1 MATERIALS

A. Use the milled material obtained from the rotomill process passing a 50 mm sieve as optional use of Reclaimed Asphalt Pavement (RAP) as per Section 02968 or Section 02969.

2.2 EQUIPMENT

A. Use power-operated track propelled planing machine or grinder:
   1. Capable of milling to the plan cross slope.
   2. Self-propelled with sufficient power, traction, and stability to maintain accurate depth of cut.
   3. Maximum of 15 mm between the cutting teeth on the mandrel.

B. Use appropriate cleaning equipment capable of sweeping and picking up millings to clean up after milling operation.

PART 3 EXECUTION

3.1 PREPARATION

A. The Engineer will measure and record profile grades during rotomilling operation:
   1. Use a means that provides the required accuracy.
   2. Take two (2) random measurements for every 300 meters of each pass.

B. Achieve a rotomilled depth in the field of plan depth ± 6 mm, measured from original surface to the top of the ridge.

C. Rotomill existing bituminous pavement surface to a depth below final profile and cross slope grade, as shown on the plans.

D. Clean rotomilled surface after milling operation and prior to opening to traffic. Meet environmental regulations as per Section 01355 for cleaning process.

E. Remove and replace, or repair damage by the Contractor's operation outside of the widths and depths shown in the plans. Repair at Contractor's expense. Damage to traffic due to loose material on milled surface repaired at Contractor's expense.

F. Use a wire guide or other approved grade control methods to control the profile grade and cross slope of the rotomill.

G. Load the reclaimed material from milling operation into a truck in one operation. Remove and clean all millings from the surface daily. Control dust created by the cutting action.

H. Milled material is the property of the Contractor, unless specified otherwise by the Engineer.

I. Dispose of the milled material in a manner approved by the Engineer and in accordance to Section 01355.

J. Rotomill the area directly surrounding manholes, catch basins, water meters, water valves or any other permanent fixtures to the specified depth.

END OF SECTION

February 13, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 03211 M

REINFORCING STEEL AND WELDED WIRE

Add the following to Line B.3 of Paragraph 1.4, "Quality Assurance:"

3. Reinforcing steel suppliers through UDOT's Quality Management Plan (QMP) for steel.

Delete Line A. from Paragraph 2.1, "Reinforcing Steel," and replace with the following:

A. Deformed billet-steel bars as specified.
   1. Soft metric bar sizes. AASHTO M 31M, Grade 420.
   2. Hard metric bar sizes. AASHTO M 31M-94, Grade 400.

Delete Paragraph 2.5 and replace with the following:

2.5 HARD METRIC BAR SIZES

A. May choose to use soft metric bar sizes in lieu of hard metric bar sizes with the following restrictions:
   1. When substituting soft metric bars for hard metric bars, adjust the spacing or the number of bars using the appropriate multiplier in Table 1.
      a. Adjust development and splice lengths in either case.
      b. Apply the appropriate multiplier to bars on each face of all concrete members.
      c. Always round up when calculating the number of bars required.
   2. Submit changes for approval prior to fabrication of bars.

Table 1

Conversion of Hard Metric Bars to Soft Metric Bars				
Hard Metric Bar Size	Soft Metric Bar Size	Multipliers		
		No. of Bars	Bar Spacing	Development & Splice Length
10M	13	1.00	1.00	1.22
15M	16	1.00	1.00	1.00
20M	19	1.06	0.94	1.00
25M	25	1.00	1.00	1.02
30M	29	1.09	0.91	1.00
35M	36	1.00	1.00	1.01
45M	43	1.03	0.97	1.00
55M	57	1.00	1.00	1.03

Delete the headings from Line E and Line E.1 from Paragraph 3.3, "Splicing" and replace with the following:

E. Do not lap splice bars greater than 40 mm in diameter.
   1. Use mechanical butt splices when using bars greater than 40 mm in diameter.

Delete Line F from Paragraph 3.3, "Splicing" and replace with the following:

F. Use one of the following mechanical butt splices for bars less than 40 mm in diameter when designated on the plans. Follow the manufacturer's published recommendations for equipment and splicing procedures.
   1. A full mechanical connection that develops in tension or compression at least 175 percent of the specified yield strength of the bar.
   2. As described in this Section, Paragraph 3.3 Splicing, Line E.

April 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03310 M

STRUCTURAL CONCRETE

Delete line C.5 from paragraph 3.10, Construction Joints, and replace with the following:

C.

5. Apply epoxy adhesive as specified to face of construction joints.

September 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03311

JOINT CLOSURE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove asphalt surfacing, deck concrete, joint armor steel, and reinforcing steel at existing joint area; place new reinforcing steel; and recast joint area.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete

B. Section 03152: Concrete Joint Control

C. Section 03211: Reinforcing Steel and Welded Wire

D. Section 03310: Structural Concrete

1.3 REFERENCES

A. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation

B. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Class AA(AE). Refer to Section 03055, Part 2.

B. Reinforcing Steel (Coated): Refer to Section 03211, Part 2.

C. Galvanized Sheet Metal: 16 gage, 1.613 mm thick.

D. Rigid Plastic Foam: Type 9, density of 32 kg/m^3.

E. Backer Rod: Refer to Section 03152, Part 2.

2.2 SEALANT MATERIAL

A. With the following characteristics:
   1. Applied cold and curable under field conditions
   2. Polyurethane based, gun grade
   3. Elastomeric, non-sag seal
   4. Bonds tightly to concrete sides and joints

B. Physical properties when cured 21 days at 23 degrees C. Refer to the following table.

Table 1

Property	Value	Method
Modulus of elasticity of 100 percent elongation	910 kPa	ASTM D 412
Hardness	40 ± 5	Shore A
Elongation (at break)	450 percent	ASTM D 412
Recovery	Greater Than 90 percent	
Tensile strength	1310 kPa	ASTM D 412
Adhesive in Peel	3.5 N/mm	
Adhesive loss	0 percent	
Service range	-40 degree C to 66 degrees C	
Initial cure, tack free, (depending on temperature and humidity)	6 to 8 hours	
Final cure	5 to 8 hours	
Staining Characteristics	Non-staining	

PART 3 EXECUTION

3.1 PREPARATION

A. Asphalt Removal:
   1. Make saw cuts full depth, parallel to existing joints to define removal area.
   2. Do not damage concrete deck when removing asphalt surfacing.

B. Concrete Saw Cuts:
   1. Saw Cut in concrete deck 25 mm deep and parallel to existing joints to define the work area.
   2. Note that the length of the joint closure is the length of the bridge deck adjusted for the skew of the individual structure.

C. Prevent debris from falling into streams, pedestrian areas, traffic areas, and onto railroad tracks.

3.2 REMOVE CONCRETE

A. Use jackhammer method to remove existing concrete.
   1. Partial Depth Removal of Concrete Slab: Use 30-pound class jack hammers or smaller.
   2. Full Depth Removal of Concrete Slab: Use 90-pound class hand operated jack hammers or smaller.
   3. Operate jack hammers at an angle greater than 45 degrees as measured from the deck surface.

B. Remove parapet concrete in the closure area. Where an existing electrical conduit is encountered, protect the conduit from damage.

3.3 REINFORCING STEEL

A. Existing Reinforcing Steel
   1. Refer to the design plans for specific directions.
   2. Thoroughly clean steel that remains in place of all corrosion and adhering materials by sandblasting.

B. New Reinforcing Steel: Place coated reinforcing steel after sandblasting operations are complete.

3.4 PLACE CONCRETE

A. Refer to Sections 03055 and 03310.

B. Clean existing concrete and steel surfaces. Dampen before placing concrete.

C. Restrict traffic on the joint closure areas until the concrete has reached a compressive strength of 21 000 kPa. ENGINEER may take additional concrete samples.

END OF SECTION

January 9, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 03390 M

CONCRETE CURING

Delete Table 1 and replace with the following:

Table 1

Characteristics (Curing Compound for PCC)	Min.	Max.	ASTM
Total Solids, percent by weight compound	35		
$Ti0_2$ Pigment, percent reflectance	60		E 1347
Drying Time: Set to touch, min Track Free, min		 60 120	C 309
Coverage rate, L/m^2	0.4		
Water Loss, kg/m^2 in 72 hours		0.30	C 156
Flash point, degrees C	38		
V.O.C. Content, $g/L_{N.W.}$		350	D 3960

March 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03575 M

FLOWABLE FILL

Delete line A of paragraph 3.1, Installation, and replace with the following:

A. Combine materials to meet the requirements for strength and constructability as required. Determine strength from trial batches at 28 days.
   1. Minimum strength: 0.3 MPa. ASTM D 4832.
   2. Maximum strength: 1.0 MPa. ASTM D 4832.
   3. Slump: 130 mm to 250 mm.

June 13, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03605

APPROACH SLAB JACKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Raising the approach slab(s) by pumping cement grout underneath.

1.2 REFERENCES

A. AASHTO M 85: Portland Cement.

B. AASHTO M 295: Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.

1.3 CERTIFICATION

A. Provide compliance certifications for the mix design materials conforming to the requirements of the specified specifications.

PART 2 PRODUCTS

2.1 EQUIPMENT

A. Furnish all equipment necessary to perform this work.

B. Grout device
   1. Consisting of a cement injection pump and a high speed colloidal mixing machine.
   2. The colloidal mixing machine must operate at a minimum speed of 1200 rpm and consist of a rotor operating in close proximity to a strator, creating a high shearing action and subsequent pressure release to make a homogeneous mixture.

C. Provide water storage tank and a pump to deliver water to the grout mixer.

D. Furnish an air compressor and rock drills or other device capable of drilling the grout injection holes through the approach slab and any base material, if necessary. Equipment must be in good condition.

2.2 DRY MIX DESIGN

A. Use the standard mix design for jacking and grouting as follows:
   1. One part (by volume) Portland Cement Type I or II.
   2. Three parts (by volume) Pozzolan (natural or artificial).

B. Do not deviate from the dry mix proportions of Portland Cement and Pozzolan unless approved by the ENGINEER. The water content may be varied, as required for the local conditions.

C. The CONTRACTOR may add an approved liquefier and/or water reducing agent. The ENGINEER will approve the proportions.

PART 3 EXECUTION

3.1 PREPARATION

A. Measure the dry cement and Pozzolan accurately in cubic meters whether available in bulk or packaged.

B. Batch water through a meter or scale.

3.2 DRILLING

A. Drill a minimum of 4 evenly spaced holes into each half of every approach slab where required to obtain uniform placement underneath the approach slab. Drill holes that are vertical and not out-of-round.

3.3 PUMPING

A. Pump in a pattern and in the amount required to completely fill the voids underneath the slab. Raise the approach slabs to within plus or minus 5 mm from a string line grade.

B. Remove Pozzolan mix material from the drill holes at the completion of the pumping operation. Clean and seal the circumference of the hole using a stiff sand and cement grout or an approved fast setting cement mortar.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03921

PARAPET SURFACE REPAIR AND SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair and seal existing concrete front face and top of parapets.

1.2 RELATED SECTIONS

A. Section 03310: Structural Concrete.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Concrete:
   1. Approved patching concrete product from the Qualified Products Listing (QPL). Contact UDOT Research Division.
   2. Use only products for which vertical application is recommended by the manufacturer.

B. Substrate Coating: Bonding agent or primer recommended by the patching concrete manufacturer.

C. Surface Sealing Material (Non-penetrating Type): Approved concrete epoxy sealer product from the Qualified Products Listing (QPL).

PART 3 EXECUTION

3.1 PREPARATION

A. For Surface Repair:
   1. Remove loose and spalled concrete before sandblasting.
   2. Sandblast the top and traffic face of the concrete surfaces to remove all dirt, grease, laitance, rust and corrosion prior to placing concrete.

B. For Sealing:
   1. Sandblast the top and traffic face of the parapet surfaces to remove all dirt, grease, and laitance.
   2. Patch spalled or damaged spots on parapets before applying sealer.

3.2 SURFACE REPAIR

A. Prevent sandblasting material and debris from falling into streams, pedestrian areas, traffic areas, or onto railroad tracks.

B. After sandblasting, coat concrete substrate with the manufacturer's recommended primer of the particular patching concrete.

C. Place concrete within the manufacturer's prescribed time period after sandblasting and prime coating has been completed.

D. Patching Concrete:
   1. Apply the one component, non-shrinking patching concrete uniformly to build back the original surfaces of the face and top areas of the parapets to within ± 3 mm of the original surface. Allow concrete to cure in accordance with the requirements of the manufacturer's recommendation.
   2. If the patch fails to bond to the existing concrete, remove the patch completely and repair again.

E. Finishing Surfaces:
   1. Provide a uniform color matching existing parapet.
   2. Finish according to Section 03310, part 3, paragraph: Concrete Surface Finishing. Follow manufacturer's recommendations for procedure.

F. Coating Parapet Surfaces:

1. Allow concrete to properly cure.
2. Sandblast all curing compound from the top and traffic face of the parapet.
3. Coat all sandblasted surfaces with non-penetrating type epoxy sealer following the manufacturer's recommended procedure.

G. If wingwalls, overhanging portions of the deck, and/or exterior beam surfaces become stained or discolored due to water or concrete leaking from the forms, provide a satisfactory treatment to restore these surfaces to a uniform color.

H. Remove sandblasting materials and debris from the deck after the work is complete.

3.3 SEALING

A. Coat the top and traffic face (front face) with non-penetrating type epoxy sealer, following the manufacturer’s application procedures and recommendations.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03922

DELAMINATION REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair delaminated concrete areas.

1.2 PAYMENT PROCEDURES

A. This item is included in other items of work.

1.3 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03310: Structural Concrete.

1.4 REFERENCES

A. AASHTO M 235: Epoxy Resin Adhesives.

1.5 ACCEPTANCE

A. Rebuild the areas to original shape, ± 3 mm.

B. Remove and repair if the patching fails to bond. Department will not allow additional compensation for continual repair.

PART 2 PRODUCTS

2.1 MATERIALS

A. Repair Concrete:
   1. Portland Cement Concrete: Class AA(AE). Refer to Section 03055, Part 2.

2. Cement: Type II. Refer to Section 03055, Part 2.
3. Aggregate: 19 mm maximum.

B. Patching Concrete:
1. Use an approved patching concrete product from the Qualified Products Listing (QPL), available from the UDOT Research Division.
2. Use only products for which vertical application is recommended by the manufacturer.

C. Substrate Coating: Use a bonding agent or primer recommended by the particular patching concrete manufacturer.

D. Epoxy Resin Adhesive: Type II. AASHTO M 235.
1. Use a class rating consistent with the application temperature.
2. Choose from the Qualified Products Listing (QPL).

E. Surface Sealing Material (Non-Penetrating Type): Choose an approved concrete epoxy sealer product from the Qualified Products Listing (QPL).

2.2 MIXER

A. Use an approved type of small mixer to batch out the repair concrete when specifically approved by the ENGINEER.

PART 3 EXECUTION

3.1 PREPARATION

A. Locate the repair areas: Sound the items requiring this work and mark the limits of delaminated areas for repair work in the presence of the ENGINEER.

B. Remove concrete:
1. Remove all loose materials by dry sweeping.
2. Clean by blowing with compressed air at 620 kPa.
3. Make 13 mm deep saw cuts in the sound concrete surrounding the damaged areas.
4. Remove all damaged and shattered concrete.

C. Cleaning:

1. Remove all loose materials by dry sweeping.
2. Clean by blowing with compressed air at 620 kPa.
3. Sandblast clean all exposed reinforcing steel and concrete surfaces before placing new concrete.

3.2 INSTALLATION

A. Form Work
1. Use forms and braces to place new concrete to the original dimensions.
2. Vibration is required in the forms when the area between forms and existing concrete surface will allow use of vibrators.

B. Use one type of repair concrete.

C. Placing concrete: when thickness to be placed is less than or equal to 75 mm.
1. Use patching concrete.
2. Coat the cleaned concrete using the manufacturer's recommended primer.
3. Place patching concrete in layers not exceeding the manufacturer's recommended application thickness per layer.
4. Apply the surface sealer recommended by the manufacturer.
5. Consult the manufacturer's recommendations for finishing.

D. Placing concrete: when thickness to be placed is greater than 75 mm.
1. Apply an epoxy-resin adhesive to the cleaned concrete surface of the repair area before placing the new concrete.
2. Place the concrete and allow to cure following the requirements of Section 03310, paragraphs 3.11 through 3.13, Concrete Surface Finishing.
3. After the concrete has properly cured, sandblast the finished concrete surfaces and coat with a non-penetrating type epoxy sealer. Follow the manufacturer's procedure.

E. Finished surfaces: Provide the look of one color.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03923

COLUMN SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clean concrete column and apply sealing to entire column.

PART 2 PRODUCTS

2.1 CONCRETE SEALER

A. Non-penetrating type.

B. Use an approved concrete epoxy sealer product from the Qualified Products Listing (QPL) available from the UDOT Research Division.

PART 3 EXECUTION

3.1 APPLICATION

A. Sandblast the entire exposed column surfaces clean of all dirt, grease, and laitance.

B. Coat the entire exposed column with the non-penetrating type epoxy concrete sealer following the manufacturer's application procedures and recommendations.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03924

STRUCTURAL CONCRETE REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Restore to sound condition:
   1. Column
   2. Pedestal
   3. Bent Cap
   4. Pier Cap
   5. Diaphragm
   6. Wingwall
   7. Abutment Backwall
   8. Beam End

1.2 RELATED SECTIONS

A. Section 03935: Epoxy Injection and Sealing.

B. Section 03922: Delamination Repair.

PART 2 PRODUCTS

2.1 MATERIALS

A. Refer to Sections 03935 and 03922.

2.2 BEAM END REPAIR SURFACE SEALING MATERIAL

A. Non-penetrating.

B. Use an approved concrete epoxy sealer product from the Qualified Products Listing (QPL). Contact UDOT Research Division

PART 3 EXECUTION

3.1 CRACK REPAIR

A. Repair cracks from 0.5 to 6 mm wide by epoxy injection and sealing. See Section 03935.

B. Repair cracks greater than 6 mm wide as "delaminated concrete."

3.2 DELAMINATION REPAIR

A. Repair delaminated concrete by delamination repair. Refer to Section 03922.

B. Beam End Delamination Repair: Use a patching concrete as the repair concrete exclusively.

C. After concrete removal:
   1. Repair any crack found in a delaminated area according to Section 03935.
   2. After the injection operation, apply surface sealing after repairing the delaminated area.

D. When surface sealing after crack injection and delamination repair operations:
   1. Use epoxy sealer for surface sealing exclusively.
   2. Apply sealer to a minimum beam length of 1.2 m covering all surfaces in that beam segment.

September 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03932

CONCRETE SLOPE PROTECTION REPAIR

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prepare and place concrete slope protection and cutoff wall where required.

1.2 RELATED SECTIONS

A. Section 02226: Remove Concrete Slope Protection

B. Section 02721: Untreated Base Course

C. Section 03055: Portland Cement Concrete

D. Section 03211: Reinforcing Steel and Welded Wire

E. Section 03310: Structural Concrete

F. Section 03390: Concrete Curing

1.3 REFERENCES

A. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

1.4 SUBMITTALS

A. For each lot of materials supplied, submit certificates of compliance and sealant material test results.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Concrete Class A(AE). Refer to Section 03055.

B. Cement: Refer to Section 03055.

C. Reinforcing Steel: Refer to Section 03211.

D. Backer Rod: Refer to Section 03211.

E. Rigid Plastic Foam: Type 9, Density of 32 kg/m^3.

F. Sealant Material
   1. Applied cold and curable under field conditions.
   2. Polyurethane based, gun grade.
   3. Elastomeric, non-sag seal.
   4. Bonds tightly to concrete sides and joints.
   5. Physical properties when cured 21 days at 23 degrees C as follows.

Table 1

Property	Value	Method
Modulus of elasticity at 100% elongation	910 kPa	ASTM D 412
Hardness	40 ± 5	Shore A
Elongation (at break)	450 percent	ASTM D 412
Recovery	Greater than 90 percent	
Tensile strength	1310 kPa	ASTM D 412
Adhesive in peel	3.5 N/mm	
Adhesive in loss	0 percent	
Service range	-40 degrees C to 66 degrees C	
Initial cure, tack free (depending on temperature and humidity)	6 to 8 hours	
Final cure	5 to 8 days	
Staining characteristics	Non-staining	

PART 3 EXECUTION

3.1 PREPARATION

A. Prepare the subgrade of the area to be paved:
   1. Smooth and shape the berms and slopes. Excavate cutoff walls where required.
   2. Fill depressions with untreated base course material, grade and compact.
   3. Firmly compact the subgrade.
   4. Thoroughly sprinkle the surface with water prior to placing the concrete. The ENGINEER will approve all surfaces before concrete is placed.

3.2 PLACING CONCRETE

A. Place concrete slope protection within 7 days after removing concrete slope protection. Refer to Section 03055 and Section 03310.

B. Make concrete consistency such that concrete may be placed on the slopes without deformation.

C. Complete all scoring as indicated on the plans.

D. Stop placing concrete if it is not feasible to complete the entire slope protection during one placement. Use a construction joint located in a scoring, or at the junction of the slope and the abutment.

3.3 FINISHING AND CURING CONCRETE

A. Use a floated surface finish. Refer to Section 03310, Part 3, paragraph "Concrete Surface Finishing Procedures."

B. Cure following Section 03390.

3.4 SEALING JOINTS AND CLOSURES

A. Place the backing rod and sealant when the concrete has properly cured.
   1. Concrete surfaces in the grooves must be clean and dry when backing and sealant are placed.
   2. Completely remove curing compounds, oil, grease, dirt, and any other foreign materials from concrete surfaces in the grooves by sandblasting.

B. Place the sealant with hand or power operated caulking guns after placing the backing rod.
   1. Start the placement at one side and proceed to the other side on horizontal grooves and from top to bottom on vertical grooves.
   2. Tool the sealant using a concave pointing tool with soap solution.

C. Place rigid plastic foam material (styrofoam), 25 mm thick against the surface of all structural members prior to placing the concrete slope protection.
   1. Anchor the rigid plastic foam in place with a compatible adhesive.
   2. Recess the rigid plastic foam in the joints so a groove is formed above the styrofoam filler.
   3. Fill the groove with sealant above the styrofoam so the joint is sealed over completely.
   4. Place sealant when the temperature is at least 10 degrees C and rising.

END OF SECTION

July 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03933

PARAPET/PARAPET END MODIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Methods and materials for modifying existing concrete parapet systems to:
   1. Meet current standards.
   2. Prepare the parapet system for attachment of guardrail system or precast concrete barrier.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

C. Section 03310: Structural Concrete.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 213: Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

C. AASHTO M 235: Epoxy Resin Adhesives.

D. AASHTO M 270M: Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched and Tempered Alloy Structural Steel Plates for Bridges.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete, Class AA(AE). Refer to Section 03055.

B. Cement: Refer to Section 03055.

C. Reinforcing Steel (Coated): Refer to Section 03211.

D. Connection Bar:
   1. AASHTO M 270M, Grade 250.
   2. Galvanized. AASHTO M 111.

E. Guardrail Preset Anchors: Follow plans.

F. Surface Sealing Material:
   1. (Non-penetrating type)
   2. Approved concrete epoxy sealer product from the Qualified Products Listing (QPL). Contact UDOT Research Division.

G. Preformed Joint Filler: As specified. AASHTO M 213.

H. Anchoring Epoxy:
   1. Type I.
   2. Class rating consistent with the application temperature.
   3. From the Qualified Products Listing (QPL).
   4. AASHTO M 235.

PART 3 EXECUTION

3.1 PREPARATION

A. Locate existing electric conduit, protect from damage.

B. Carefully remove existing parapet railing and brackets, and deliver to the UDOT maintenance shed designated by the ENGINEER.

3.2 CONCRETE REMOVAL

A. Prevent debris from falling into streams, pedestrian areas, traffic areas or railroad tracks.

B. For parapet modification to meet standards:
   1. Remove the existing parapet concrete. Prevent damage to wingwalls and deck surface.
   2. Remove loose and spalled concrete. Sandblast the removal areas.

C. For preparing parapet end modifications:
   1. Make saw cuts 25 mm deep to define the work area.
   2. Remove concrete using 90 pound class hand-held jackhammers or smaller. Prevent damage to wingwall.
   3. Remove approach slab curb between the parapet end and the approach slab end.
   4. Remove loose and spalled concrete and sandblast the removal areas.

3.3 REINFORCING STEEL

A. Existing Reinforcing Steel:
   1. Refer to the design plans for specific directions.
   2. Thoroughly clean by sandblasting remaining steel of all corrosion and adhering materials.

B. New Reinforcing Steel:
   1. For parapet end modifications: Use epoxy resin adhesive to attach rebar as indicated on the plans. AASHTO M 235.
   2. Place new coated reinforcing steel after sandblasting operations are complete.

3.4 PLACE CONCRETE

A. Refer to Sections 03055 and 03310.

B. Clean concrete and steel surfaces. Dampen existing concrete before placing new concrete.

3.5 CONNECTION BARS

A. For modifying to meet standards: Provide two bars for each parapet end.

B. For preparing parapet end modifications: Provide two bars for each parapet end modification except where noted otherwise.

3.6 FORMS

A. Clean forms thoroughly.

B. Coat forms using a release agent guaranteed in writing by the manufacturer not to stain concrete or impair bonding properties of any concrete protective surface coating.

3.7 FINISHING

A. Refer to Section 03310, Part 3.

3.8 COATING CONCRETE SURFACES

A. Allow concrete to properly cure.

B. Sandblast the top and traffic face of the parapet of all curing compound.

C. Coat all sandblasted surfaces with the non-penetrating type epoxy sealer. Follow the manufacturer's recommended procedure.

3.9 STAINING

A. When any concrete surface of the structural members become stained, provide a treatment to restore to a uniform color.

END OF SECTION

June 13, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03934

STRUCTURAL POTHOLE PATCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair potholes and delaminated areas on bridge decks and approach slabs.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03390: Concrete Curing.

C. Section 01571: Temporary Environmental Controls.

1.3 REFERENCES

A. AASHTO M 235: Epoxy Resin Adhesives.

1.4 SUBMITTALS

A. Submit a plan for handling water approved by the ENGINEER before the water blasting operation begins.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Class AA(AE), 19 mm maximum aggregate. Refer to Section 03055.

B. Cement: Refer to Section 03055.

C. Epoxy Resin Adhesive:
   1. Type II.
   2. Choose class rating consistent with the application temperature.
   3. AASHTO M 235.

D. Water: Use water containing no hazardous or toxic materials.

2.2 EQUIPMENT

A. Jackhammer: 30 pound class.

B. Water Blast Equipment:
   1. Provide a complete concrete removal system capable of removing concrete to the specified depth.
   2. Equipped with a full rotation water jet. Use a water jet having an angle of impingement of 60 degrees or less as measured from the deck surface.

2.3 TESTING AND CALIBRATING HYDRODEMOLITION EQUIPMENT

A. The ENGINEER will designate a trial area to demonstrate that the equipment, personnel, and method of operations are capable of producing results satisfactory to the ENGINEER.

B. Do not change parameters once the operation parameters of the hydrodemolisher are defined and satisfactorily demonstrated.

C. Maintain an inventory of common wear parts and replacement accessories for the equipment on the job site.

PART 3 EXECUTION

3.1 PREPARATION

A. Locate all unsound concrete in the deck and approach slabs and mark a rectangular area surrounding each pothole in the presence of the ENGINEER.
   1. Refer to pothole patching plan.
   2. Remove any asphalt surfacing prior to sounding survey.

3.2 CONCRETE REMOVAL

A. Use either the jackhammer or hydrodemolition method described below.

B. Jackhammer Method:
   1. Saw Cuts: Make saw cuts 25 mm deep at the rectangular limits of the repair areas.
   2. Remove concrete using 30 pound class jackhammer.
   3. Operate jackhammer at an angle greater than 45 degrees as measured from the deck surface. Protect any reinforcing steel encountered.
   4. Pneumatic hammers heavier than 15 pound class will not be permitted for removals in areas directly below the top reinforcing steel.

C. Hydrodemolition Method:
   1. Remove delaminated concrete to the required depth using hydrodemolition methods. Required depth depends on the delamination depth.
   2. Provide the water necessary for the hydrodemolition operation. Use water containing no hazardous or toxic materials.
   3. Collect water and debris from the removal operations retention basins or sediment traps. Refer to Section 01571 and Standard Drawing 1014.
      a. Use pond liners to limit the amount of water leached into the soil from retention basins at the ends of the bridge. Contain waste water, along with concrete debris from the removal operation, in holding ponds for 12 hours before discharging of the water.
      b. The ponds must be equipped with a turn-down elbow to eliminate oil or floatables from being discharged. Dispose of remaining material in the holding ponds in the proper manner.
      c. Clean all water which is returned to the stream bed of sediments and debris. Use temporary slope drains to return water to the stream. Do not allow water to run across traveled lane.
   4. Light Jackhammer Removal Method:
      a. Use a jackhammer to remove concrete that cannot be removed with the water blast equipment.
      b. Operate jackhammer at an angle greater than 45 degrees as measured from the deck surface. Protect any reinforcing steel encountered.
      c. Pneumatic hammers heavier than 15 pound class will not be permitted for removals in areas directly below the top reinforcing steel.

D. Blow Through:

1. Should removal blow completely through the bridge deck, immediately stop the equipment and make the necessary adjustments to limit the area of complete concrete removal. Use sandbags to limit the flow of water through the hole, if necessary.
2. Lower a rope through the hole and lift a 19 mm thick piece of plywood large enough to cover the hole with a 50 mm overlap on all sides.
3. Secure the plywood tightly against the bottom of the slab using 6 to 13 mm threaded tie rods fastened to 2 x 4 studs at the top of the deck. Remove the forms as soon as the concrete is set and patch the hole.
4. Use treated plywood to facilitate stripping.

3.3 BONDING CONCRETE

A. Apply an epoxy resin adhesive to the repair area to assist in bonding the fresh concrete to the hardened concrete.

1. Apply the material according to the manufacturer's specifications.
2. Keep the repair area clean until new concrete has been placed.

3.4 PATCHING CONCRETE

A. Sandblast clean all exposed concrete surfaces and reinforcing steel prior to placing new concrete. Place concrete within 4 hours after sandblasting has been completed.

B. Provide new rebar splices to existing rebars, equivalent size, wherever a section loss greater than 50 percent occurs.

C. Place concrete and strike off level with deck surface. Cure a minimum of 4 days using the water method. Refer to Section 03390, Part 3.

E. Patch failure: if the patch fails to bond to the existing concrete, remove the patch completely and repair the pothole again.

3.5 PROTECTION

A. Prevent debris from falling into streams, pedestrian areas, traffic areas, or railroad tracks.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 03935

EPOXY INJECTION AND SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Repair concrete cracks by injecting epoxy and sealing the concrete surfaces.

1.2 PAYMENT PROCEDURES

A. These items are included in other items of work.

1.3 ACCEPTANCE

A. Penetration of 95 percent of all cracks from 0.5 to 6 mm wide is required.

1.4 DELIVERY

A. Deliver the packages materials in unopened packages with labels clearly indicating the following:
   1. Name of Manufacturer
   2. Manufacturer's product name or product number
   3. Manufacturer's lot number
   4. Mix ratio
   5. SPI Hazardous Material Rating and appropriate warnings for handling

PART 2 PRODUCTS

2.1 MATERIALS

A. Use approved products from the Qualified Products Listing (QPL) available from the UDOT Research Division.
   1. Epoxy Injection Material:

a. Use only products for which vertical crack injection is recommended by the manufacturer.
b. Use appropriate cap seal material recommended by the particular epoxy manufacturer.

2. Surface Sealing Material: Non-penetrating epoxy sealer.

2.2 EQUIPMENT

A. Minimum of two pumps with the following required characteristics:
1. Electric-powered and portable.
2. Positive displacement.
3. Positive-ratio control of exact proportions of the two components at the nozzle.
4. In-line metering and mixing.

B. Injection equipment required characteristics:
1. Automatic pressure control capable of discharging the mixed adhesive at any pre-set pressure up to 1400 kPa ± 35 kPa.
2. Equipped with a manual pressure control override.

C. Capable of maintaining the volume ratio of the injection material prescribed by the manufacturer within a tolerance of ± 5 percent by volume at any discharge pressure up to 1400 kPa.

D. With sensors on both the component A and B reservoirs that automatically stop the machine when only one component is being pumped to the mixing head.

PART 3 EXECUTION

3.1 INSTALLERS

A. Injection equipment operators must have a minimum of 2 years experience in the methods and materials of the selected system for application of epoxy injection.

B. Injection equipment operators must know the technical aspects of:
1. Correct material selection and use.
2. Equipment operation, maintenance, and troubleshooting.

3.2 PREPARATION

A. Sandblast clean the concrete surfaces.

B. Seal cracks.

C. Provide entry ports for the epoxy injection. Space ports a maximum of 150 mm apart so all cracks are penetrated.

3.3 EPOXY INJECTION

A. Proceed from lower to higher ports.

B. When epoxy appears at a higher port, plug the port being injected and move to a higher port.

3.4 EPOXY SEALING

A. Grind flush all ports extending above the concrete surfaces.

B. Apply the sealant at the minimum application rate of 0.4 L/m^2.

C. Cover the entire length of the crack with epoxy sealant for a minimum of 600 mm on either side of the crack.

D. Mask the member so a straight vertical line is produced at the cutoff point.

E. Apply a second coat at the same application rate as soon as the first coat is dry to the touch. Do not exceed the following times between coats:

Hours	Temperature
72	19 E C
36	25 E C
24	32 E C

END OF SECTION

September 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 05831

EXPANSION JOINT MODIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Remove existing expansion joint system from bridge deck and install new expansion joint system.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03211: Reinforcing Steel and Welded Wire.

C. Section 03310: Structural Concrete.

D. Section 05120: Structural Steel.

1.3 REFERENCES

A. AASHTO M 111: Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. AASHTO M 235: Epoxy Resin Adhesives.

C. AASHTO M 270M: Structural Steel for Bridges.

D. AISC: American Institute of Steel Construction.

E. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

F. ASTM D 395: Rubber Property-Compression Set.

G. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

H. ASTM D 471: Rubber Property-Effect of Liquids.

I. ASTM D 573: Rubber-Deterioration in an Air Oven.

J. ASTM D 1149: Rubber Deterioration-Surface Ozone Cracking in a Chamber.

K. ASTM D 2240: Rubber Property-Durometer Hardness.

1.4 FABRICATION

A. Shop drawing requirements: Comply with Section 05120.

B. Certification: Comply with Section 05120, except that AISC, Category I Certification or the DEPARTMENT's Quality Certification program is acceptable.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement Concrete: Class AA(AE). Refer to Section 03055.

B. Cement: Refer to Section 03055.

C. Structural Steel: Galvanized all structural steel as specified. AASHTO M 111.
   1. Steel Extrusions: AASHTO M 270M, Grade 250.
   2. Plates: AASHTO M 270M, Grade 250.
   3. Round Bars: AASHTO M 270M, Grade 250.

D. Lubricating Material: In accordance with manufacturer's recommendations.

E. Epoxy Resin Adhesive: Follow AASHTO M 235.
   1. Type II.
   2. Choose class rating consistent with the application temperature.

F. Reinforcing Steel (Coated): Refer to Section 03211.

G. Rigid Plastic Foam: Type 9, density of 32 kg/m^3. ASTM C 578.

H. Neoprene Gland: Single convolution type with the following physical properties:

Table 1

Property Method	Requirements	ASTM
Tensile Strength, min. kPa	14 000	D 412
Elongation at break, min. percent	250	D 412
Hardness, Type A Durometer (modified)	55 ± 5	D 2240
Compression Set, 70 hr. at 100 degrees C. Method B (modified)	40 percent	D 395
Oven Aging, 70 hr. at 100 degrees C. Tensile Strength. Loss, max. Elongation, loss, max.	 20 percent 20 percent	D 573
Hardness, Type A Durometer (points change)	0 to + 10	
Oil Swell, ASTM Oil 3, 70 hr at 100 degrees C. Weight Change, max	45 percent	D 471
Ozone Resistance, 20 percent Strain, 300 pphm in air 70 hr. at 40 degrees C. (modified)	No cracks	D 1149

2.2 JOINT SYSTEMS

A. Use only one brand of strip seal system on any single project.

B. The following systems will be acceptable for this project and are detailed in the plans.

1. Wabo Strip Seal System
2. Structural Accessories Strip Seal System
3. D. S. Brown Strip Seal System

2.3 TOLERANCES

A. After fabrication of the expansion joint and anchorage system, check the gland face and top of the extruded steel shape of each section for straightness. Use a string line stretched taut from curb angle point to curb angle point.

B. Shop Tolerances:
   1. Steel surfaces are not to deviate from the string line by more than 3 mm.
   2. No surface is to deviate more than 2 mm when the string line is stretched between either end or crown point and the point of maximum departure from true.

C. Field Tolerances: Recheck steel surfaces for straightness under shop tolerance requirements after installing joint system in its final position and before placing concrete.

D. Final In-Place Tolerances:
   1. Re-check the extrusion gland face after concrete placement. It is not to deviate from the string line by more than 6 mm. The parallel extrusion faces are not to deviate from each other by more than 3 mm at any location.
   2. Place the top of the extrusion to meet the grade requirements shown on the plans.

PART 3 EXECUTION

3.1 PREPARATION

A. Asphalt Removal
   1. Make saw cuts parallel to existing joints to define the removal area.
   2. Remove asphalt surfacing in such a manner that the concrete deck is not damaged.

B. Concrete Saw Cuts
   1. Make saw cuts in the concrete deck 25 mm deep and parallel to existing joints to define work area.
   2. Note that the location of the saw cuts will be placed at the normal offset from the center line of the existing expansion joint as shown on the plans.

C. Prevent debris from falling into streams, pedestrian areas, traffic areas and on railroad tracks.

3.2 CONCRETE REMOVAL

A. Use jackhammer method to remove existing concrete.
   1. Partial Depth Removal: Use 30-pound class hand operated jackhammers or smaller.
   2. Full Depth Removal: Use 90-pound class hand operated jackhammers or smaller.
   3. Operate jackhammers at an angle greater than 45 degrees as measured from the deck surface.

B. Parapet:
   1. Remove parapet concrete in the prescribed limits shown on the plans.
   2. Where existing electrical conduit is encountered, protect the conduit from damage.

3.3 REINFORCING STEEL

A. Existing Reinforcing Steel: Clean steel that remains in place thoroughly of all corrosion and adhering materials by sandblasting.

B. New Reinforcing Steel: Place coated reinforcing steel after sandblasting operations are complete.

3.4 SYSTEM INSTALLATION

A. Install expansion joint system according to the manufacturer's recommendations.

B. A factory-trained representative must be present during setting of the system, placement of concrete, installation of neoprene seal element, and during the watertight integrity test.

3.5 JOINT WIDTH

A. Form the joint width, as shown on the plans, using rigid plastic foam. Anchor securely.

B. Place rigid plastic foam between sections of concrete parapet to maintain separation of sections.

3.5 PLACE CONCRETE

A. Clean concrete and steel surfaces before coating with an epoxy adhesive. Follow adhesive manufacturer's application instructions.

B. Place Concrete according to Sections 03055 and 03310.

3.6 INSTALL JOINT GLAND

A. Install the gland after the complete steel extrusion installation to ensure that the length of the joint has a continuous seal, except as noted on the plans.

B. Lubricate the steel extrusion cavity before installing the neoprene gland.

C. Ensure free hanging of the gland convolution after installation by removing the foam used to form the joint opening and any other objects that may interfere with the installation and operation of the gland.

3.7 WATERTIGHT INTEGRITY TEST

A. Joint areas must be capable of holding water for 15 minutes without leaking.

B. If joint areas fail the test, remove any leaking seals, clean steel extrusion grooves, and reinstall the seals.

C. Install new seals when leakage persists.

END OF SECTION

July 11, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 07105

WATERPROOFING MEMBRANE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prepare an entire concrete deck and the approach slabs, or specified structure joint areas for waterproofing membrane.

B. Place waterproofing membrane.

1.2 REFERENCES

A. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM D 5: Penetration of Bituminous Materials.

C. ASTM D 36: Softening Point of Bitumen (Ring-and-Ball Apparatus).

D. ASTM D 146: Sampling and Testing Bitumen - Saturated Felts and Woven Fabrics for Roofing and Waterproofing.

E. ASTM D 882: Tensile Properties of Thin Plastic Sheeting.

F. ASTM D 3236: Apparent Viscosity of Hot Melt Adhesives and Coating Materials.

G. ASTM E 96: Water Vapor Transmission of Materials.

H. ASTM E 154: Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.

I. Vermont DOT: Low Temperature Flexibility Test.

1.3 WEATHER LIMITATIONS

A. Do not work during wet conditions or when the deck or ambient air temperatures are below 10 degrees C.

B. Do not apply the membrane unless the deck is surface dry.

1.4 SCHEDULING

A. Notify the ENGINEER at least 1 week before installing the membrane.

PART 2 PRODUCTS

2.1 HOT POURED POLYMER MEMBRANE

A. Characteristics:
   1. Single Component Elastomeric Material
   2. Applied hot
   3. Spreadable to uniform thickness after cooling
   4. ASTM C 578

B. Mechanical Properties:
   1. Penetration, Max, (dmm): 100
   2. Pliability, at -12 degrees C: No cracks when bent 180 degrees over a 25 mm mandrel.

2.2 RUBBERIZED ASPHALT MEMBRANE

A. Characteristics:
   1. Laminate Form
   2. Heat Resistant
   3. Self-adhesive surface protected by special release paper.

B. Mechanical Properties:

Property	Method	Value
Thickness, mm min.		1.65
Permeance-Perms, g/Pa·s·m^2	ASTM E 96, Method B	5.72 x 10^{-9}
Tensile Strength, kPa	ASTM D 882, (modified for 25 mm opening)	345
Elongation, percent	ASTM D 882, (modified for 25 mm opening)	75
Puncture Resistance (Mesh), N	ASTM E 154	890
Pliability, at -26 degrees C	ASTM D 146	No cracks in mesh or rubberized asphalt when bent 180 degrees over a 6.33 mm mandrel

2.3 PATCHING CONCRETE

A. Approved product from the Qualified Products Listing (QPL). Contact UDOT Research Division.

2.4 FIBERGLASS MATTING

A. Weight, g/m^2: 814

2.5 BINDER

A. Compatible with the matting material and conforming to the following requirements:

Property	Method	Value
Penetration, 0.1 mm	ASTM D 5	40-82
Softening point, min.	ASTM D 36	68 degrees C
193 degrees C. viscosity, cps	ASTM D 3236	1000 - 1800
Low temperature flexibility, max.	Vermont DOT (modified)	-18 degrees C

PART 3 EXECUTION

3.1 PREPARATION

A. Concrete deck:
   1. Sandblast to remove asphalt and all other foreign material from the entire deck, approach slabs and sides of the parapet for a height of 100 mm above the concrete deck.
   2. Vacuum or use compressed air to remove all dust and loose material from the deck.
   3. Remove all sharp ridges and projections that could puncture the membrane.
   4. Patch holes or spalled areas in the concrete deck with patching concrete to provide a flat deck surface.

B. Asphalt Surface: When membrane will be placed on an asphalt surface, apply a 12. 5 mm layer of Hot Mix Asphalt as shown on the plans to provide a flat deck surface.

C. Joints and Cracks: Bond a 300 mm wide strip of woven fiberglass reinforcing to the deck over cracks and joints greater than 5 mm wide using a compatible binder.

3.2 APPLY MEMBRANE

A. Use either hot poured polymer membrane or rubberized asphalt membrane.

B. Hot pour polymer membrane: Follow manufacturer's recommendations for application temperatures, equipment, and procedures.
   1. Primer: Apply primer according to the instructions of the membrane manufacturer, if required.
   2. Application Rate: Apply at a uniform rate to yield a minimum membrane thickness of 2.3 mm.
   3. Vertical Surfaces: Apply the membrane on existing vertical surfaces and curb faces to a height 25 mm above that required for the asphalt surfacing overlay without splattering.
   4. Defects: Repair membrane that exhibits pin holes surface blisters, crazing or cracking after cooling.
   5. Protection: Protect the membrane from damage by using asphalt roofing felt (15 kg/20 m^2) when asphalt surfacing is not placed within 4 hours of placing waterproofing membrane. Observe the following characteristics and

procedures when using the asphalt roofing felt:

a. Cover entire surface and lay dust side up.
b. Lay parallel to the centerline of the roadway with a minimum overlap of 100 mm.
c. Use a minimum overlap of 100 mm between adjoining sections of the asphalt rolled roofing.
d. Bond overlap with suitable mastic or cement.
e. Place free of wrinkles, bubbles or other defects. Repair any placement defects.

6. Traffic: Allow only necessary rubber tire vehicles on the membrane system.
   a. Do not allow public traffic.
   b. Maintain the roofing material in good condition until covered with pavement.
7. Preparation for overlaying: Do not use a tack or prime coat on the top surface of the asphalt rolled roofing.

C. Rubberized Asphalt Membrane: Follow membrane manufacturer's recommendations for application temperatures, equipment, and procedures.

1. Primer: Use primer furnished by the manufacturer of membrane material. Apply primer to all surfaces to be covered by the membrane according to the manufacturer's recommended procedure and application rate.
2. Placement: Overlap prefabricated membrane strips a minimum of 100 mm. Place joints such that a shingling effect will be achieved in which water will drain effectively.
3. Bonding: Use hand rollers or other satisfactory pressure apparatus on the membrane to assure firm and uniform contact with the primed surfaces. If necessary to assure a good seal at joints, an adhesive may be required or use a wide tipped torch to cause tackiness.
4. Placement: Place the membrane on the vertical face of the concrete curb to the height of the finished overlay surfacing.
5. Defects: Protect the entire membrane from developing wrinkles, air bubbles, or other placement defects. Patch any torn or cut areas and narrow overlaps using a satisfactory adhesive and a piece of membrane. Extend the patch at least 100 mm beyond any defect. Bond the patch firmly to the surface.
6. Traffic: Allow only necessary rubber tire vehicles on the membrane. Do not allow public traffic. Maintain the membrane in good condition until covered with pavement.
7. Preparation for Overlaying: If required by the membrane manufacturer, apply a

bond coat of an acceptable adhesive to the surface of the membrane.

3.3 ASPHALT SURFACING OVERLAY

A. Place required surfacing after the membrane has cured according to manufacturer's recommendations. Deposit, spread, and roll asphalt material so the membrane will not be damaged.

END OF SECTION

September 12, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 07921

SEALING EXISTING CONCRETE SLOPE PROTECTION JOINTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Seal existing concrete slope protection joints.

1.2 RELATED SECTIONS

A. Section 03055: Portland Cement Concrete.

B. Section 03152: Concrete Joint Control.

1.3 REFERENCES

A. ASTM C 578: Rigid, Cellular Polystyrene Thermal Insulation.

B. ASTM D 412: Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.

1.4 CERTIFICATES

A. Furnish the certificates of compliance and sealant material test results for each lot of material supplied.

PART 2 PRODUCTS

2.1 MATERIALS

A. Rigid Plastic Foam
   1. Type 9, density of 32 kg/m^3.
   2. ASTM C 578.

B. Backer Rod: Refer to Section 03152, Part 2.

C. Portland Cement Concrete
   1. Refer to Section 03055, Part 2.
   2. Maximum aggregate size of 19 mm.

D. Cement: Refer to Section 03055, Part 2.

E. Sealant Material with the following characteristics:
   1. Applied cold and curable under field conditions.
   2. Polyurethane based, gun grade.
   3. Elastomer, non-sag seal.
   4. Bonds tightly to concrete sides and joints.
   5. Physical properties when cured 21 days at 23 degrees C as in Table 1.

Table 1

Property	Value	Method
Modulus of elasticity at 100 percent elongation	910 kPa	ASTM D 412
Hardness	40 ± 5	Shore A
Elongation (at break)	450 percent	ASTM D 412
Recovery	Greater than 90 percent	
Tensile strength	1310 kPa	ASTM D 412
Adhesive in peel	3.5 N/mm	
Adhesive Loss	0 percent	
Service Range	-40EC to 66EC	
Initial Cure, Tack Free (depending on temperature and humidity)	6 to 8 h	
Final Cure	5 to 8 days	
Staining Characteristics	Non-staining	

PART 3 EXECUTION

3.1 JOINT LOCATIONS

A. The ENGINEER must mark the existing joints and the joint limits that require sealing according to the "Typical Vertical Joint Sealing Detail," and "Typical Contraction Joint Sealing Detail" in the plans.

3.2 PREPARING JOINT AND CRACKS

A. Clean the existing joint material from the designated joints. Keep concrete surfaces in the joints clean and dry at the time the backing rod and sealant are placed.

B. Remove curing compounds, oil, grease, dirt, and any other foreign materials from the joint concrete surfaces by sandblasting.

3.3 SEALING HORIZONTAL JOINTS AND CRACKS

A. Seal the horizontal joints and cracks field marked by the ENGINEER.

B. Use a backer rod when the joint or crack width is greater than 13mm.

C. Start at one side and proceed to the other side on horizontal grooves (cracks or joints).

3.4 SEALING VERTICAL JOINTS AND CRACKS

A. Seal the vertical joints and cracks field marked by the ENGINEER.

B. Start from top to bottom on vertical grooves (cracks or joints.)

3.5 SEALING ALONG WINGWALLS AND BACKWALL JOINTS

A. Place the rigid plastic foam material (styrofoam) against the surface of all structural members before placing the joint sealant.

B. Anchor the rigid plastic foam in place with a compatible adhesive.

C. Recess the styrofoam 10 mm in the joints so a groove is formed above the styrofoam filler.

D. Fill the groove above the styrofoam with sealant so the joint is sealed over completely.

3.6 PLACING SEALANT

A. Place with a hand- or power-operated caulking gun.

B. Tool the sealant using a concave pointing tool with soap solution.

C. Do not place sealant unless temperature is at least 10 degrees C. and rising.

3.7 LARGE JOINT AND CRACK SEPARATION

A. Reestablish the original joint design by filling vertical or horizontal joints with concrete when joint widths are greater than 50 mm.

B. Fill vertical or horizontal cracks with concrete when crack widths are greater than 50 mm.

END OF SECTION

May 22, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 07922

RELIEF JOINT CRACK SEALING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clean and seal designated relief joints.

1.2 RELATED SECTIONS

A. Section 03152: Concrete Joint Control.

1.3 REFERENCES

A. ASTM D 3405: Joint Sealants, Hot-Applied, for Concrete and Asphalt Pavements.

B. ASTM D 3406: Joint Sealant, Hot-Applied, Elastomeric-Type, for Portland Cement Concrete Pavements.

1.4 CERTIFICATION

A. Submit the manufacturer's certification of compliance for all shipments.

1.5 DELIVERY

A. Deliver packaged material in unopened packages with labels clearly indicating the following:
   1. Name of manufacturer
   2. Manufacturer's product name or product number
   3. Manufacturer's batch or lot number
   4. The application temperature range
   5. The recommended application temperature and the safe heating temperature range

PART 2 PRODUCTS

2.1 MATERIALS

A. Backer Rod: Refer to Section 03152, Part 2.

B. Crack Sealing Compound: Sealant with the following characteristics:

Table 1

Property	Test Method	Requirement
Tensile Strength Adhesion, 4 h Cure	ASTM D-3406	Section 4.7
Ductility	*	min. 30 cm @ 1 cm/min. @ 4E C
Force-Ductility	*	18 N max.
Flow	ASTM D-3405	Section 4.3
Asphalt Compatibility	*	@ 60E C
Workability	*	6 mm penetration
Curing	*	45 minutes
Flexibility, 3 mm x 25 mm x 150 mm	*	no cracks

* Contact UDOT Research Division.

2.2 EQUIPMENT

A. Sealant placement equipment:
   1. Capable of circulating hot oil for heat transfer to heat the product (sealant machines).
   2. Do not use direct heat transfer units (tar pots).
   3. Do not exceed the 2000 L maximum product tank capacity of the sealant placement equipment.

B. Temperature control
   1. Sealant unit required to have an approved ASTM Thermometer Number 10 degrees C, or a temperature measurement device capable of reading within ± 2 degrees C from 90 degrees to 370 degrees C.
   2. Observe the sealant manufacturer's instruction on application temperature.

PART 3 EXECUTION

3.1 PREPARATION

A. Sampling:
   1. Stockpile all sealant to be used on the project at least 20 working days prior to use. Keep the stockpile dry.
   2. Notify the ENGINEER when stockpile is established and ready to be sampled.
   3. Take at least one random sample of each batch or lot number (minimum of 5 kg/sample).
   4. Do not place any material until the batch or lot material has been approved.
   5. No claim or extension of contract applies when the material fails to meet specification.

3.2 APPLICATION

A. Apply designated joints as shown on the plans.

B. Immediately before sealing the joints, clean 150 mm on both sides of the joint of foreign matter and loosened particles with an HCA (hot compressed air) heat lance. Adequate cleaning is determined by a darkening of the surface at least 150 mm in width, centered on the joint.

C. Fill the joints following the "Relief Joint Crack Sealing" detail on the plans.

D. Use an appropriate backer rod in the joint opening where the depth and width of the joint opening are greater than 50 mm and 12 mm respectively.

E. Replace the sealant material picked up or pulled out at the CONTRACTOR's expense. The CONTRACTOR will remain liable for any damage to the traveling public resulting from sealant application or sealant pull-out.

END OF SECTION

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 09972 M

PAINTING FOR STRUCTURAL STEEL

February 8, 2000
Add the following to PART I GENERAL:

1.6 PAYMENT PROCEDURES

A. Surface Preparation, or Painting, or both, are included in the contract lump sum price for structural steel.

September 12, 2000
Delete line E of paragraph 1.2, "References," and replace with the following:

E. SSPC-PA1.

Delete line B of paragraph 3.4 "Applying Paint," and replace with the following:

B. Produce a uniform, even coating that bonds to the underlying surface. Follow SSPC-PA1.

August 14, 2001
Delete line A of paragraph 2.1, "Materials," and replace with the following:

A. Select a complete 3-part coating system consisting of a Zinc primer, Epoxy or Urethane intermediate coat and aliphatic Urethane top coat as approved by the New England Protective Coating Specification Criteria (NEPCOAT). This list may be found at http://www.state.me.us/mdot/planning/products/nepcoat.htm. Use system A for newly fabricated Structural Steel and system B for repainting or overcoating existing structural steel.

August 14, 2001

SUPPLEMENTAL SPECIFICATION

SECTION 09991

CLEANING AND REPAINTING STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Apply this section when repainting structural steel whose existing paint system does not contain a red lead primer.

B. Remove existing paint from existing structural steel surfaces.

C. Prepare existing steel surface for repainting, and paint the cleaned structural steel surfaces.

1.2 REFERENCES

A. ASTM E 11: Wire Cloth and Sieves For Testing Purposes.

B. Federal Standard No. 595: Color.

C. SSPC-PA 1-64: Surface Preparation.

D. SSPC Paint Application Guide No. 3, "A Guide to Safety in Paint Application."

E. SSPC-SP10: Near White Blast.

F. SSPC-SP11: Mechanical Cleaning.

G. SSPC-Vis 1: Visual Standard.

1.3 QUALIFICATION AND EVALUATION

A. Coating Application Evaluation: ENGINEER will evaluate painters and blasting operators on their ability to prepare the surface and apply specified coatings with the proper tools and equipment.

1. Establish a test area approximately 3 m long, or as determined by the ENGINEER, and prepare the surfaces of the test area according to the project specifications.
2. Apply the coating using technique and application equipment consistent with the specified coating materials, and with the paint manufacturer's recommendations. ENGINEER will evaluate the painter's ability to apply the specified coating to a uniform dry-film thickness.
3. Allow the required drying time as prescribed by these specifications and the manufacturer's recommendations to elapse before taking the dry-film thickness readings.
4. Treat primer, intermediate, and finish coats as separate applications, allowing the specified drying time to elapse before inspecting each completed coat.

B. Disqualification:
1. ENGINEER may withdraw qualification for questionable performance of the painter, blasting operator, or the equipment.
2. Disqualification will result from inadequate surface preparation, improper profile, runs, sags, overspray, thin film thickness, excessive film build-up, uneven coating, nonuniform color, improper curing, or any other defect in the coating system.
3. The disqualified person or equipment may be required to re-qualify or be removed from the project site at the option of the ENGINEER.

C. Requalification:
1. The ENGINEER may accept the qualifications of a sandblaster or painter who has been qualified on a previous Department project within the year.
2. The blasting operator, painter, or both must re-qualify if any materials or equipment changes are made from the original qualification.

1.4 REQUIREMENTS FOR COATING APPLICATION

A. Have the painter, the blasting operator, or both consult with the manufacturer's technical representative for answers to technical questions relating to the application of the specified coating materials.

B. The painter must be familiar with the specified coating material and acceptance criteria, and be aware of any difficulties in applying the coating to any specified surface.

C. Obtain surface preparation approval from the ENGINEER before applying paint.

D. Use equipment capable of taking dry-film thickness readings on all portions including nuts and bolts.

1.5 PROJECT CONDITIONS/WEATHER LIMITATIONS

A. If weather conditions require paint thinning, follow the manufacturer's recommendations.

B. Apply paint only when the following weather conditions exist:
   1. The temperature of the air and the steel: above 5 degrees C.
   2. The relative humidity:
      a. Less than 85 percent, or such that the combination of temperature and humidity conditions inhibits surface condensation.
      b. To test humidity, apply a thin film of water to a small area. If the film evaporates within 15 minutes, the surface may be painted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Blasting abrasive: type and size as specified.

B. Solvent: type and source as required.

C. Coating materials:
   1. Mix properly following manufacturer’s recommendations and project specifications.
   2. Use necessary equipment for the proper application of the specified coating.

2.2 COATING SYSTEM

A. Select a complete 3-part coating system consisting of a Zinc primer, Epoxy or Urethane intermediate coat, and aliphatic urethane top coat, system B as approved by the New England Protective coating Specification Criteria (NEPCOAT). This list may be found at http://www.state.me.us/planning/products/nepcoat.htm.

B. Use manufacturer's information regarding the specified coating materials, including required wet- and dry-film thickness, project safety data, thinning recommendations, temperature requirements, profile recommendations, mixing and application procedures, and required equipment.

C. Use coating materials properly mixed meeting the manufacturer's recommendations and project specifications.

D. Paint Color: Federal Standard No. 595.
   1. Field coat: Color # 26293.
   2. Top coat: Color # 26306.

2.3 MIXING

A. Mix the paint to a lump-free consistency with a high shear mixer (such as a Jiffy mixer), according to the producer's directions.
   1. Do not use paddle mixers or paint shakers.
   2. Keep paint in the original containers and mix until all the metallic powder or pigment is suspended.
   3. Continue mixing until all solids that may have settled to the bottom of the container are thoroughly dispersed.

B. Strain the paint through a screen having openings no larger than those specified for a 300 Fm sieve. ASTM E 11.

C. After straining, continuously agitate the mixed material up to and during the time of application.

2.4 QUALITY CONTROL

A. Sampling:
   1. Take samples from each batch or lot of paint to be tested.
   2. Test the samples using infrared and gas chromatography techniques prior to use.
   3. Reject paint that does not match the standard. The prints must match the spectrum samples on file in the Central Laboratory.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces, including bearing units, of all oil, grease, and dirt with clean petroleum solvents or steam cleaning prior to blasting operation. SSPC-SP10.

B. Blast surfaces clean to near white with 0.5 to 2 mil profile.

C. Discoloration, light shadows, or slight streaks caused by stains of rust is not allowed on more than 5 percent per square inch of surface area.

D. Define acceptable surface preparation using SSPC-Vis 1.

E. Use SSPC-SP-11 to clean areas such as backside of base plates, corners, etc., that cannot otherwise be cleaned.

F. Prime the surface within 24 hours from blasting.

G. Do not prime the surface if rust has started to form. Clean the surface again before applying the prime coat.

H. Protection:
   1. Fully contain all material resulting from paint overspray.
   2. Enclosure system must withstand extreme high winds.
   3. Protect all portions of the structure that will not be painted.

3.2 APPLICATION

A. Conform to Field Inspection Provisions:
   1. Do not apply paint until the ENGINEER approves the prepared surface.
   2. Use rubber rollers or other approved protective devices on scaffold fastenings.
   3. Do not use metal rollers, clamps, and other types of fastenings which mar or damage freshly coated surfaces.

B. Apply paint with spray nozzles at pressures recommended by the producer of the coating system.

C. Prime Coat:
   1. Maintain the dry-film thickness of the prime coat between 2.5 and 6.0 mils.
   2. Apply two or more coats without producing runs, bubbles, or sags if the required film thickness cannot be obtained by one coat.
   3. Scrape any coat that produces "mud-cracking" or adds more than 7.0 mils to a soundly bonded coating or bare steel. Re-coat the surface.
   4. Thoroughly clean areas having deficient primer thickness with power washing equipment to remove all dirt. Wire-brush, vacuum, and re-coat the area.

D. Intermediate Coat: Paint as described in the standard specifications to produce a uniform, even coating which bonds to the underlying surface. SSPC-PA 1-64.
   1. Use the coating type and minimum dry-film thickness specified.
   2. Produce a dry-film thickness of the intermediate coat greater than 4 mils.

E. Finish coat: Keep the dry-film thickness greater than 2 mils.

F. Use wet and dry-film thickness gauges for testing the coating thickness during and after application.

G. Painting Safety: Follow SSPC Paint Application Guide No. 3, “A Guide to Safety in Paint Application.”

END OF SECTION

November 14, 2000

SUPPLEMENTAL SPECIFICATION

SECTION 09992

CLEANING AND OVERCOATING STRUCTURAL STEEL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clean and overcoat existing structural steel surfaces including all bearing units for existing paint systems that have red lead primer.

1.2 REFERENCES

A. ASTM E 11: Wire Cloth and Sieves For Testing Purposes.

B. Federal Standard No. 595: Color.

C. SSPC 25: Prime and Intermediate Coat Paint.

D. SSPC 104, Type II: Specified Type of Paint.

E. SSPC-PA 1-64: Surface Preparation.

F. SSPC-SP3: Mechanical Cleaning.

G. SSPC Paint Application Guide No. 3 “A Guide to Safety in Paint Application.”

1.3 DEFINITIONS

A. Overcoating: spot prime, an intermediate coat, and a top coat of paint over the entire surface on each girder.

1.4 QUALIFICATIONS AND EVALUATION

A. The existing structure contains lead-based paint. It is mandatory that the painter and blasting operator be in total compliance with OSHA's standard on lead exposure in

construction, as published in Federal Register, Section 29 CFR 1962.62, May 4, 1993.

1. The CONTRACTOR or the subcontractor must submit a written compliance program indicating that he has the equipment, training, containment and monitoring system to comply with the said standard.

B. Lack of proper tools or equipment is cause for disqualification.

C. Coating Application Evaluation: ENGINEER will evaluate painters on their ability to prepare the surface and to apply specified coatings with the proper tools and equipment.

1. Establish a test area, approximately 3 m long, or as determined by the ENGINEER.
2. Apply the coating using the technique and the application equipment consistent with the specified coating materials, and with the paint manufacturer's recommendations.
3. Prepare the surfaces of the test area according to the project specifications.
4. The ENGINEER will judge the painter's ability to apply the specified coating to a uniform dry-film thickness.
5. Allow the required drying time as prescribed by these specifications and the manufacturer's recommendations to elapse before taking the dry-film thickness readings.
6. Treat primer, intermediate, and finish coats as separate applications, allowing the specified drying time to elapse before inspecting each completed coat.

D. Disqualification:

1. ENGINEER may withdraw qualification for questionable performance of the painter, blasting operator, or the equipment. Lack of proper tools or equipment is cause for disqualification.
2. Disqualification will result from inadequate surface preparation, improper profile, runs, sags, overspray, thin film thickness, excessive film build-up, uneven coating, nonuniform color, improper curing, or any other defect in the coating system.
3. The disqualified person or equipment may be required to re-qualify or be removed from the project site at the option of the ENGINEER.

E. Requalification:

1. The ENGINEER may accept the qualifications of a sandblaster or painter who has been qualified on a previous Department project within the year.

2. The blasting operator, painter, or both must re-qualify if any materials or equipment changes are made from the original qualification.

1.5 REQUIREMENTS FOR COATING APPLICATIONS

A. Have the painter, the blasting operator, or both consult with the manufacturer's technical representative for answers to technical questions relating to the application of the specified coating materials.

B. The painter must be familiar with the specified coating material and acceptance criteria, and be aware of any difficulties in applying the coating to any specified surface.

C. Obtain surface preparation approval from the ENGINEER before applying paint.

D. Use equipment capable of taking dry-film thickness readings on all portions including nuts and bolts.

1.6 PROJECT CONDITIONS/WEATHER LIMITATIONS

A. If weather conditions require paint thinning, follow the manufacturer's recommendations.

B. Apply paint only when the following weather conditions exist:
   1. The temperature of the air and the steel: above 5 degrees C.
   2. The relative humidity:
      a. Less than 85 percent, or such that the combination of temperature and humidity conditions inhibits surface condensation.
      b. To test humidity, apply a thin film of water to a small area. If the film evaporates within 15 minutes, the surface may be painted.

PART 2 PRODUCTS

2.1 MATERIALS

A. Solvent: As recommended by the manufacturer.

2.2 COATING SYSTEM

A. Use a prime and intermediate coat. SSPC 25

B. Top Coat:
   1. Gray tinted alkyd paint. SSPC 104, Type II.
   2. Use Color No. 26306. Federal Standard No. 595.

C. Use manufacturer's information regarding the specified coating materials, including project safety data, thinning recommendations, temperature requirements, profile recommendations, mixing and application procedures, and required equipment.

D. Properly mix coating system. Meet the manufacturer's recommendations and project specifications.

E. Use necessary equipment for the proper application of the specified coating, observing safety practices found in SSPC Paint Application Guide No. 3, "A Guide to Safety in Paint Application."

F. Use wet and dry-film thickness gauges for testing the coating thickness during and after application.

2.3 TESTING

A. Provide samples from each batch or lot of paint prior to use.

B. UDOT Central Lab will test for acceptance.

2.4 MIXING PAINT

A. Mix the paint to a lump-free consistency according to the producer's directions.
   1. Keep paint in the original containers and mix until all the pigment is suspended.
   2. Continue mixing until all solids that may have settled to the bottom of the container are thoroughly dispersed.

B. Strain the paint through a screen having openings no larger than those specified for a 300 Fm sieve. ASTM E 11.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces of all oil, grease, and dirt with clean petroleum solvents and low-pressure water-jetting wash.

B. Remove all corrosion, and all paint that shows peeling, brittleness, checking, scaling, or general disintegration, including bearing units.
   1. Use vacuum shrouded power tool cleaning.
   2. Remove paint from the area and beyond the edges of the area so that remaining paint system shows no rusting or blistering underneath, and adheres tightly to the surface. Remaining paint system should have sufficient adhesion that cannot be lifted as a layer by inserting a blade or putty knife under it.
   3. Feather the edges of the remaining paint system around the cleaned areas so the repainted surface will appear smooth.

C. Protection:
   1. Fully contain all material resulting from surface preparation and paint overspray.
   2. Enclosure system must withstand extreme high winds.
   3. Protect all portions of the structure that will not be painted.

D. Recover a minimum of 95 percent of debris from cleaning operation.
   1. Sample debris from cleaning operation. Submit samples to UDOT Materials and an independent accredited Materials Testing Lab for composition and disposal evaluation.
   2. Place reclaimed waste paint in EPA-USDOT approved containment. Store at the project site.
   3. The ENGINEER will test the waste paint. Contact UDOT chemist at 965-4298. Submit paint composition and disposal evaluation results from the independent material testing lab. Disposition will be given to the contractor within 30 days. Dispose of waste paint as directed by the ENGINEER, submit disposal certificates for all waste paint.

3.2 APPLICATION

A. Do not apply paint until the ENGINEER approves the prepared surface.
   1. Use rubber rollers or other approved protective devices on scaffold fastenings.

2. Do not use metal rollers, clamps, and other types of fastenings which mar or damage freshly coated surfaces.

B. Apply paint with spray nozzles at pressures recommended by the producer of the coating system.

C. Apply a minimum dry-film thickness of 2 mils spot prime, 2 mils intermediate coat, and a minimum of 1.5 mils for the top coat. Use a magnetic film thickness gauge for verification.

D. Apply two or more coats if the required film thickness cannot be obtained by one coat without producing runs, bubbles, or sags.

E. Paint as described in the standard specifications to produce a uniform, even coating which bonds to the underlying surface. SSPC-PA 1-64.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13551

GENERAL ATMS REQUIREMENTS

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Follow the ATMS requirements defined herein.

1.2 RELATED SECTIONS

A. Section 00725: Scope of Work.

B. Section 01554: Traffic Control.

1.3 REFERENCES

A. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A 307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

1.4 DEFINITIONS

A. ATMS - Advanced Traffic Management System

B. CCTV – Closed Circuit Television

C. RMS – Ramp Meter System

D. RWIS – Road Weather Information System

E. TOC - Traffic Operations Center

F. TMS – Traffic Monitoring Station

G. VMS - Variable message sign

H. WIMS – Weight In Motion System

PART 2 PRODUCTS

2.1 FACTORY ISSUED MANUALS

A. Furnish two copies of original, factory-issued manuals containing all technical information for each piece of equipment furnished.

B. Acceptable factory manuals must contain technical, diagnostic, and maintenance (preventative and troubleshooting) information. Advertising brochures and catalog cuts will not be accepted.

2.2 AS-BUILT DRAWINGS

A. Department: provide project design files in MicroStation format.

B. Contractor:
   1. Carefully documents all changes and updates all files to accurately represent the system as-built conditions.
   2. Plots three sets of the updated files on 11 inch x 17 inch bond paper and submits the plots to the Engineer for review and approval.

C. As-built drawings will not be considered complete until the Engineer has given formal approval of the plots and design files.

PART 3 EXECUTION

3.1 EXISTING MATERIALS: LOCATION AND PROTECTION

A. Locate and mark all underground traffic signal circuits, lighting circuits, power sources, detection loops, and fiber optic cable.

B. Until final acceptance, repair all damage to traffic signal equipment, lighting equipment, and other ATMS devices including but not limited to, conduit, junction boxes, underground traffic signal circuits, VMS, power sources, detection loops, power conductors, or fiber optic cable, caused by the Contractor's activities or failure to maintain adequate traffic control or protection of the work. Existing improvements include but not limited to pavement, sidewalks, ramps, decorative pavement, driveways, parkways, landscaping, irrigation systems, snow ditches, and drainage improvements.

C. Following any repairs to underground facilities, contact the Engineer for inspection, prior to restoring cover.

D. Locate all utilities prior to construction:
   1. Contact Blue Stakes and all other utilities not participating in Blue Stakes.
   2. Determine the exact location of all existing utilities before commencing work.
   3. Repair any utility that is damaged resulting from the Contractor's failure to exactly locate and preserve all underground and overhead utilities, at no additional compensation.

E. Resolve any utility conflicts with the Engineer.

F. Minimize disruption to existing vegetation at all sites. Restore all grading to pre-existing condition.

3.2 LOCATION OF INSTALLED EQUIPMENT

A. Proposed equipment locations may be modified to avoid conflict with underground utilities or other obstructions. Consult Engineer for approval.

B. Install all above ground equipment the maximum practical distance from traffic or behind barrier or other approved protection.

C. No portion of the equipment can infringe within the following distances unless behind a barrier or other approved protection.
   1. 10.5 m from the edge of traveled way for a freeway
   2. 10.5 m from the edge of traveled way for an off ramp
   3. 15 m from the edge of traveled way for an on ramp

D. Minimum distance behind guard rail for all above ground equipment: 1.2 m.

E. Minimum distance behind concrete barrier for all above ground equipment: 0.6 m.

3.3. EXCAVATION

A. When excavation is required do not damage streets, sidewalks, landscaping, or other surrounding conditions.

B. Do not excavate wider than necessary for the proper construction of the foundations and other equipment.

C. Do not perform excavation until immediately before construction of foundations.

D. Place the material from the excavation in a position that will minimize obstructions to pedestrian or vehicular traffic and interference with surface drainage.

E. Remove all surplus excavated material and properly dispose of it within 48 hours as directed by the Engineer.

F. After each excavation is completed, notify the Engineer for inspection.

G. Do not cover any underground materials or equipment fill under any circumstances, without the approval of the Engineer.

H. At the end of each working period, barricade and cover all excavations to provide safe passage for pedestrian and vehicular traffic.

I. Keep sidewalk and pavement excavations well covered and protected to provide safe passage for pedestrian and vehicular traffic until permanent repairs are made.

3.4 ANCHOR BOLTS

A. Place and hold anchor bolts in proper alignment, position, and height during the placing and vibrating of concrete.

B. Assemble bolts, nuts, washers and torque bolts as required by the manufacturer.

C. Anchor bolts will conform to minimum requirements of ASTM A 307. Do not weld anchor bolts to reinforcing steel. Galvanize all nuts, washers and anchor bolts in accordance with ASTM A 153.

3.5 TRAFFIC CONTROL

A. Refer to Section 00725, Maintaining Traffic.

B. Submit all lane closure and traffic control plans to the Department for approval. Refer to Section 01554, Traffic Control.

C. Contact each business manager 48 hours prior to construction affecting any business access. Place BUSINESS ACCESS signs where access to business is not readily apparent. Keep at least one driveway open during periods when business is open for businesses with multiple driveways. Coordinate with the business owner for businesses with only one driveway to minimize the amount of time that the driveway is closed.

3.6 TEMPORARY TRAFFIC SIGNAL TIMING

A. Design and implement any temporary traffic signal timing or phasing required for traffic management during construction. Submit any proposed timing or phasing changes, including any temporary signal head placement, to the Engineer for review and approval seven days in advance.

B. Implement the approved temporary changes including for example, programming the controller, relocating traffic signal heads and, recabling. Contact the Engineer for inspection (giving 24 hours notice) prior to implementing temporary phasing.

3.7 REUSE EXISTING CONDUIT AND JUNCTION BOXES

A. Reuse existing conduit as follows:
   1. When no new adjacent conduit is being installed.
   2. When new adjacent conduit is being installed within 0.3 m of existing conduit the Contractor is proposing to reuse.

B. Reuse only existing conduit that meets National Electric Code requirements and UDOT standards for conduit material and depth of cover.

C. Replace existing plastic lid on all reused junction boxes with polymer concrete lid.

3.8 ABANDON EXISTING EQUIPMENT IN PLACE

A. Install #14 pull wire in all conduit that is abandoned in place.

B. Obliterate all existing foundations left in place to a depth of at least 150 mm below the existing surface. Properly dispose of removed concrete.

C. Properly label in each junction box all cables and conductors that are left in place.

3.9 REMOVE EXISTING EQUIPMENT

A. Remove existing equipment as specified.
   1. Either properly dispose of equipment or return equipment to the appropriate UDOT facility, as indicated.
   2. Contact Engineer at least 48 hours prior.

B. All removed poles, cabinets, and polymer concrete junction boxes:
   1. Contact the Engineer at least 48 hours prior.
   2. Return to respective UDOT maintenance shed.

C. Return all removed electronics and control equipment to:
   Utah Department of Transportation
   Traffic Operations Center
   2060 South 2760 West
   Salt Lake City, UT 84104-4592

3.10 ELECTRICAL

A. Perform all work in accordance with the National Electric Code.

3.11 WIRING

A. Tape the ends of unused conductors and label them as spares.

B. Crimp and solder all terminal connections.

C. Use powdered soapstone, talc, or other approved lubricants when pulling wiring in conduit.

D. Use color coded conductors as specified.

E. Neatly arrange wiring within cabinets, junction boxes, and enclosures. Do not install cables or conductors behind the cabinet heater.

F. Ground step-down transformer at cabinet to the ground rod in the nearest junction box that has power service conductors running directly to the transformer.

3.12 WIRE SPLICING

A. Do not splice wires except in detection circuits when changing the wire type in the junction boxes.

B. Mechanically secure, solder, individually insulate, and water seal all splices.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13552

RAMP METER SIGNALS AND SIGNING

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install ramp meter signals and signing.

B. Test the Ramp Meter System after installation.

1.2 RELATED SECTIONS

A. Section 02891: Traffic Signs

B. Section 02892: Traffic Signal.

C. Section 03055: Portland Cement Concrete

D. Section 03211: Reinforcing Steel and Welded Wire

E. Section 13551: General ATMS Requirements

F. Section 13553: ATMS Conduit.

G. Section 13554: Polymer Concrete Junction Box

H. Section 13555: ATMS Cabinet

I. Section 16525: Highway Lighting.

1.3 REFERENCES

A. AASHTO M 31M: Deformed and Plaint Billet-Steel Bars for Concrete Reinforcement.

B. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products.

C. AASHTO M 284M: Epoxy Coated Reinforcing Bars.

D. AASHTO Standard Specifications for Highway Bridges.

E. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

F. American Iron and Steel Institute.

G. American National Standards Institute (ANSI)

H. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

I. ASTM A 307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

J. National Electric Code (NEC).

K. UL 510: Polyvinyl chloride, Polyethylene, and Rubber Insulating Tape

1.4 SUBMITTALS

A. Two copies of the following to the Engineer 15 days after receiving a Notice to Proceed:
   1. List of equipment and materials (name of manufacturer, size, and identification number).
   2. Detailed shop drawing, wiring diagrams, and certifications.
   3. All manufacturers' warranties, guarantees, instruction sheets, and parts lists.
   4. Submit a testing plan to the Department for approval. Local Field Operations testing is performed prior to opening of all lanes to live traffic.

B. Samples of materials to the Engineer for approval when requested.

C. Results of all tests conducted.

1.5 ACCEPTANCE TESTING

A. Conduct a Detector Loop Circuit Test per Section 02892, Part 1, article: Acceptance Testing, paragraph A. Submit Detector Loop Circuit Test to the Engineer for acceptance.

B. Perform the following Local Field Operations Test. After all ramp meter elements, equipment and hardware, power supply, and connecting cabling have been installed, demonstrate the following:

1. Conduct and document a local field operation test demonstrating that all hardware, cables, and connections operates correctly and in conformance with the manufacturer's requirements.
2. Verify the power supply voltages and the functionality of the cabinet fans and heaters.
3. Verify the ability of the controller to properly process lane volume, occupancy, and speed for each detection zone indicated in the plans.
   a. Required accuracy for vehicle speed as recorded by the controller: +/-4.8 km/hr.
   b. Speed data is not required for ramp meter detection zones, and for entrance and exit ramp detection zones located on ramps originating or terminating at a crossroad intersection.
4. Use test vehicles physically passing through the detection zones of any non-live lanes to simulate live traffic conditions.
   a. Do not perform test until the Department has approved the testing plan.
   b. Supply any necessary test vehicles if the testing is performed prior to opening of lanes to live traffic.
5. Verify visually that each ramp meter detection zone properly registers a call to the controller when a vehicle passes through the detection zone.
   a. Supply test vehicle if the testing is performed prior to opening of ramp meter to live traffic.
   b. Verify that all entrance and exit ramp detection zones have been properly located in relation to the stop bar and crossroad, as indicated in the plans.
6. Verify that:
   a. All ramp meter signal heads and all advanced flashing beacon and meter-on signs properly respond to activation and deactivation control from the controller.

b. Verify that all ramp meter signals and signs properly respond to metering plan changes from the controller.

7. Perform testing after all construction for the site has been completed and final road surface has been constructed.
   a. It is not necessary for the communications installation to be completed at the time of the test.
   b. It is not necessary that all stations be locally tested concurrently.
   c. Notify the Engineer 48 hours prior to testing. Submit written verification of testing results.

C. Satisfy all additional testing requirements specific to the project.

PART 2 PRODUCTS

2.1 GENERAL

A. Use electrical components as listed and defined by the NEC.

2.2 FOUNDATION

A. Concrete: Class AA(AE) Concrete. Refer to Section 03055.

B. Reinforcing Steel: Coated steel. Refer to Section 03211.

2.3 RAMP METER SIGNAL ASSEMBLY

A. Signal Pole: Section 02892, Article: Signal Pole and Traffic Signal Light Support Arm; Standard Drawing 745-55D.

B. For 300 mm signal heads: Section 02892, Article: Traffic Signal Head, Paragraphs B through E. Louvered backplate required. Signal head housing: yellow.

C. 200 mm 1 section signal head with red lens for enforcement. Signal head housing yellow. No backplate required.

D. Regulatory Sign: R10-6; 609 mm x 914 mm.

E. For 200 mm signal heads: Section 02892, Article: Traffic Signal Head. Louvered backplate required. Signal head housing yellow.

F. 609 mm x 445 mm“1 VEHICLE PER GREEN” Sign: Standard Drawing 2100-3.

G. Foundation Concrete: Class A(AE) Concrete. Refer to Section 03055.

2.4 MAST ARM SIGNAL ASSEMBLY

A. Signal Pole: Standard Drawing 745-55 A1 and 745-55 A2.

B. For 300 mm signal heads: Section 02892, Article 2.5: Traffic Signal Head, Paragraphs B through E. Louvered backplate required. Signal head housing yellow.

C. 1519 mm x 905 mm “1 VEHICLE PER GREEN EACH LANE” Sign: Standard Drawing 2100-3.

D. Concrete: Class AA(AE) Concrete. Refer to Section 03055.

E. Reinforcing Steel: Coated steel. Refer to Section 03211.

2.5 ADVANCE FLASHING BEACON SIGN

A. Signal Pole: Section 02892, Article: Signal Pole and Traffic Signal Light Support Arm; Standard Drawing 745-55D.

B. Two-8 inch (200 mm) signal heads with yellow lens: Section 02892, Article: Traffic Signal Arm. Signal head housing: yellow. No backplate required.

C. Warning Sign: W3-3, 762 mm x 762 mm.

D. 760 mm x 580 mm black on yellow “METERING WHEN FLASHING” Sign: Standard Drawing 2100-3.

E. Foundation Concrete: Class A(AE) Concrete. Refer to Section 03055.

2.6 BOLTS AND NUTS

A. Follow Section 02892, Article: Bolts and Nuts, Paragraphs A and B.

2.7 WIRE

A. Follow Section 02892, Article: Wire, Paragraphs A through H.

2.8 DETECTOR CIRCUIT

A. Follow Section 02892, Article: Detector Circuit, Paragraphs A through B.

B. Consult with the Engineer: saw cut loop or pre-formed loop.

2.9 LUMINAIRE

A. For luminaires installed on ramp meter signal pole, follow Section 02892, Article Luminaire, Paragraphs A through I.

B. For luminaires not installed on ramp meter signal pole, refer to Section 16525.

2.10 GROUND ROD

A. Copper-coated steel as specified.

B. ANSI/UL 467.

2.11 MOUNTING BANDS AND BUCKLES

A. As Specified.

B. American Iron and Steel Institute, (AISI) Type 201.

C. Universal Mounting Brackets for Signals mounted on mast arm.

2.12 STATE FURNISHED MATERIALS PICK UP

A. Pick up all Department-furnished poles, anchor bolts, and signs at:
UDOT Complex
4501 South 2700 West
Salt Lake City, Utah 84114

B. Contact Engineer at least 10 days prior to pick up.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform to the requirements of the NEC, current edition.

B. Load, transport, and install all state-furnished materials per the manufacturer's instructions and as shown in the plans.

C. Provide foundation, junction boxes, ground rod, grounding lug, conduit, signal heads, assemblies, and mounting devices, signs, and all additional equipment required for a complete and operational ramp meter system.

D. Install all wiring, conduit, and junction boxes as shown on site plans and details.
   1. Field locate all conduits and junction boxes to avoid drainage areas and steep slopes whenever possible.
   2. Protect existing conductors while installing new conductors.

E. Connect the controller and all wires as specified by the manufacturer.

F. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the ramp meter system complete.

G. After installation, the exterior of all equipment is free of all loose rust and mill scale, dirt, oil, grease and other foreign substances.

3.2 FOUNDATION

A. All material and workmanship conforms to AASHTO's Standard Specifications for Highway Bridges.

B. Prior to work, verify that the installation of the signal heads, mast arm, pole, and foundation in the location marked in the field has no conflict with existing utilities, underground and overhead. Comply with all utility and Blue Stakes requirements.

C. Place Ramp Meter Signal Assemblies 0.6 m downstream of the stop bar and 1.2 m outside the edge of shoulder. For Ramp Signal Assembly Details, see Standard Drawing 2100-5.

D. Place Mast Arm Signal Assemblies 12 m to 36 m downstream of stop bar. For Mast Arm Details, see Standard Drawing 2100-2.

E. Place Advance Flashing Beacon Assembly 105 m to 110 m downstream of stop bar. For Flashing Beacon Details, see Standard Drawing 2100-2.

F. Excavation: Refer to Section 13551, General ATMS Requirements.

G. Caissons conform to AASHTO Division II Section 5, Drilled Piles and Shafts. Caissons are drilled into either native soil or compacted fill.
   1. If formwork is required during drilling, the forms may be withdrawn during concrete placement.
   2. Cast the top of the caisson against the formwork for appearance.

H. Place concrete directly into the excavation. Use minimum forming.

I. Do not weld reinforcing steel, conduit, or anchor bolts; tie reinforcing steel and conduit securely in place.

J. Coat all reinforcing steel to conform to AASHTO M284 or M111 and AASHTO M31M Grade 420, respectively. Coat the ends of cut reinforcing with approved epoxy coating.

K. Use class AA(AE) for all cast-in-place concrete. Cap all conduits before placing concrete.

L. Install weep hole in foundation per UDOT Standard drawing 745-55C.

3.3 ANCHOR BOLTS

A. Refer to Section 13551, General ATMS Requirements.

3.4 SIGNAL POLES

A. Install the poles on new concrete bases. Apply rust, corrosion, and anti-seize protection at all threaded assemblies by coating the mating surfaces with an approved compound.

B. Install pole with the hand hole facing away from traffic.

C. Install ground rod per plans. NEC 250.

D. All fasteners and attachment hardware for bands and other equipment: stainless steel.

E. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the ramp meter system complete.

F. Adjusting the anchor bolt nuts, plumb all steel poles to the vertical with all signal heads and signs installed.

3.5 INSTALL WIRING

A. Follow Section 02892, Part 3, Article: Install Wiring, Paragraphs A through E.

B. Mark cabinet cables with vinyl electrical color coding tape as specified in Table 1. Meet UL 510.

TABLE 1			
Cables Marked with Colored Tape			
	Lane One	Lane Two	Lane Three
Ramp Meter Circuit	Blue	Red	Yellow
Detector Circuit	Blue	Red	Yellow
Advance Flashing Beacon Signal	Blue and White	Red and White	Yellow and White

C. Use Table 2 when connecting the conductors for ramp meter signal heads.

TABLE 2	
Color-Coded Conductors	
	All Lanes
Ramp Meter Signal Circuit	White- Neutral Red- Red indicative Green- Green indicative Blue- Enforcement (if present) or spare

3.6 ADVANCE FLASHING BEACON SIGN

A. Follow Section 02891, Traffic Signs.

3.7 RAMP METER SIGNAL ASSEMBLY SIGN

A. Follow Section 02891, Traffic Signs.

3.8 INSTALL SIGNAL HEADS

A. Do not install signal heads at the intersection until ready for operation.

B. If turn on is not immediate, completely cover the signal heads with non-transparent, non-paper material tied securely around head.

C. Install directed and veiled optically-programmed signals following the manufacturer's instructions. Mask each section of the signal with recommended manufacturer's materials.

D. Use louvered back plates on those signal heads indicated. Use a minimum of four 3 mm stainless steel screws per section to mount the back plates, or according to manufacturer's instructions.

E. Orient meter-on ramp signal toward vehicles approaching the intersection stop-bar. Side Signal Head: axis or indication parallel to roadway surface.

3.9 INSTALL DETECTOR LOOPS

A. Follow Section 02892, Article: Install Detector Loops, Paragraphs A through F.

B. For location of Presence and Discharge Loop, see Standard Drawing 2100-5.

C. For saw cut loops, consult the Engineer: circular or octagon shaped.

3.10 INSTALL LUMINAIRE

A. Refer to Section 16525, Highway Lighting.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13553

ATMS CONDUIT

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install conduit for ATMS field elements and communication.

1.2 RELATED SECTIONS

A. Section 00725, Scope of Work

B. Section 02061: Select Aggregate

C. Section 02705: Pavement Sawing

D. Section 02741: HMA (Hot Mix Asphalt)

E. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork

F. Section 02892: Traffic Signal

G. Section 03575: Flowable Fill

H. Section 13554: Polymer Concrete Junction Box

I. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. ASTM D2241: Standard Specification for Poly-Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).

B. American National Standards Institutes (ANSI).

C. National Electric Code(NEC).

D. NEC Article 346: Rigid Metal Conduit.

E. NEC Article 347: Rigid Nonmetallic Conduit.

F. National Electrical Manufacturers Association (NEMA).

G. NEMA Article TC-2: Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

H. NEMA Article TC-3: PVC Fittings for Use with Rigid PVC Conduit and Tubing.

I. Underwriters Laboratories (UL).

PART 2 PRODUCTS

2.1 MATERIALS

A. Conduit and Fittings:
   1. Schedule 40 PVC (poly vinyl chloride) rated at 90 degrees C, as specified. NEMA TC-2, NEMA TC-3, UL Listed.
   2. HDPE (high density polyethylene) SDR11 rated, as specified. ASTM D2241.
   3. Rigid steel as specified. UL-6.
   4. Galvanized as specified. ANSI C80.1.

B. Multi-Conduit
   1. New, prefabricated.
   2. Minimum of 4 each 25 mm conduit.
   3. Label: FIBER OPTIC COMMUNICATIONS, permanent 10 mm black letters, every 2 m, on outside of each conduit.
   4. Color code each conduit or cell.

C. Provide all materials used in the installation of conduits, such as bends, adapters, couplings, glue, plugs and fittings, to meet or exceed all of the recommendations of the conduit manufacturer for suitable installation.

D. Provide special termination kits from the conduit manufacturer for terminating the conduit in vaults and junction boxes. Provide kits that form a watertight seal of conduit to structure wall.

E. Use complete conduit sections in nominal 6 m sections; couplings and fittings to provide for watertight integrity.

F. Use complete conduit rigid bend sections (11 1/4, 22 1/2, 45, 90 degree angles) complete with bell and spigot. Do not field bend conduit.

G. Provide #14 solid copper conductor pull wire, Type THHN, for each empty conduit or cell.

H. Provide fiber optic and electrical buried cable marker warning tape that meets the following requirements:
   1. Material: Composite reinforced thermoplastic.
   2. Tape Color: Orange (communication) or Red (electric).
   3. Length: 1.5 m minimum.
   4. Text: "Caution Buried Communication Cable" or "Caution Buried Electric" (front and back).
   5. Text Color: Black.
   6. Width: 75 mm minimum (face or diameter).

I. Provide jacketed #14 THHN solid green locator wire.

J. Provide locator wire connection device that meets the following requirements:
   1. Screw clamp connection type.
   2. Suitable for 22 to 8 AWG.
   3. Rated 50 amps.
   4. Rated 600 V.
   5. Provide zinc bichromate plated steel mounting rail for locator wire connection device.

K. Backfill
   1. Flowable Fill: Section 03575.
   2. Free Draining Granular Backfill Borrow: Section 02061.
   3. Native material: 96 percent compaction.

PART 3 EXECUTION

3.1 INSTALLATION

A. Plans depict conduit routing in schematic form only. Base final routing on actual field conditions at the time of construction, including Blue Stake markings, to prevent conflicts with existing utilities.

B. When installing conduit that houses communication cable, do not allow conduit to deflect vertically or horizontally along its length by a ratio greater than 1:10, (e.g. no more than 100 mm deflection per 1000 mm in length).

C. When installing conduit, do not allow the sum total of the vertical and horizontal deflection of conduit between any two junction boxes to exceed 360 degrees.

D. Do not place conduit directly above parallel utilities.

E. If the planned location of conduit is parallel to the existing traffic signal or ATMS conduit, locate conduit within 0.3 m of existing parallel conduit run.

F. Install all conduit bends to have a radius that is:
   1. Not less than 12 times the inside diameter of the conduit.
   2. Not less than the minimum bend radius of the cable installed within, per cable manufacturer's specifications.

G. Install conduits that cross finished curbs and gutters, sidewalks, concrete flatwork, textured or decorative surfaces by boring, jacking, or drilling. Entirely replace any damaged section at no additional cost to the Department.

H. Obtain appropriate permits before work commences.

3.2 TRENCH FOR CONDUIT

A. Paved Surface (asphalt concrete):
   1. Prior to any backhoe use, sawcut roadway to roadway base on both sides of trench to provide clean, straight wall for T-patch.
   2. Use flowable fill to within 90 mm -150 mm of the existing roadway surface, depending on the existing pavement thickness.
   3. Minimum soil compaction under pavement: 96 percent.
   4. Evenly apply tack coat before final backfill.

5. Restoration patch: match the composition, density, and elevation (±5 mm), of the existing surface.

B. Sidewalk or Decorative Pavement.
1. Use flowable fill to within 90 mm -150 mm of the existing roadway surface, depending on the existing pavement thickness.
2. Minimum soil compaction under pavement: 96 percent.
3. Restore sidewalk or decorative pavement to original condition or better after work is completed.

C. Unpaved Surface:
1. Use backfill that matches the composition, density, and elevation (±5 mm) of the existing surface.
2. Dispose of surplus material daily.

D. Conduit under Railroad Right-of-Way: Refer to Section 00725, Article: Railway Highway Provisions, and appropriate Railroad, such as Union Pacific Railroad, Standard Specifications:
1. Coordinate all work with appropriate Railroad personnel.
2. Complete Railroad Safety Training.

E. Minimum cover of conduit:
1. Minimum cover in sidewalks, paved ditches, unlined ditches, gutters: 610 mm.
2. Minimum cover in highway right of way under pavement surface: 915 mm.
3. Minimum cover within 6.1 m of edge of pavement where signs or delineators are located: 1.5 m.
4. Where final landscape above conduit is not finished and has elevation greater than adjacent curb, use top back of curb as base elevation for determining minimum cover.

F. Warning Tape:
1. Install orange warning tape with black legend CAUTION - BURIED COMMUNICATION CABLE in all trenches containing multi-duct conduit or conduit containing communication cables.
2. Install red warning tape with black legend CAUTION - BURIED ELECTRIC in all other trenches.
3. Not required when flowable fill is directly overlayed with asphalt pavement or PCCP.
4. Not required when boring conduit.

G. Locator Wire:
   1. Install #14 THHN solid green locator wire continuously in 19 mm conduit and bond to grounding rods within each junction box.
   2. Mount locator wire connection device to the side wall of each junction box using a mounting rail.
   3. Connect the locator wire to the terminal block and connect the terminal block to the ground rod.
   4. Weld or clamp locator wire at transition if a sweep is used in place of a junction box at a transition between GRS and PVC. Provide corrosion protection as per NEC Article 346, at location of weld or clamp.

3.3 INSTALL CONDUIT

A. Place all conduits in the same trench before surfacing.

B. Above ground use galvanized rigid steel; underground use PVC or HDPE. Apply corrosion protection per NEC Article 346 to any portion of galvanized rigid steel conduit buried in the ground or encased in concrete.

C. Seal uncapped conduit ends inside junction box with duct seal. Insert seals a minimum of 50 mm inside the conduit.

D. Install #14 stranded THHN pull wire in all empty conduit including all cells of multi-duct conduit.
   1. On each end of conduit install plug with 6 mm hole for pull wire.
   2. Leave 0.6 m of pull wire outside of the plug and fasten securely to plug.

E. Place all conduit that passes through a structural member in a metallic sleeve.

F. Secure conduit on structures with standard galvanized iron conduit clamps using at least 8 mm diameter concrete expansion anchors at maximum 1.5 m spacing.

G. Use conduit expansion fittings at structure expansion joint crossings.

H. Install all conduits so the backfill completely surrounds all exterior surfaces of the conduit. Separate multi-duct conduits using a commercially available conduit spacer or approved equivalent.

I. Install a bushing or adapter at ends of all nonmetallic conduit that contains a conductor per NEC section 347, to protect the conductor from abrasion. Install rounded bushings on the ends of metal conduits per NEC section 347.

J. Fill all new and existing conduit to less than 40 percent as per NEC.

K. Install bends in the multiconduit to be manufactured sweeps (11 1/4, 22 1/2, 45, 90 degree angle) with conduit compatible bell and spigot ends.

L. Prior to pouring flowable fill, anchor the conduit in trench, at 5 m intervals, to maintain the required conduit depth during pour.

M. Minimum separation between all conduit is 38 mm. This does not include the separation between individual conduit within a single cluster of multiduct conduit, which are permitted to be closer.

N. Minimum separation between all conduit and the wall of the trench is 38 mm.

O. Place the locator wire conduit on the plane of the uppermost conduit in the trench. The separation between the locator wire conduit and other conduit may be less than 38 mm.

P. In native earth, do not place flowable fill closer than 150 mm to finished grade.

Q. If flowable fill is used, encapsulate conduit a minimum of 75 mm above the top conduit with flowable fill.

3.4 USE OF OCCUPIED CONDUIT

A. Maintain the physical condition and functional integrity of all cabling and wiring in existing occupied conduit.

B. Prior to installing fiber optic cable in an occupied conduit:
   1. Remove any existing fiber optic cable/copper wire
   2. Re-pull new and existing fiber optic cable/copper wire together
   3. Perform all necessary fiber splices, replace any impacted fiber cable spider fan-out kits
   4. Perform all additional necessary work needed to restore existing fiber optic system

3.5 REPAIR/RESTORATION

A. Restore all areas, including landscaping, concrete pavement, asphalt, finished curbs and gutters, box culverts, sewers, underground water mains, sprinkler systems, sidewalks, concrete flatwork, textured or decorative surfaces, that were damaged during conduit and junction box installation.

B. Coordinate with local utilities for utility repair. Advise the Engineer of all repairs.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13554

POLYMER CONCRETE JUNCTION BOX

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install polymer concrete junction box, ground rod, and maintenance marker.

1.2 RELATED SECTIONS

A. Section 02061: Select Aggregate

B. Section 02842: Delineators

C. Section 02892: Traffic Signal

D. Section 03055: Portland Cement Concrete

1.3 REFERENCES

A. ANSI/UL 467: Grounding and Bonding Equipment.

B. ASTM C 109: Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2 inch or 50 mm cubes).

C. ASTM C 496: Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens.

D. ASTM C 1028: Standard Test Method for Determining the Static Coefficient of Friction of Ceramic Tile and Other Like Surfaces by the Horizontal Dynamometer Pull Meter Method.

E. ASTM D 543: Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.

F. ASTM D 570: Standard Test Method for Water Absorption of Plastics.

G. ASTM D 635: Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastic in a Horizontal Position.

H. ASTM D 790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Insulating Materials.

I. ASTM G 154: Standard Practice for Operating Flourescent Light Apparatus for UV Exposure of Nonmetallic Materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Provide special termination kits from the conduit manufacturer for terminating the conduit in junction boxes. Provide kits that form a watertight seal of conduit to structure wall.

B. Use free draining granular backfill borrow as per Section 02061.

C. Provide maintenance markers for junction boxes along freeways and expressways.

D. Provide concrete AA(AE) for concrete collar. Refer to Section 03055.

E. Fabricate junction boxes per the size and type specified in the plans. Boxes are made from polymer-concrete.

F. Use body, ring, and lid meeting the physical and chemical requirements listed in Table 1:

Table 1

Property	ASTM Test	Value
Compressive Strength	C 109	75 800 kPA
Flexural Strength	D 790	51 700 kPA
Tensile Strength	C 496	11 700 kPA
Effects of Acids	D 543	Very Resistant
Effects of Alkalies	D 543	Very Resistant

G. Provide all components with ultraviolet inhibitors per ASTM G 154.

H. Provide all components flame-resistant per ASTM D 635.

2.2 JUNCTION BOXES AND LIDS

A. Provide junction boxes and vaults that resist water absorption in accordance with ASTM D 570.

B. "Load Rating 3" for Non Wheel Loading Accessible, Behind Sidewalk

1. In area behind sidewalk, provide boxes, rings, and lids that sustain a minimum vertical test load of 5443 kg over a 254 mm x 254 mm square.

C. "Load Rating 2" for Incidental Vehicular Traffic:

1. In area not in traveled way, provide boxes, rings, and lids that sustain a minimum vertical test load of 10 200 kg over a 254 mm x 508 mm square.
2. Provide concrete collar per Standard Drawing 2100-7 for all boxes that may experience incidental traffic.

D. "Load Rating 1" for Deliberate Vehicular Traffic:

1. In traveled way, or in any paved area immediately adjacent to the mainline, such as shoulders, snow storage areas, or vehicle pullout areas, provide boxes, rings, and lids that sustain a minimum vertical test load of 20 400 kg over a 254 mm x 510 mm square.
2. Provide steel ring and steel lid.

E. Provide a poured-in-place 25 mm thick grout floor, with a 25 mm diameter drain, for all type I-PC, II-PC, and III-PC boxes.

F. Provide lid for all junction boxes as specified by application.

G. Provide lids with a non-skid surface with minimum coefficient of friction of 0.50, per ASTM C 1028. Coatings will not be approved.

H. Mark the junction box lid in the logo area with 25 mm letters:

1. "Traffic Signal" when the junction box contains cables or wires for traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.

2. “Traffic Signal” when the junction box contains power conductors under 480 V used for traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.
3. “Electric - 480 V” contains power conductors at 480 V used for traffic signal, CCTV, VMS, RWIS, WIM, ramp meter, traffic monitoring, or any other ATMS element.
4. “Street Lighting” when the junction box contains street lighting conductors only. Inscribe “High Voltage” below the words “Street Lighting” when the junction box contains voltage above 600 V.
5. "Communication” when the junction box contains multiduct conduit for future use.
6. “Sprinkler Control” when sprinkler control conduit enters the junction box.

I. Provide lids with recessed access point to allow removal of cover with a hook or lever. Damage to the pulling point in the lid must be repaired.

J. Provide lids with vandal-resistant stainless steel recessed bolts.

2.3 MAINTENANCE MARKERS

A. Steel posts: Refer to Section 02842.

2.4 BACKFILL

A. Compact free draining granular backfill borrow under junction boxes. Refer to Section 02061.

2.5 DUCT SEAL

A. Waterproof, rodent proof, non-corrosive, non-oxidizing, and non-hardening when subject to temperatures ranging from -25 degrees C to 65 degrees C. Do not use foam sealant.

2.6 GROUND ROD

A. Copper-coated steel as specified.

B. ANSI/UL 467.

2.7 GROUND WIRE

A. Ground Wire: Refer to Section 02892.

PART 3 EXECUTION

3.1 JUNCTION BOX AND EXTENSION

A. Install per manufacturer's recommendations.

B. Cast conduit holes in junction box at the time of precasting or drill at the time of placement with no structural damage to the box.

1. Holes drilled in junction box must not be more than 6 mm larger than conduit diameter.
2. Seal conduit ends inside all junction boxes with at least 50 mm thick duct caulking after wires are installed.

C. Place the top of the junction box flush with the surrounding grade or set at the planned finished grade.

D. Hand tamp the backfill material around the junction box. Match the top 100 mm to the composition, density, and elevation of the surrounding surface.

E. Do not install junction boxes inside of railroad right of way.

F. Field locate junction boxes to avoid steep slopes and low lying locations with poor drainage.

G. Do not install junction boxes within the traveled way, shoulders, or on approaches to signal poles.

H. Do not install conduit in corner of junction box, or within 50 mm of corner of junction box. Extend multiduct conduit 150 mm (nominal) beyond the inside wall of the junction box. Extend all other non-multiduct conduits 50 mm minimum to 75 mm maximum beyond the inside wall of the junction box. Refer to Standard Drawing 2100-7.

I. Extend conduit entering through bottom of junction box 100 mm above the top of floor.

J. Orient the recessed access point in a location which provides both leverage and safety.

K. Saw cut concrete or other improved surfaces that require removal in the sidewalk area. Remove entire section of sidewalk. Replace with in-kind materials to match the existing grade.

L. Provide 300 mm deep free draining granular backfill borrow directly under junction box.

M. Install expansion joint material around entire periphery of ring for junction boxes installed in paved surface.

3.2 CONCRETE COLLAR

A. See Standard Drawing 2100-7.

B. Concrete: AA(AE). Refer to Section 03055.

C. Do not install concrete collar for junction boxes in paved surface. Install concrete collars in areas of incidental traffic.

3.3 GROUND ROD

A. Install ground rod to extend maximum 50 mm above box floor.

B. Attach ground wire or locator wire with clamps.

3.4 RESTORATION

A. Restore all areas damaged during the installation of the junction boxes.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13555

ATMS CABINET

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish and install or modify concrete foundations of the size and type as specified in the plans.

B. Install ATMS Equipment Cabinet.

1.2 RELATED SECTIONS

A. Section 02892: Traffic Signal

B. Section 03055 : Portland Cement Concrete

C. Section 03152: Concrete Joint Control

D. Section 03211 : Reinforcing Steel and Welded Wire.

E. Section 13553 : ATMS Conduit

F. Section 13554 : Polymer Concrete Junction Box

1.3 REFERENCES

A. ASTM A123/A123M: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

B. ASTM A307: Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.

C. ASTM B766: Standard Specification for Electro-deposited Coatings of Cadmium.

1.4 SUBMITTALS

A. Submit samples of materials for approval when requested.

B. Submit two copies of the following within 15 days after receiving Notice to Proceed:

1. List of equipment and materials (name of manufacturer, size, and identification number)
2. Wiring diagrams and certifications.
3. Warranties, guarantees, instruction sheets, parts list.

PART 2 PRODUCTS

2.1 CABINET FOUNDATION

A. Concrete: A(AE) required. Refer to Section 03055.

2.2 BOLTS, NUTS, AND HARDWARE

A. For cabinet mounts, provide wedge expansion type, or poured in place, anchor bolts.

1. 19 mm x 200 mm expansion anchor bolts.
2. 40 kN pullout strength.

B. Provide commercially available framing strut to attach transformers, breaker enclosures, disconnects, or other electrical equipment to cabinet foundation.

1. 12-gauge, U-shaped stainless steel product with 14 mm diameter pre-drilled holes.
2. cross-section dimensions: 41 mm by 41 mm minimum.

C. For framing struts, provide wedge expansion anchor bolts to secure framing strut to foundation.

1. 13 mm x 200 mm embedded a minimum of 150 mm in foundation.
2. shear capacity of 10.9 kN and pullout tension capacity of 11.3 kN.

D. Provide stainless steel, galvanized, or zinc plated bolts, nuts, washers, struts, and hardware, as specified.

1. Steel as specified. ASTM A 307.
2. Galvanized as specified. ASTM A 123.
3. Zinc plated as specified. ASTM B 766.

E. Provide nuts that are free-running, by hand, for total thread length.

F. Provide all bolted connections with lock washers, locking nuts, or other approved means to prevent the connection nuts from backing off.

G. Provide nipples, elbows, and grommets necessary for wiring.

2.3 CONDUIT

A. Refer to Section 13553, ATMS Conduit.

B. Refer to Section 02892, Paragraph 2.7, Electrical Conduit.

2.4 JUNCTION BOX AND GROUND ROD

A. Refer to Section 13554, Polymer Junction Box.

2.5 POWER SOURCE

A. Refer to Section 02892, Paragraph 2.13, Power Source.

2.6 TRANSFORMER AND DISCONNECT

A. Submit to the Engineer specifications for approval.

2.7 BITUMINOUS JOINT FILLER

A. Preformed material. Refer to Section 03152.

PART 3 EXECUTION

3.1 PREPARATION

A. Maintenance platforms are required when surrounding area is not paved. Platforms provide access to the cabinets for maintenance activities. Locate cabinet in an area where full access is allowed.

B. Repair any damage to existing utilities.

C. Restore area to the condition prior to beginning work.

D. Field locate cabinet location with the Engineer. Avoid areas with poor drainage. Satisfy clear zone requirements.

3.2 CONSTRUCT CABINET FOUNDATION

A. Reinforcing Steel and Welded Wire : Refer to Section 03211.

B. Verify bolt pattern, conduit runs, and foundation dimensions prior to foundation construction.

1. Orient anchor bolts to accommodate conduit runs.
2. Embed strut anchor bolts a minimum of 150 mm into foundation
3. Embed cabinet anchor bolts a minimum of 150 mm into foundation.

C. Concrete : A(AE) required. Refer to Section 03055.

D. Do not weld reinforcing steel, conduit, or anchor bolts.

1. Use tie wire to secure conduits.
2. Use template to align and secure anchor bolts.
3. Locate steel, conduit, or anchor bolts a minimum of 75 mm from concrete edge.

E. Place the concrete directly into the excavation. Use minimum forming above ground.

F. Provide 915 mm minimum clearance between foundation and all walls, guardrails, poles, and other above-ground features.

G. Do not extend conduit stubs in cabinet more than 75 mm above floor of foundation.

H. Conduit

1. Install all conduit in base of cabinet in a 300 mm x 450 mm rectangle centered in the cabinet base.
2. Refer to the Project Plans for the number, size, and orientation of all conduits entering the junction boxes.
3. Conduit (typical) for power from cabinet with disconnect to Type I junction box
   a. One-38 mm from cabinet to disconnect
   b. One-38 mm from disconnect to Type I junction box
4. Conduit (typical) for power from cabinet with disconnect/stepdown transformer to Type I junction box
   a. One-50 mm from disconnect to Type I junction box
   b. One-38 mm from disconnect to transformer
   c. One-38 mm from transformer to cabinet
5. Conduit (typical) for communication from cabinet to Type II junction box
   a. Two-75 mm
   b. Four-50 mm
6. Conduit (typical) for communication stubbed out of Type II junction box
   a. Two-75 mm
   b. Four-50 mm
   c. One-75 mm (used as a spare conduit)
7. Above ground, use galvanized rigid steel; underground, use PVC.
8. Install bushings on the ends of metallic conduit. Install end bells on non-metallic conduit.
9. Provide 25 mm minimum spacing between conduit in cabinet base. Cap conduit at both ends until used. Stub conduit a maximum of 75 mm above the concrete base.

I. Orient the cabinet to allow maintenance personnel facing the front door of the cabinet to also face the device (such as VMS, CCTV, RMS, TMS, etc). Orient the cabinet such that the door that accesses the front face of the control equipment is adjacent to the Type II-PC junction box.

J. Trowel finish the foundation surface and level prior to cabinet installation. After the concrete base has cured, leveling can only be accomplished by grinding the top surface.

K. Bituminous filler at concrete joints. See section 03152.

3.3 INSTALL ATMS CABINET ON FOUNDATION

A. Securely fasten the cabinet on concrete foundation. After the cabinet has been installed on the foundation, the cabinet door must be able to fully open and close.

B. Provide a rain-tight seal that does not degrade the NEMA 3R rating of the enclosure for all conduit fittings and chases to adjoining enclosures.

C. Isolate dissimilar materials from one another by stainless steel fittings.

D. Make all power connections as shown in plans.

1. Isolate the neutral bus from the cabinet and equipment ground.
2. Terminate the neutral bus at the neutral lug attached to the meter pedestal.

E. Install caulk between base of cabinet and top of foundation.

3.4 INSTALL DISCONNECT AND/OR TRANSFORMER

A. Install 12 gauge framing strut to the foundation with 3 expansion anchors per superstrut.

B. Install disconnect and transformer on the side of cabinet that faces away from the nearest traffic. If wall blocks access to disconnect, then install the disconnect and transformer on the opposite side of cabinet.

C. Ground disconnect on ground rod located in Type I junction box.

D. Ground the transformer to the control cabinet ground terminal.

E. Install disconnect and/or transformer per manufacturer's instructions.

F. Install 16 mm spacers on each expansion anchor between foundation and disconnect.

3.5 INSTALL WIRING

A. Conductors:

1. Clean and dry the inside of the conduit before installing conductors.
2. Install grounding conductor in all power circuit conduits.
3. Use powered soapstone, talc, or other approved lubricants when pulling conductors in conduit.
4. Tape the ends of unused conductors and label them as spares.

B. Ground Wire:

1. Clamp the ground wire from the cabinet ground to the ground rod in the Type II junction box.

C. Neatly arrange wiring within cabinets and junction boxes.

D. Terminate all terminal connections by a mechanical (spade) connector.

E. Identify and label all field terminals and cables.

3.6 INSTALL POWER SOURCE

A. Verify the exact location, voltage, procedure, and materials required by the power company.

B. Follow Standard Drawing 745-55E.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13556

CLOSED CIRCUIT TELEVISION (CCTV) ASSEMBLY

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Install all State-furnished items including CCTV assembly, pan/tilt unit, camera control receiver, pole cabinet, and freeway pole with anchor bolts.

B. Furnish and install foundation, wood pole, and any additional equipment required for a complete and operational CCTV assembly.

C. Test the installed CCTV using Department furnished software. (Furnish remainder of test equipment including laptop).

1.2 RELATED SECTIONS

A. Section 03211: Reinforcing Steel and Welded Wire

B. Section 03310: Structural Concrete

C. Section 13551: General ATMS Requirements

D. Section 13553: ATMS Conduit

E. Section 13554: Polymer Concrete Junction Box

F. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. AASHTO M31M: Deformed and Plaint Billet-Steel Bars for Concrete Reinforcement.

B. AASHTO M111: Zinc (Hot Dipped Galvanized) Coatings on Iron and Steel Products.

C. AASHTO M 284M: Epoxy Coated Reinforcing Bars.

D. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaries, and Highway Bridges.

E. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals.

F. ASTM A36: Standard Specification for Carbon Structural Steel.

G. ASTM A123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron or Steel Products.

H. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

I. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

J. NEC 250.1: National Electric Code.

1.4 SUBMITTALS

A. Submit two copies of the following to the Engineer within 15 days after receiving the Notice to Proceed. (Submit samples of all materials, when requested).

1. List of equipment and materials (name of manufacturer, size, and identification number).
2. Detailed shop drawings, wiring diagrams, and certifications.
3. Provide copies of all manufacturers' warranties, guarantees, instruction sheets, and parts lists.
4. Camera Cable Test and Local Field Operations Test plan. Engineer will accept or reject these plans within ten days of receipt.

B. Submit copies of the Camera Cable Test results, including any unsuccessful and subsequently successful tests to the Engineer prior to any Field Operations testing.

C. Upon successful completion of both the Camera Cable Test and the Local Field Operations Test, demonstrating that the work is in accordance with the specifications, deliver within three days, a written Completion Notice to the Engineer along with a copy of the test results.

1.5 TESTING AND ACCEPTANCE

A. Complete the following:

1. Camera Cable Test
2. Local Field Operations Test

B. Notify the Engineer two days prior to CCTV installation so that the Engineer can be present to establish appropriate pan and tilt stops for the Contractor to set.

C. Notify the Engineer at least two days in advance of the proposed date for the Camera Cable Test and Local Field Operations Test. The Engineer will have the right to witness such tests or to designate an individual or entity to witness such tests on the Departments behalf.

D. Perform the following Camera Cable Test as indicated following the approved test plan. Furnish all equipment, appliances, and labor necessary to test the installed camera cable between the camera assembly and the camera control receiver. Perform the following tests before any connections are made:

1. Perform continuity test on the camera cable. Camera cable must not exhibit any discontinuities such as opens, shorts, crimps, or defects.
2. Perform continuity tests on the stranded conductors element of the camera cable using a meter having a minimum input resistance of 20,000 ohms per volt. Show that each conductor has a resistance of not more than 16 ohms per 300 meters of conductor.
3. Measure the insulation resistance between the conductors and between each conductor, ground, and shielding using a meggar meter. The resistance must be infinity. Perform all resistance testing after final termination and cable installation, but prior to connection of any electronics or field devices.

4. Replace any cable that fails to meet these parameters, or if any testing reveals defects in the cable. Retest new cable as specified above.
5. Furnish all test equipment.

E. Perform the following Local Field Operations Test at the CCTV field site, in accordance with the approved test plans. Demonstrate the following after the camera controller assembly, other camera hardware, power supply, and connecting cabling have been installed:

1. Verify physical construction has been completed in accordance with the plans and specifications.
2. Inspect quality and tightness of ground and surge protector connections.
3. Check power supply voltages and output.
4. Connect devices to power source.
5. Verify installation of specified cables and connections between camera, pan/tilt unit, camera control receiver.
6. Set the camera control address.
7. Verify presence and quality of video image with a vector scope and a portable NTSC monitor.
8. Test local operation of all CCTV equipment
   a. Exercise the pan, tilt, zoom, focus, iris opening, and manual iris control selection and operation, low pressure alarm (if present), pre-set positioning, and power on/off function.
   b. Observe the video picture on a portable video and waveform monitor.
9. Demonstrate camera sensitivity at low light levels to meet the specified requirements.
10. Demonstrate pan/tilt speed and extent of movement to meet the specified requirements.
11. Measure video signal level at the communications interface with a waveform monitor to verify NTSC Standards.
12. Verify proper voltage of power supply.

F. Deliver within three days, a written Completion Notice to the Engineer along with a copy of the test results upon successful completion of such test.

1. In the first part of the Completion Notice, document any discrepancies.
2. Within ten days of receipt of the Completion Notice and test results, the Engineer will either accept or reject the work (specifying, if rejected, the defect of failure in the work) by delivery of written notice to the Contractor.

G. In the event the Engineer rejects the work, the Contractor will promptly remedy the defect of failure specified in Engineer's notice.

1. Provide the Engineer with a Completion Notice.
2. The Engineer may identify an independent, third party to specify what defects must be addressed in order for the work to meet the specifications.

H. The Engineer may authorize others to complete the work at the Contractors expense if the Contractor fails to remedy any identified deficiencies in the work within ten days of receipt of the Completion Notice.

PART 2 PRODUCTS

2.1 CCTV POLE OR LUMINAIRE

A. Wood Pole Mounted CCTV: provide class 5 or 6 Douglas Fir wood pole, treated with Chromated Copper Arsenate CCA Type C, 10 meters nominal length and not less than 133 mm diameter at top.

B. Steel Pole Mounted CCTV: steel pole with anchor bolts provided by the Department.

1. Anchor bolts: conform to M 270 Grade 36.
2. Nuts, washers, and anchor bolts: galvanized according to ASTM A153.

C. Luminaire Mast Arm Mounted CCTV: provide luminaire extension per Section 02892 and Std Dwg 745-55A1.

2.2 CCTV STEEL POLE FOUNDATION

A. Class AA(AE) concrete. See Section 03055.

B. Reinforcing Steel

1. Coated.
2. AASHTO M284 or M111
3. AASHTO M 31M Grade 400

C. Non-Shrink Grout.

2.3 JUNCTION BOX

A. See section 13554, Polymer Concrete Junction Box.

2.4 CCTV ASSEMBLY

A. Department funished:

1. Camera assembly, including camera, pan/tilt unit, control receiver, environmental enclosure, and cabling.

2. Type G Pole mount cabinet.

2.5 MOUNTING EQUIPMENT

A. Provide clamp kit, mounting hardware, pipe, shims, grommet, and all additional equipment to attach CCTV assembly to pole or mast arm.

B. Provide all stainless steel or hot-dipped galvanized fasteners and hardware unless otherwise approved. Provide copper pole grounding lug.

2.6 24VAC TRANSFORMER

A. Department furnished: 24VAC transformer for powering the CCTV enclosure.

2.7 RS-232/RS-422 CONVERTER

A. Department furnished: converter for connecting communication equipment to CCTV enclosure.

2.8 DATA SURGE SUPPRESSOR

A. General characteristics (typical):

1. Typical application: RS-422.
2. Surge: 36 kA.
3. Turn-on at 10 mA: +2.8/-0.6 V dc.
4. Resistance: 1 Ohm.
5. Capacitance: 30 pF.
6. Energy: 425 J.
7. Let-through: less than +10/-1 Vp (peak open circuit voltage at max current).

8. -3dB (600 Ohms) BW: 95Mhz
9. Temperature: -40 degrees C to 85 degrees C Storage/Operating 50 degrees C.

2.9 VIDEO SURGE SUPPRESSOR

A. General characteristics (typical):

1. Typical application: VLF/HF receive only, LAN, closed circuit video.
2. Surge: 18 kA IEC 1000-4-5 8/20 ms waveform 110 Joules.
3. Turn-on Time: 4 ns for 2 kV/ns.
4. VSWR: less than or equal to 1.1 to 1 over frequency range.
5. Insertion Loss: less than or equal to 0.3 dB over frequency range.
6. User Current: 2.0A dc continuous.
7. Vibration: 1G up to 100Hz.
8. Temperature: -45 degrees C to +85 degrees C Storage/Operating 45 degrees C.

2.10 POWER LINE SURGE SUPPRESSOR

A. Conform to the following requirements (typical):

1. Peak surge current occurrences: 20 minimum.
2. Peak 8x20 msec wave shape: 20K amps.
3. Response: 250 maximum.
4. Maximum current at 120-VAC, 60Hz: 10 amps.
5. Series inductance: 200 mH.
6. Temperature: NEMA TS-1.

B. Provide two stage power line surge protector that allows the connection of a radio interference filter (to prevent disruption in the event of a power surge) in the circuit between the stages. Equip each cabinet with one or more radio interference filters in the power line surge protector to provide attenuation of at least 50 dB over a range of 50 KHz to 20 MHz.

2.11 DEPARTMENT FURNISHED MATERIALS PICK UP

A. Pick up all Department furnished camera assemblies and cabinets at:

Utah Department of Transportation
Traffic Operations Center
2060 South 2760 West
Salt Lake City, UT 84104-4592

Contact the Engineer seven calendar days before pick-up date.

B. Pick up all Department furnished poles, anchor bolts, and light pole extensions at:

UDOT Complex
4501 South 2700 West
Salt Lake City, Utah 84119

PART 3 EXECUTION

3.1 INSTALLATION

A. Conform to the requirements of the NEC, current edition.

B. Load, transport, and install all state-furnished materials per the manufacturer's instructions and as shown in the plans.

C. Provide foundation, junction boxes, ground rod, grounding lug, conduit, stainless steel mounting bands, wood pole, and all additional equipment required for a complete and operational CCTV system.

D. Install all wiring, conduit, and junction boxes as shown on site plans and details.

1. Field locate all conduits and junction boxes to avoid drainage areas and steep slopes whenever possible.
2. Protect existing conductors while installing camera cables and conductors.

E. Connect the controller and all wires as specified by the manufacturer.

F. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the CCTV system complete.

G. After installation, the exterior of all equipment: free of all loose rust and mill scale, dirt, oil, grease and other foreign substances.

3.2 STEEL CCTV POLE FOUNDATION

A. All material and workmanship conforms to AASHTO's Standard Specifications for Highway Bridges.

B. Verify that the installation of the CCTV camera, pole, pole mount cabinet, junction boxes, and foundation in the location marked in the field has no conflict with existing utilities, underground and overhead. Comply with all utility and blue stake requirements.

C. Excavation

1. See Section 13551.

D. Caissons conform to AASHTO Division II Section 5, Drilled Piles and Shafts. Drill caissons into either native soil or compacted fill.

1. If formwork is required during drilling, the forms may be withdrawn during concrete placement.
2. Cast the top of the caisson against the formwork for appearance.

E. Place concrete directly into the excavation. Use minimum forming.

F. Do not weld reinforcing steel, conduit, or anchor bolts; tie reinforcing steel and conduit securely in place.

G. Coat all reinforcing steel to conform to AASHTO M284 or M111 and AASHTO M31M Grade 420, respectively. Coat the ends of cut reinforcing with approved coating.

H. All cast-in-place concrete will be class AA(AE) except where specified otherwise. Cap all conduits before placing concrete.

I. After pole is installed, place non-shrink grout between base plate and foundation surface.

J. Install weep hole in foundation per Standard drawing SL 4.

3.3 ANCHOR BOLTS

A. Refer to Section 13551.

3.4 STEEL CCTV POLES

A. Install the metal camera poles on concrete bases as described herein. Apply rust, corrosion, and anti-seize protection at all threaded assemblies by coating the mating surfaces with an approved compound.

B. Install pole such that the hand hole is facing away from traffic.

C. Install ground rod. NEC 250.

D. All fasteners and attachment hardware for bands and other equipment: stainless steel.

E. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, electrical nuts, etc., necessary to make the CCTV system complete.

F. Adjusting the anchor bolt nuts, plumb all steel poles to the vertical with all camera equipment installed.

G. Pole Mount Cabinet

1. The Department rejects poles that are damaged by improper drilling of holes.
2. Drill and nipple holes at each site.
3. Touch-up by hot stick method.

3.5 WOOD CCTV POLE

A. Install wood pole below grade to a minimum depth equal to one sixth the total pole height.

B. Tamp and compact surrounding grade to match existing soil compaction.

3.6 CCTV ASSEMBLY

A. Assemble the camera assembly and prepare for installation per the manufacturer's instructions prior to delivery to the job site.

B. Deliver the assemblies to the job site as complete units, and install as per the plan details.

3.7 CCTV CABLES

A. Install camera cables in conduit and poles. All cable runs must be continuous and must run without splices between the camera and the cabinet.

B. Keep cable ends sealed at all times during installation using an approved cable end cap. Keep cable end sealed until connectors are installed.

C. Do not violate the minimum bending radius and the maximum pulling tension recommended by the manufacturer's specifications at any time.

D. Provide 1.8 m of cable slack in all cabinets.

E. Make all camera cable connections between the CCTV assembly, RS-422/RS-232 converter, and communications equipment, as required to provide a fully operational CCTV system.

3.8 CONDUCTORS

A. Domed CCTV: furnish and install 3-#12 stranded IMSA Spec 20-1 power conductor cables between the 24 VAC transformer in the cabinet and the cabinet assembly on the luminaire arm.

B. Freeway CCTV: furnish and install 3-#6 from camera assembly to cabinet.

C. Freeway CCTV with Pole Mounted Cabinet: furnish and install 3-#12 from camera assembly to cabinet.

D. Splices: not allowed between camera and cabinet.

3.9 POLE MOUNTED CABINET

A. Install cabinet such that cables enter the underside of the cabinet.

B. Arrange all equipment installed in the cabinet in a neat and orderly fashion on cabinet shelf.

C. Install pole mounted cabinet such that it faces away from traffic. Use stainless steel bands.

3.10 JUNCTION BOX

A. Refer to section 13554.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13557

VARIABLE MESSAGE SIGN

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Install all Department-Furnished items including VMS, cabinet, controller and any additional equipment required for a complete and operational VMS assembly.

B. Furnish and install VMS tubular support structures, sign connection hardware, catwalk, cabinet foundations and any additional equipment required for a complete and operational VMS assembly.

C. Test the installed VMS. Adjust VMS viewing angle as required.

1.2 RELATED SECTIONS

A. Section 01554: Traffic Control

B. Section 02466: Drilled Caisson

C. Section 02841: Traffic Barriers

D. Section 02843: Attenuation/End Section

E. Section 03152: Concrete Joint Control

F. Section 03211: Reinforcing Steel and Welded Wire

G. Section 03310: Structural Concrete

H. Section 05120: Structural Steel

I. Section 13551: General ATMS Requirements

J. Section 13553: ATMS Conduit

K. Section 13554: ATMS Junction Box

L. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. AASHTO M 31M: Deformed and Plaint Billet-Steel Bars for Concrete Reinforcement

B. AASHTO M 32: Steel Wire, Plain, for Concrete Reinforcement

C. AASHTO M 111: Zinc (Hot-dip Galvanized) Coatings on Iron and Steel Products

D. AASHTO M 232: Zinc (Hot-dip Galvanized) on Iron and Steel Hardware

E. AASHTO M 270: Carbon and High-Strength Low-Alloy Structural Steel Shapes, Plates, and Bars and Quenched and Tempered Alloy Structural Steel Plates for Bridges

F. AASHTO M 284M: Epoxy Coated Reinforcing Bar

G. AASHTO Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

H. ASTM A 36: Carbon Structured Steel

I. ASTM A 53: Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

J. ASTM A 123: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

K. ASTM A 153: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Hardware (nuts, washers, and anchor bolts)

L. ASTM A 307: Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength

M. ASTM A 325: Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

N. ASTM F 436M: Hardened Steel Washers (Metric)

O. ASTM A 563M: Carbon and Alloy Steel Nuts

P. ASTM F 593M: Stainless Steel Bolts, Hex Cap Screws, and Studs

Q. ANSI/AASHTO/AWS D1.5: Welding Specifications

R. National Electric Code (NEC)

1.4 SUBMITTALS

A. Mill Certificates for all structural steel, Refer to Section 05120 Article Submittals.

B. Shop Drawings for all structure steel, Refer to Section 05120 Article Submittals.

C. Test results for all tests.

1.5 TESTING AND ACCEPTANCE

A. Complete the Local Field Operations Test.

B. Testing:

1. Submit Local Field Operations testing plan to Engineer for approval prior to testing. Do not perform any testing until the Engineer has approved the testing plans.
2. Submit documentation of successful completion of test to the Engineer for approval prior to final acceptance.

C. Notify the Engineer at least two days in advance of the proposed date for the Local Field Operations Test. The Engineer has the right to witness such tests or to designate an individual or entity to witness such tests.

D. Perform the following Local Field Operations Test as indicated, following the approved test plan. After all local installations are complete and the sign is functional, the Contractor will demonstrate to the Engineer all hardware, cables, and connectors have been properly installed and that all functions are in conformance with the requirements as stated in the Plans and Specifications.

Contact Engineer twenty four hours in advance of local testing. Local testing is not complete until TOC personnel are able to verify the following:

1. Power supply voltages and the functionality of the fans and heaters for both the sign housing and controller cabinet.
2. Accurate ambient light measurements are being read from the photocells (front, back and top).
3. Accurate sign temperature readings are measured in the sign and controller cabinet.
4. Sign diagnostic tests perform properly.
5. Sign message can be displayed and blanked.
6. Proper vertical and horizontal angle of the sign.
7. Presence of dial-tone inside the cabinet.
8. Sign status information can be remotely and accurately viewed from TOC.
9. TOC can initiate sign diagnostic tests and display and then blank the sign message.

E. Upon successful completion of such tests, deliver within three days, a written Completion Notice to the Engineer along with a copy of the test results.

1. Included in the first part of the Completion Notice will be a section specifically documenting any discrepancies.
2. The Engineer will within ten days of receipt of the Completion Notice and test results, either accept or reject the Work (specifying, if rejected, the defect of failure in the Work) by delivery of written notice to the Contractor.

F. In the event the Engineer rejects the Work, the Contractor will promptly commence to remedy the defect of failure specified in Engineer's notice.

1. Thereafter, the Contractor gives the Engineer a Completion Notice.
2. In the event that the Engineer has not accepted the installation after this second round of tests, the Engineer may identify an independent; third party to specify what defects must be addressed in order for the Work to meet the Specifications.

G. If Contractor fails to remedy any identified deficiencies in the Work within ten days of receipt of the Completion Notice The Engineer may authorize others to complete the work at the Contractors expense.

PART 2 PRODUCTS

2.1 VMS FOUNDATIONS

A. Concrete: Class AA (AE) required. Refer to Section 03055.

B. Reinforcing Steel:

1. Deformed billet-steel bars conforming to AASHTO M 284M and M 31M (Grade 400) respectively.
2. Coated.
3. Spiral reinforcing steel must be #15 conforming to AASHTO M32 except minimum tensile strength of 400 MPa.

C. Anchor Bolts:

1. Conform to AASHTO M270 Grade 36 and ASTM A 307 Specifications.
2. Thread and galvanize the upper 300 mm: free running nuts, by hand, for the entire length of the threads.
3. Galvanize the upper 350 mm of the anchor bolts, all nuts and washers, in accordance with the requirements of AASHTO M232.
4. Hook dimension of 200 mm as shown in Standard Plans.
5. Do not weld anchor bolts to reinforcing steel.
6. Nuts: Conform to ASTM A 563 Specifications.
7. Washers: Conform to ASTM F 436 Specifications.

2.2 BITUMOUS JOINT FILLER

A. Preformed material. Refer to Section 03152.

2.3 JUNCTION BOX AND GROUND ROD

A. Refer to Section 13554.

2.4 VMS SUPPORTS

A. Structural Steel: General

1. Hot dip galvanize all structural steel after fabrication in accordance with AASHTO M 111. Structural steel may be metallized using electric arc sprayed zinc wire as an alternative.

2. Welding design and fabrication: In accordance with the ANSI/AASHTO/AWS D1.5 Specifications.
3. Use galvanized bolts, nuts, and washers in conformance with AASHTO M232. Lock washers required on all bolts.

B. Structural Tubing:

1. Use low carbon steel conforming to ASTM A 53 Grade B, except that its chemical composition requirements will be: carbon 0.25 percent, phosphorus 0.04 percent, manganese 1.35 percent, and silicon 0.05 percent (the other elements are to conform to ASTM A 53 Grade B).
2. Bolts: Conform to ASTM A 325 Specifications.
3. Nuts: Conform to ASTM A 563 DH Specifications.
4. Washers: Conform to ASTM F 436 Specifications. Lock washer: all bolts.
5. Galvanize bolts, nuts, washers: AASHTO M232.

C. All Other Structural Steel:

1. All other shapes and plates: Conform to AASHTO M 270M Grade 250.
2. Bolts: Conform to ASTM A 307 Specifications.
3. Stainless Steel Bolts: Conform to ASTM F593 Type 304 Specifications.
4. Nuts: Conform to ASTM A 563 M Specifications.
5. Washers: Conform to ASTM 436 M Specifications. Use lock washers on all bolts.
6. Galvanize bolts, nuts, washers: AASHTO M232.
7. Entire sign assembly with mounting brackets: Galvanize to AASHTO M111.

D. Welding design and fabrication: ANSI/AASHTO/AWS D1.5 specifications.

PART 3 EXECUTION

3.1 PREPARATION

A. Type I Sign Design Criteria

1. Dead Load: 2180 kg
2. Live Load: 230 kg
3. Wind load: 160 km/hr
4. Snow and ice loadings.

B. Conform to the requirements of the National Electric Code (NEC), current edition.

C. Load, transport, and install all state-furnished materials per the manufacturer's instructions and as shown in the plans.

D. Provide foundation, VMS supports, junction boxes, ground rod, grounding lug, conduit, and all additional miscellaneous items required for a complete and operational VMS.

E. Install all wiring, conduit, and junction boxes as shown on site plans and details.

1. Field locate all conduits and junction boxes to avoid drainage areas and steep slopes whenever possible.
2. Protect existing conductors while installing cables and conductors.

F. Furnish and install all incidental items, such as wire nuts, grommets, tape connectors, and electrical nuts, necessary to make the VMS system complete.

G. After installation, the exterior of all equipment: Free of all loose rust and mill scale, dirt, oil, grease and other foreign substances.

H. Maintenance platforms required when the surrounding areas are not paved.

I. Restore work area to the original condition or better after work is completed.

3.2 CONSTRUCTION SEQUENCE

A. Construct foundations, establishing base plate elevations in accordance with project plans.

B. Determine design height of both vertical supports, and length of horizontal support based on the 'as-built' foundation field survey. A prudent safety factor may be added to the vertical dimensions of each vertical support to assure ease of construction to vertical clearance requirements. Determine catwalk design dimensions based on survey data. Obtain Engineer's approval for all dimension changes.

C. Fabricate structural supports and catwalk. Review shop-drawings and relate to survey information to assure consistency.

D. Erect structure with sign.

E. Remove shipping supports, connect all wiring and cables in a neat and orderly fashion, verify all parts are properly seated and functional and make final adjustments to sign horizontal and vertical angles. The Engineer reserves the right to order adjustments to the sign angle during the initial installation.

3.3 VMS FOUNDATIONS

A. Excavation

1. Perform per Section 13551, General ATMS Requirements.

B. Anchor Bolts:

1. Provide anchor bolt template during installation of anchor bolts. Fabricate the bolt template of 6 mm thick minimum steel plate, similar to anchor plate details. Match drill to each base plate.

C. Earthwork

1. Place compacted embankments prior to drilling.
2. Drill Caisson forms 150 mm minimum below ground surface. Place compacted backfill before erecting post.

D. Bitumous filler at concrete joints. Refer to section 03152.

3.4 VMS SUPPORTS

A. Structural Tubing:

1. Provide handholes for tubular overhead frame one side only.
2. Locate inserts at the bottom of the mast arm where shown on the Standard Plans. Weld 38 mm diameter insert in each hole. Thread inserts before galvanizing and provide galvanized plugs.
3. During sign erection, the post will be racked as necessary with the use of leveling nuts to make the sign panels level. At final position, both top and bottom anchor bolt nuts are to be wrench tightened against the base plate.

B. All Other Structural Steel:

1. One sign-mounting bracket is required at each sign Z bracket. See sign fabricator's drawings for number and location of Z brackets.
2. Pre-tension steel rod to 48 kN.
3. During sign erection, rake post as necessary with the use of leveling nuts to make the variable message sign level. At final position both top and bottom anchor bolt nuts are to be wrench tightened against base plate.
4. Sign placement on horizontal member may be adjusted up to 10 mm upward for VMS platform to match catwalk elevation.

C. Earthwork:

1. Place and compact backfill prior to erecting supports.

3.5 VMS CABINET

A. Cabinet Foundation

1. Concrete: A(AE) required. Refer to Section 03055.
2. Trowel finish and level top surfaces, prior to cabinet installation. Level top surfaces of cured concrete by grinding.

B. Bolts, Nuts, and Hardware

1. Furnish and install 19 mm x 200 mm anchor bolts to secure cabinet. Cabinet anchor bolts: minimum pullout strength 40 kN.
2. Expansion anchor bolts to secure framing strut to foundation: 13 mm diameter embedded 150 mm minimum in foundation, with shear capacity of 10.9 kN and tension (pullout) capacity of 11.3 kN. Locate expansion anchors a minimum of 75 mm from any edge of concrete.
3. Provide stainless steel, galvanized, or zinc plated bolts, nuts, hardware.
   a. Steel as specified. ASTM A 307.
   b. Galvanized as specified. ASTM A 123.
   c. Zinc plated as specified. ASTM B 766.
4. Provide all bolted connections with lock washers, nuts, or other approved means to prevent the connection nuts from backing off.

5. For framing struts, provide commercially available 12-gauge, u-shaped stainless steel product with 14 mm diameter pre-drilled holes, to attach transformers, breaker enclosures, disconnects, or other electrical equipment to cabinet foundation. Provide strut with cross-section dimensions 41 mm by 41 mm minimum.
6. Verify bolt pattern and foundation dimensions prior to foundation construction.

C. Conduit

1. Install all conduit in base of cabinet in a 300 mm x 450 mm rectangle centered in the cabinet base. Conduit may be aligned in alternate pattern than shown in plan. Refer to plans for the number, size, and orientation of all conduits entering the junction boxes.
2. Conduit (typical) from cabinet to Type I junction box
   One-38 mm from cabinet to disconnect
   One-38 mm from disconnect to Type I junction box
3. Conduit (typical) from cabinet to Type II junction box
   Two-75 mm
   Four-50 mm
4. Conduit (typical) stubbed out of Type II junction box
   Two-75 mm
   Four-50 mm
   One-75 mm (spare)
5. All exposed conduit: metallic.
6. Install bushings on metallic conduit ends at top of concrete bases if wire or cable is installed. Install end bells on non-metallic conduit if wire or cable is installed.
7. Provide 25 mm minimum spacing between conduit in cabinet base. Cap conduit at both ends until used. Stub conduit 75 mm above the concrete base.

D. Orient the cabinet such that the front door is on the opposite side of the cabinet from the VMS to allow maintenance personnel facing the front door of the cabinet to also face the VMS. Orient the cabinet such that the door that accesses the front face of the control equipment is adjacent to the Type II junction box.

E. Disconnect and Transformer

1. Install struts as per Section 13555, ATMS Cabinet.

2. Install disconnect and transformer on the side of cabinet that faces away from the nearest traffic. If wall blocks access to disconnect, then install the disconnect and transformer on the opposite side of cabinet.
3. Install 16 mm spacers with each expansion anchor between the foundation and disconnect/transformer. Maintain a 16 mm gap between the disconnect/transformer and the foundation.
4. Ground the transformer to the control cabinet ground terminal.
5. Install disconnect and transformer per manufacturer's instructions.

F. Identify all field terminals.

G. Refer to Section 13554 for junction box installation.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13591

TRAFFIC MONITORING DETECTOR LOOP

Add this Supplemental Specification to the Standard Specification.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish, install, and test detector loop and detector cable. Connect detector loop to control cabinet and provide complete functioning detection capability for loops.

1.2 RELATED SECTIONS

A. Section 02892: Traffic Signal.

B. Section 13552: Ramp Meter Signals and Signing

C. Section 13553: ATMS Conduit

D. Section 13554: Polymer Concrete Junction Box

E. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. International Municipal Signal Association (IMSA).

B. National Electric Code (NEC).

1.4 SUBMITTALS

A. Certified test report of detector lead-in cable compliance as specified. IMSA 50-2.

B. Samples of materials for approval when requested.

C. Two copies of the following within fifteen days after receiving a Notice to Proceed:

1. List of equipment and materials (name of manufacturer, size, and identification number.)
2. Manufacturers' warranties, guarantees, instruction sheets, installation details, and parts lists.

D. Detector Loop Circuit Test and Shield Isolation Test to Engineer for acceptance.

1.5 ACCEPTANCE TESTING

A. Detector Loop Circuit Test: Follow Section 02892, Part 1, Article: Acceptance Testing.

B. Perform Shield Isolation Test after the loop wire is connected to the detector lead-in wire to test the continuity of the detector lead-in wire shield.

PART 2 PRODUCTS

2.1 MATERIALS

A. Use electrical components as listed and defined by the National Electric Code (NEC).

B. Follow Section 02892, Part 2, Article, "Detector Circuit," Paragraphs A and B, Wire and Traffic Loop Embedding Sealant.

PART 3 EXECUTION

3.1 PREPARATION

A. The number of loops and number of lanes varies based on location shown in plans.

B. Conform to the National Electric Code (NEC).

3.2 SAWCUT

A. Maximize the area and width of any pavement sections that are created by the sawcuts.

B. Do not saw cut across a transverse joint in the travelled way.

C. Saw cut is allowed across a transverse joint in a shoulder slab. To maximize the pavement slabs created, position the cut approximately halfway along the joint.

D. Maximum allowable distance between saw-cut and transverse joints, or between adjacent sawcuts: 0.5 m.

E. Loop Spacing: 6.5 m between leading edges.
Maximum tolerance: 25 mm.

F. Do not install loops in cracked or spalled pavement.

G. Avoid water in active traffic during installation.

H. Shape: Refer to Standard Drawing 745-55N.

3.3 LOOP WIRE AND LEAD IN CABLE INSTALLATION

A. Section 02892, Part 3, Article, "Install Detector Loops," Paragraphs B through E.

B. Section 02892, Part 3, Article, "Install Wiring," Paragraphs C through E.

C. Loops: 4 turns per loop, placed counter clockwise, center all loops in lane.

D. Use blunt wood sticks to push wire into saw cut. Do not use metal tools.

E. Tag each loop within the junction box at the termination of the loop wire and within the cabinet at the termination of the detector loop cable (DLC).

F. Immediately upon installation:

1. Seal loop wire ends with waterproof coating, coil neatly, place in a junction box or a sealed plastic bag, and bury.
2. Install a plywood shield above all buried wire ends.
3. Do not allow loop wire ends be left exposed to the weather.

G. Install Loop Sealant

1. Fill and encapsulate loop wires and home runs a minimum depth of 40 mm from the pavement surface.

2. Install embedding loop sealant in saw cuts ± 6 mm from the top of the pavement after curing is complete.
3. Allow sealant adequate time to cure under ambient environmental conditions before lane is re-opened to traffic, or cover loop sealant with sand or cement dust to minimize tire tracking.
4. Refer to manufacturer's specifications regarding expansion of sealant uring curing period.

H. Install detector lead-in cable to from loop wire to cabinet. Connect cable to input file in cabinet to make loop detection fully functional at cabinet controller location.

I. Maximum detector lead in cable length allowed: 200 m.

J. Pavement Exit

1. Drill 50 mm diameter hole at 45 degree angle at pavement edge.
2. Install conduit originating from splicing junction box to the pavement edge. Extend conduit 75 mm into drilled hole.
3. After loop wires are installed, seal conduit, fill the hole within 50 mm of road surface with silica sand.
4. Seal remaining hole in the road surface with loop sealant.

K. Conduit Connection to Junction Box

1. Conduit to be sealed with waterproof bushings or acceptable caulking compound.
2. Fill voids resulting from entrance of conduit into junction box with duct seal or hydraulic cement grout.
3. Field locate junction box to avoid drainage areas and steep slopes.

L. Splicing in junction box

1. No splices allowed between the loop wire and controller cabinet.
2. The only splice allowed is the transition from the loop wire to the detector lead-in cable.
3. Carry the shield over the splice.
4. Splice detector lead-in cable to loop wire in junction box with approved splice encapsulation kit.

M. Notify Engineer at least 72 hours prior to any installation or testing. Allow the Engineer to witness installation and testing on all equipment. Work is not complete without acceptance by the Engineer.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13592

ROADWAY WEATHER INFORMATION SYSTEM

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construct a complete roadway weather information system (RWIS) environmental sensor site (ESS), including all labor and materials required for a complete and accepted installation.

1.2 RELATED SECTIONS

A. Section 02776: Concrete Sidewalk, Median Filler, and Flatwork.

B. Section 02821: Chain Link Fence and Gate.

C. Section 03055: Portland Cement Concrete.

D. Section 03211: Reinforcing Steel and Welded Wire.

E. Section 03310: Structural Concrete.

F. Section 13551: ATMS General Requirements

G. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. National Electrical Code (NEC).

1.4 SUBMITTALS

A. Materials:

1. Submit samples of materials for approval when requested.
2. Submit two copies of the following within fifteen days after receiving a Notice to Proceed:
   a. List of equipment and materials (name of manufacturer, size, and identification number.)
   b. Manufacturers' warranties, guarantees, instruction sheets, installation details, and parts lists.

B. Testing:

1. Submit Local Field Operations testing plan to Department for approval prior to testing. Do not perform any testing until the Department has approved the testing plans.
2. Submit documentation of successful completion of test to the Department for approval prior to final acceptance.

C. Fence and Gate: If using anti-climb plating to tower as an alternative to fence and gate, submit complete anti-climb plating details including materials, mounting, hardware, dimensions, and all other relevant information to the Engineer for consideration prior to installation.

1.5 ACCEPTANCE TESTING

A. Conduct the following Local Field Operations Test.

B. After all sensors, data processor, tower, power, and cabling have been installed, demonstrate the following:

1. Verify that all installed hardware, cables, and connections operate correctly and that all functions are in accordance with the manufacturers' specifications.
2. Verify the power supply voltages and the functionality of any cabinet fans and heaters.
3. Verify the ability of the controller to properly process all of the relevant data from each sensor at the site.

C. Conduct the test after all construction for the site has been completed and final road surface has been constructed. It is not necessary for the communications installation to be completed at the time of the test.

D. Satisfy all additional testing requirements specific to the project.

E. The system must be commissioned by the manufacturer prior to acceptance.

PART 2 PRODUCTS

2.1 MATERIALS

A. Use electrical components as listed and defined by the NEC.

2.2 TOWER FOUNDATION AND TOWER PAD

A. Use Class A(AE) concrete per Section 03055.

B. Substitute higher class of concrete if desired.

2.3 GROUNDING SYSTEM

A. Wire: copper wire of the size specified.

B. Ground Wire: solid, bare, soft-drawn, copper wire as specified.

C. Ground Rod: copper coated steel of the size specified.

2.4 ENVIRONMENTAL SENSORS, PROCESSING UNIT, AND TOWER

A. The Department will furnish environmental sensors, processing unit, tower and manufacturer's installation instructions. The environmental sensors may include, but are not limited to, the following:

1. Wind speed indicator
2. Wind direction indicator
3. Relative humidity sensor
4. Air temperature sensor
5. Dew point sensor
6. Precipitation detector
7. Fog sensor

8. Roadway surface sensor
9. Sub-surface probe

2.5 CABINET

A. Provide cabinet for housing processing unit, communication equipment, and any additional equipment, as indicated.

B. For ground-mounted cabinets, not mounted on RWIS tower, follow Section 13555.

C. For cabinets mounted on RWIS tower, provide cabinet and all necessary mounting hardware as follows:

1. NEMA 3R rated, single door, aluminum enclosure.
2. Sized to accommodate all processing, communication, and additional equipment, as indicated.
3. With correctly-sized factory-installed conduit knockouts to accommodate all necessary conduit entries.
4. Locking enclosure.
5. All stainless steel mounting hardware.

2.6 FENCE AND GATE

A. Follow Section 02821, Part 2.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform to the requirements of the NEC.

B. Contact the Engineer thirty days prior to start of work, to schedule and attend a pre-installation meeting.

C. Pick up Department-furnished materials at the following:
Utah Department of Transportation
Traffic Operations Center
2060 South 2760 West
Salt Lake City, UT 84104-4592

D. Contact the Engineer seven calendar days before picking up Department Furnished materials.

E. Install all Department-furnished materials following manufacturers' instructions.

3.2 FOUNDATION AND TOWER

A. Follow Sections 03055 and 03211.

B. Provide all necessary grading for a flat and level site.

C. Finish all surface concrete with Ordinary Surface Finish per Section 03310.

D. Use tie wire to secure conduits. Do not weld conduit.

E. Place the concrete directly into the excavation. Use minimum forming above ground. For excavation, refer to section 13551.

F. Install tower securely on foundation as indicated following all manufacturers' installation instructions.

3.3 ENVIRONMENTAL SENSORS

A. Install all sensors on tower as indicated following all manufacturers' installation instructions.

B. Install all cabling between sensors and processing unit following all manufacturers' installation instructions.

3.4 CABINET, PROCESSING UNIT

A. Install cabinet as indicated.

B. For ground-mounted cabinet, not on RWIS tower, refer to Section 13555.

C. For cabinet mounted on RWIS tower, install cabinet securely to tower.

3.5 COMMUNICATION EQUIPMENT

A. Install all communication equipment in cabinet as indicated following all manufacturers' installation instructions.

B. Install all cabling between communication equipment and processing unit following all manufacturers' installation instructions.

3.6 FOUNDATION PAD

A. Install concrete maintenance platforms refer to Section 02776.

3.7 FENCE AND GATE

A. Furnish and install Chain Link Fence and Gate refer to Section 02821.

B. Refer to Standard Drawing 720-3.

C. Furnish and install 2.1 m high Type IV fence, with barbed wire and arm, with 1.8 m high gate.

D. Orient fence gate, and size the fence dimensions, so that tower can be lowered through the open gate without obstruction.

E. As alternative to fence and gate, furnish and install anti-climb plating to tower.

1. Anti-climb plating must cover all climbable faces of the tower structure, from ground level, to ten feet above grade.
2. Do not install anti-climb plating without approval of details from Engineer.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13593

WEIGH IN MOTION

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Construct complete weigh in motion (WIM) site, including all labor and materials required for a complete and accepted installation.

1.2 RELATED SECTIONS

A. Section 13553: ATMS Conduit

B. Section 13554: Polymer Concrete Junction Box

C. Section 13555: ATMS Cabinet

1.3 REFERENCES

A. National Electric Code (NEC)

1.4 SUBMITTALS

A. Materials:

1. Submit samples of materials for approval when requested.
2. Submit two copies of the following within fifteen days after receiving a Notice to Proceed:
   a. List of equipment and materials (name of manufacturer, size, and identification number).
   b. Manufacturers' warranties, guarantees, instruction sheets, installation details, and parts lists.

B. Testing:

1. Submit Local Field Operations Testing plan to the Department for approval prior to testing. Do not perform any testing until the Department has approved the testing plans.
2. Submit documentation of successful completion of Local Field Operations Test to the Department for approval prior to final acceptance.

1.5 ACCEPTANCE TESTING

A. Conduct the following Local Field Operations Test. Satisfy submittal requirements.

B. After all sensors, data processor, power, and cabling have been installed, verify the following:

1. All installed hardware, cables, and connections operate correctly and that all functions are in accordance with the manufacturers' specifications.
2. The power supply voltages and the functionality of any cabinet fans and heaters.
3. The ability of the controller to properly process all of the relevant data from each sensor at the site.

C. Conduct the test after all construction for the site has been completed and final road surface has been constructed. It is not necessary for the communications installation to be completed at the time of the test.

D. Satisfy all additional testing requirements specific to the project.

E. Site must be commissioned by the manufacturer prior to acceptance.

PART 2 PRODUCTS

2.1 GENERAL

A. Use electrical components as listed and defined by the NEC.

2.2 GROUNDING SYSTEM

A. Wire: copper wire of the size specified.

B. Ground Wire: solid, bare, soft-drawn, copper wire as specified.

C. Ground Rod: copper coated steel of the size specified.

2.3 PIEZO ELECTRIC SENSORS

A. Piezo Electric Sensors as follows:

1. Commercially-available "Brass Linguini"-style piezo electric sensor.
2. Functional between -29 degrees C and 71 degrees C.
3. Functional in up to 95 percent humidity
4. Manufacturer-specified operating life of three years, minimum.

B. Manufacturer's installation instructions will be provided by the Department.

2.4 CABINET

A. Provide cabinet for housing processing unit, and any additional equipment, as indicated.

B. Follow Section 13555, ATMS Cabinet.

PART 3 EXECUTION

3.1 PREPARATION

A. Conform to the requirements of the NEC.

B. Contact the Engineer thirty days prior to start of work, to schedule and attend a pre-installation meeting.

C. Pick up Department-furnished materials at the following:
Utah Department of Transportation
Traffic Operations Center
2060 South 2760 West
Salt Lake City, UT 84104-4592

D. Contact the Engineer seven calendar days before picking up Department-furnished materials.

E. Install all Department-furnished materials following manufacturers' instructions.

3.2 ENVIRONMENTAL SENSORS

A. Follow all manufacturer's installation instructions.

B. Piezo Install:

1. Cut straight slot, 19 mm wide x 19 mm deep, in one pass, perpendicular to and for the full width of the traffic lane.
2. Drill 12 mm diameter 50 mm deep holes, at 45 degrees, at 0.9 m spacing, along both sides of saw cut.
3. Minimum of 150 mm between saw cut and concrete joints
4. Clean and dry slot prior to placing piezo.

C. Lead In Wires

1. Saw cut 10 mm x 80 mm to 150 mm slot for piezo lead in wires.
2. Cover lead in wire with at least 75 mm of approved embedded sealant.
3. Provide separate slots for each piezo lead in wire.
4. Minimum of 150 mm between saw cut and concrete joints.
5. Locate all lead ins down stream of piezo.
6. Drill 12 mm hole at edge of roadway for cover on conduit.
7. One 19mm schedule 40 conduit for each lead in wire outside of roadway.
8. Piezo lead in wire: Long enough to reach the data recorder prior to placing 150 m maximum.
9. Tag and number each lead in wire for identification.

D. Refer to standard drawing 745-55N for loop detector details.

E. Install all cabling between sensors and processing unit following all manufacturers' installation instructions.

3.3 CABINET AND PROCESSING UNIT

A. Install ATMS cabinet as indicated.

B. Refer to Section 13555, ATMS Cabinet.

END OF SECTION

January 8, 2002

SUPPLEMENTAL SPECIFICATION

SECTION 13594

FIBER OPTIC COMMUNICATION

Add this Supplemental Specification to the Standard Specifications.

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Furnish, install, and test communication system.

1.2 REFERENCES

A. ASTM A615, Grade 60.

B. Bellcore Testing Requirements GR-771-CORE.

C. EIA/TIA-455-82B: Fluid Penetration Test for Fluid-Blocked Fiber Optic Cable (ANSI/EIA/TIA-455-82B-92).

D. NEC 250-1: National Electric Code Grounding.

E. Telcordia GR20-CORE: Optical Fiber and Optical Fiber Cable.

F. Telcordia GR-771: Fiber Optic Splice Enclosure.

G. TIA/EIA-4720000-A: General Specification for Fiber Optic Cable (ANSI/TIA/EIA-4720000-A-93).

H. TIA/EIA-598-A: Optical Fiber Cable Color Coding (ANSI/TIA/EIA-598-A-95).

I. USDA Rural Electrification Administration (REA) specification for filled fiber optic cables (PE-90).

1.3 RELATED SECTIONS

A. Section 13553: ATMS Conduit.

B. Section 13554: Polymer Concrete Junction Box.

C. Section 13555: ATMS Cabinet.

1.4 DEFINITIONS

A. OTDR: Optical Time Domain Reflectometer

B. OSP: Outside Plant

1.5 SUBMITTALS

A. Evidence of training and experience for fiber optic staff. Include in the file for each technician a resume listing relevant education and experience, and a certificate of completion for the fiber optic training course.

B. For approval:

1. A detailed construction and installation procedure covering all aspects for the fiber optic cable installation on this project.

2. All materials for the fiber optic cable installation on this project.

3. Fiber labeling setup.

C. Prior to the splicing of any fiber cable, submit to the Engineer the part number and manufacturer of the cleave tool along with an "end angle" distribution chart which demonstrates the actual 150 cut end angles.

D. Submit to the Department and maintain on file a current calibration certificate for the OTDR being used.

E. Submit OTDR test results to the Department in a neatly bound and printed format for acceptance. Electronic submittal to Engineer on floppy disk or CD is also required.

F. Submit Power Meter/Light Source Test results to the Department for acceptance (Fiber Optic Continuity Test Form).

1.6 ACCEPTANCE TESTING

A. Contact the Engineer 48 hours prior to performing all acceptance testing (Post Termination and Splicing OTDR and Power Meter).

B. Perform all fiber optic testing with an OTDR capable of producing output files compatible with the Siecor OTDR 383PCW Version 1.21 or higher.

C. After completing the required work, use an OTDR to test one strand per buffer tube randomly selected by the Inspector. Conduct the test for each and every buffer tube running through the splice closure.

D. If the OTDR trace for any randomly selected strand shows evidence of damage, OTDR test each and every strand passing through the splice enclosure.

E. Repair any damaged fiber strands using fusion splicing methods and repeat all tests described below.

F. OTDR Testing Requirements

1. After completing the required work, test every fiber strand passing through any splice tray that was opened by the Contractor.
2. Conduct all traces with a pigtail or fiber box between the OTDR and the fiber under test.
3. Maintain minimum length of the fiber in the fiber box greater than the dead zone specified by the manufacturer.
4. Do not exceed launch transition of 6 dB.
5. Conduct all traces at both 1310 nm and 1550 nm.
6. Unless otherwise noted, unidirectional traces are acceptable.
7. Bidirectional averaging may be used when apparent splice losses are being impacted by core offset or other factors.
8. Provide traces with the following information:
    a. Horizontal Axis: Distance in Kilometers.
    b. Vertical Axis: attenuation scale in dB.
    c. Traces showing attenuation versus distance.
    d. Cursors positioned at cable ends.

9. Tabulate for each trace: method, fiber type, wavelength, pulse width, refraction index, range, search threshold, reflection threshold, end threshold, warning threshold, backscatter, jumper length, file date, file time, fiber ID, cable ID, OTDR location, far end location, operator initials.
10. Provide an event table showing all events having more than 0.05 dB loss, containing event type, position from OTDR end, loss and reflectance.
11. For cables less than 1 km in length, the maximum total allowable attenuation is 1.0 dB.
12. Identify fibers by strand number.
13. Submit results in printed form on 8 ½ x 11 paper in a suitable binder organized by cable and strand number.
14. A cover sheet is required for each binder indicating which cable(s) were tested, the OTDR users name, the reviewers name, the type of test performed and the date(s) of the test.
15. Cover sheets for final test results bearing the reviewers signature, the date, and a statement indicating that the installation complies with the requirements of this section is required.
16. The Contractor's employee who has reviewed the traces is required to sign or initial them. A check mark is required on all traces that satisfy the requirements identified herein. For intermediate test results, flag any discrepancies which may exist with a short description of the proposed corrective action. (e.g. resplice).
17. Submit to the Engineer on 3 ½ inch floppy disk or CD electronic media with a printed index.

G. Post Termination and Splicing Test

1. Test every strand in all cable segments including connectorized strands of drop cables.
2. Light Frequency: 1310 nm and 1550 nm.
3. Direction: Unidirectional.
4. Location of test: Every field location required to obtain access to each cable segment.
5. Test after terminating and splicing at all points shown on the plans.
6. Cable Tested by: Certified Contractor Staff.
7. Department inspector witnesses and approves before final approval by the Engineer.
8. Acceptance Criteria:
   a. Cable attenuation # 0.4 dB/km at 1310 nm excluding splices shown on the plans or authorized by the Engineer.

b. Cable attenuation # 0.25 dB/km at 1550 nm excluding splices shown on the plans or authorized by the Engineer.
c. Strand lengths are consistent.
d. Launch Transition < 6 dB.
e. No event > 0.30 dB**.**
f. Maximum splice attenuation 0.20 dB per splice unless otherwise shown on the plans.

9. Trace available for each strand in all cable segments.

H. Power Meter Test

1. Connect the light source to the connectorized fiber at the location identified on the Fiber Optic Test form. Connect a power meter to the other end of the fiber at the location identified on the Fiber Optic Test form.
2. Turn on the light meter and record the power received at the power meter in the appropriate location on the Fiber Optic Test form.
3. Specifically indicate the fibers tested on Fiber Optic Test form. Otherwise, test each strand in every cable segment including connectorized strands of drop cables.
4. Use the light frequencies of 1310 nm and 1550 nm, or as indicated in test plans.
5. Perform the test uni-directional.
6. Test every field location required to obtain access to each cable segment.
7. A qualified member of the Contractor staff will perform all testing.
8. A Department inspector witnesses and approves the results before final approval by the Engineer.
9. Acceptance Criteria:
   a. Cable attenuation as called for in test plans.
   b. Strand lengths are consistent.
   c. Launch Transition less than 6 dB.
   d. No event less than 0.30 dB.
   e. Maximum splice attenuation 0.20 dB per splice unless otherwise shown on the plans.
   f. Trace is available for each strand indicated in test plans. Otherwise, trace will be available for each strand in each cable segment.

I. Light Source Test

1. Connect the light source to the connectorized fiber number at the location identified in the Fiber Optic Test Forms. Connect a power meter to the other end of the fiber at the location identified in the Fiber Optic Test Forms.
2. Testing:
   a. Turn the light source off and on at a rate of approximately once per second for three cycles. Observe the power meter and record the response of the meter in the appropriate location on the Fiber Optic Continuity Test form.
   b. Indicate OK if the Contractor notes the meter responding to each of the three cycles. Indicate BAD for any other responses, such as no cycles, less than three cycles, or more than three cycles.
   c. For each bad response, submit to the Engineer a statement summarizing the response.
   d. A tone modulated light source may be used, in place of the three cycle method, to conduct this test.

J. Fiber Optic Continuity Test Form

1. Complete the ATMS Fiber Optic Continuity Test Form included at the end of this Section and submit the completed form to the Engineer. This form identifies the specific set up location for the power meter and light source.
2. Connect the light source to the connectorized fiber number at the location identified in the ATMS Fiber Optic Continuity Test Form. Connect a power meter to the other end of the fiber at the location identified in the ATMS Fiber Optic Continuity Test Form.
3. Turn on the light meter and record the power received at the power meter in the appropriate location on the ATMS Fiber Optic Continuity Test Form.
4. The Fiber Optic Continuity Test Form identifies the specific set up location for the power meter and light source.

K. Perform all work to conform to the National Electric Code.

PART 2 PRODUCTS

2.1 GENERAL

A. All materials are UL listed.

B. Provide all incidental materials including but not limited to fiber optic jumpers, cable ties, labels, data cables, and connectors.

2.2 FIBER OPTIC CABLE

A. Contact the Engineer for approval of fiber that is to be used.

B. The fiber optic cable is an Outside Plant (OSP) type, nonarmored dielectric loose tube, single mode cable.

C. Packing and Shipping (OSP Cable):

1. Ship the cable wound on spools or reels.
   a. Pack only one continuous length of cable per spool.
   b. Package the cable to prevent damage during shipping and handling.
2. When a length of cable's weight exceeds 363 kg, a large wooden reel with wooden staves is required.
   a. Cover the cable with a thermal wrap.
   b. Secure the outer end of the cable to the reel head to prevent the cable from becoming loose in transit.
   c. Project the inner end of the cable a minimum of 2 m into a slot in the side of the reel or into a housing on the inner slot of the drum, in such a manner to make it available for testing.
   d. Arbor hole: 40 mm minimum.
3. Test tails: at least 2 m long.
   a. Fasten the inner end to prevent the cable from becoming loose during shipping and installation.
   b. Apply end seals to each end of the cable to prevent moisture from entering the cable.
4. Mark each reel with an identification number that can be used by the manufacturer to trace the manufacturing history of the cable and the fiber.
5. Mark each reel to indicate the direction in which it should be rolled to prevent loosening of the cable on the reel.

6. Include the manufacturer's test documentation with each reel. This documentation indicates the attenuation of each cable fiber in dB/km, measured at 1310 nm and 1550 nm for single mode.

D. Outside Plant (OSP) Single Mode
General Characteristics:

1. Each OSP cable is of one type with the following features: all dielectric, loose tube, conforming to PE90 outside plant cable.
2. Provide all fiber optic cable on this project from only one manufacturer who is regularly engaged in the production of this material.
3. Fiber cables:
   a. all one mode (single or multimode),
   b. single mode and multimode under one sheath construction (HYBRID CABLE), or
   c. optical fiber/copper combination (COMPOSITE).
4. Install single mode fiber optic cable for the fiber optic communication system. The fiber cable conforms to the following:
   a. Latest version of Telcordia Technologies GR20-CORE: Generic Requirement for Optical Fiber and Optical Fiber Cables;
   b. TIA/EIA-4720000-A: Generic Specification for Fiber Optic Cable;
   c. United States Department of Agriculture (USDA) Rural Electrification Administration (REA) PE-90: REA Specification for Filled Fiber Optic Cables (updated per Bulletin 1753F-601 on August 4, 1994); and appropriate sectional specifications.
5. Fiber optic cable: free of surface imperfections and inclusions to meet the optical, mechanical, and environmental requirements of this specification.
6. The fiber cable contains a water-blocking material in a loose tube construction with up to 12 buffer tubes wrapped around a dielectric central strength member. All fiber(s) are contained within buffer tubes, and each buffer tube has an inside diameter much greater than the total diameter of the fiber(s) it supports.
7. Each fiber or group of fibers freefloats within the tubes such that all mechanically or environmentally induced stress placed upon the cable is decoupled from the fibers. Air within the buffer tubes is displaced by the water-blocking material to prevent entry by water and to facilitate free movement of the fiber(s) within.
8. Buffer tubes: color coded in compliance with TIA/EIA598, Color Coding of Fiber Optic Cables. Cables constructed of more than six fibers may have several fibers occupying a buffer tube, with equal distribution of fibers as far as feasible. Color code all fiber to comply with TIA/EIA598.

9. Each buffer tube of the cable contains water-blocking material to prevent entry of water.
   a. Water blocker: provided between the cable jacket and the outside of the buffer tubes.
   b. Binder wrapping strength member of aramid fibers: provided as a final layer prior to application of the outer jacket.
10. Outer jacket:
   a. Constructed of medium density polyethylene.
   b. Minimum thickness: 1.4 mm.
   c. Applied directly over the tensile strength members and water blocking means.
   d. Outer jacket is UV and fungus resistant.
11. Outer jacket labeling:
   a. The date of manufacture and the manufacturer's name.
   b. A numerical sequence, at intervals no greater than 3 m, to determine the length of cable and amount of cable remaining on the reel.
   c. "Utah Department of Transportation Fiber Optic Cable" at an interval of no greater than 3 m.
   d. Height of the markings is 2.5 mm nominal.
12. All optical fibers are 100 percent attenuation tested at the factory for compliance with performance specifications described in this section. The attenuation results of each fiber are provided with each cable reel.
13. All fiber cable is suitable for installation in underground conduit or lashed to messenger cable, and meets or exceeds the following specifications:
   a. Operational Wavelength: 1310 nm and 1550 nm.
   b. Optical Attenuation: at 1310 nm: 0.4 dB/km at 20 C at 1550 nm: 0.25 dB/km at 20 C.
   c. Optical Dispersion: at 1310 nm: $\leq$ 4.5 psec/nm-km at 1550 nm: # 20 psec/nm-kmZero.
   d. Dispersion Wavelength:1300 to 1320 nm, nominal.
   e. Zero Dispersion Slope: # 0.092 ps/nm^2-km.
   f. Fiber Core Diameter: 8.3 Fm, typical.
   g. Fiber Coating Diameter: 250 +/- 10 mm.
   h. Fiber Cladding Diameter: 125 +/- 1 mm.
   i. Core to Cladding Offset: # 0.8 mm.
   j. Cladding NonCircularity: # 1.0 percent.
   k. Spot Size: 9.3 +/-0.5 mm at 1310 nm.
      10.5 +/-1 mm at 1550 nm.
   l. Cutoff Wavelength: # 1250 nm.
   m. Crush Resistance: 5000 N/m, length of cable.

n. Cable Outside Diameter: 13mm, maximum.
o. Minimum Bending Radius:
Installation: 20 times cable outside diameter.
Static: 10 times cable outside diameter.
p. Operating Temperature:
Installation: -30 C to +70 C.
Storage/Operation: - 40 C to +70 C.
q. Humidity: 0 to 100 percent.
r. Tensile Strength:
Installation: 2700 N.
Static: 600 N.

14. The cable is waterproof, complying with water penetration test conducted in accordance with EIA/TIA-455-82-B for fluid blocking fiber optic cable.

15. Fiber optic drop cables:
a. With the number of fiber strands and connectors as shown on the plans.
b. Terminated with ST or ST compatible connectors, installed using factory approved procedures.
c. With connectors for all fiber strands that have present usage.
d. Drop cable fan out kits: heavy duty Spider design.
e. Buffer tubes: protected by the cable sheath or fan out kit. Exposed buffer tubes are not acceptable.
f. Individual fiber strands: protected by 2.9mm kevlar tubes.
g. Minimum tubing length is 610 mm.

E. Factory Test
1. Fibers Tested: Each strand.
2. Light Frequency: 1310 nm and 1550 nm.
3. Direction: unidirectional.
4. Location: Cable Factory.
5. When Performed: Tested prior to shipment.
6. Tested by: Factory Staff.
7. Cable meets factory attenuation specifications.
a. Cable attenuation # 0.4 dB/km at 1310 nm.
b. Cable attenuation # 0.25 dB/km at 1550 nm.
c. Strand lengths are consistent.
d. Launch Transition < 6 dB.
e. No event > 0.30 dB.
8. Traces will be available for each strand in cable.

2.3 FIELD FIBER OPTIC DATA MODEM (DEPARTMENT FURNISHED ITEM)

A. Designed to support full duplex asynchronous RS232 communications in a multidrop counter rotating ring, daisy chain, and twoheaded daisy chain topology.

B. Configurable as master submaster or local units and meeting the following specifications:
   1. Optical Loss Range: 0 - 17 dB.
   2. RS-232 Data Rate: DC to 100 kbaud.
   3. Operating Wavelength: 1310 nm.
   4. Fiber Type: Single Mode.
   5. Pilot Tone Frequency: 430 to 450 khz.
   6. Power Supply: External Transformer 120 VAC Primary, 8 to 18 VDC secondary.
   7. Operating Temperature: -37 C to +75 C.
   8. Humidity: 0 to 98%.
   9. Optical Connector: ST.
   10. Data Connector: DB25 F.
   11. LED Indicators: TD1, RD1, TD2, RD2, Power, Fault.
   12. AntiStreaming Timeout: User Selectable 4, 8, 16, 32, or 64 seconds or disabled.
   13. Fault Output: Dry contact closure.
   14. Compatibility: optically and electrically operate with Force Model 2869 in the same circuit.
   15. Package: Shelf Mount 150 mm x 150 mm x 30 mm maximum.

2.4 FIBER OPTIC CONNECTORS

A. With the following characteristics:
   1. Factory installed or field installed ST or ST compatible connectors.
   2. Ceramic ferrules and metallic connector bodies.
   3. Maximum insertion loss: 0.50 dB. Maximum insertion loss of 1.0 dB is acceptable with approval of the Engineer.
   4. Connector back reflection: greater than 35 dB.

B. Clean all connectors with alcohol wipes and a compressed cleaning gas.

C. Furnish and install new spider fan-out kits, to replace any existing fan-out kits that must be severed in order to make ST connections. Replace fan-out kits in kind.

2.5 CLOSET CONNECTOR MODULE

A. Required in existing closet connection housings and hub shelters entered by fiber optic cables.

B. Characteristics:
   1. Six fibers per module.
   2. Six ST connectors.
   3. Six strand factory made single mode pigtail.
   4. Height equivalent to four rack units high.
   5. Mate with Siecor existing CCH-04U closet connector housing.
   6. Siecor CCH-CM06-61 or equivalent.

2.6 STAND ALONE VIDEO OPTICAL TRANSMITTER

A. Physical Characteristics
   1. Maximum Size: 200 mm x 120 mm x 38 mm.
   2. Maximum Weight: 1 kg.
   3. Mounting Holes: 4 minimum.
   4. Package: High quality aluminum, complete enclosure.
   5. Indicators: LED type, neatly labeled and visible from mounted position.
   6. User Settings: No user adjustments or settings.

B. Electrical Characteristics
   1. Application: Single Fiber Uni-Directional RS-250C Medium Haul Video Transmitter with bi-directional RS-232 data.
   2. Modulation: Frequency Modulation or digital encoding.
   3. Data Connector: DB 9 F.
   4. Data Rate: up to 19.2 kbps, suitable for bursty data.
   5. Bit Error Rate: 10-9 minimum over full optical range.
   6. Video Connector BNC.
   7. Power Consumption: 1-Watt maximum.
   8. Video Signal to Noise: 50-dB minimum unweighted over full optical range.

C. Optical Characteristics
   1. Physical: ST Type Connector.
   2. Optical Range: 18 dB for Single Mode Fiber, 13 dB for multi-mode fiber.
   3. Operating Wavelength: 1310 nm.
   4. Backreflection: Tolerance of -35 dB.
   5. Reliability: Laser Mean Time Between Failure 500,000 hours.

D. Compatibility: directly interchangeable.

2.7 RACK MOUNT VIDEO OPTICAL RECEIVER

A. Physical Characteristics
1. Maximum Size: 200 mm by 120 mm by 38 mm.
2. Maximum Weight: 1 kg.
3. Mounting: Sliding Rack Mount Card with retainers.
4. Package: High quality aluminum, complete enclosure, compatible with rack mounting chassis.
5. Indicators: LED type, neatly labeled and visible from mounted position.
6. User Settings: No user adjustments or settings.

B. Electrical Characteristics
1. Application: Single Fiber Uni-Directional RS-250C Medium Haul Video Receiver with bi-directional RS-232 data.
2. Modulation: Frequency Modulation or digital encoding.
3. Data Connector: DB 9 F.
4. Data Rate: up to 19.2 kbps, suitable for bursty data.
5. Bit Error Rate: 10-9 minimum over full optical range.
6. Video Connector BNC.
7. Power Consumption: 1-Watt maximum.
8. Video Signal to Noise: 50-dB minimum unweighted over full optical range.

C. Optical Characteristics
1. Physical: ST Type Connector.
2. Optical Range:18 dB for Single mode fiber, 13 dB for multi-mode fiber.
3. Operating Wavelength:1310 nm.
4. Backreflection:Tolerance of –35 dB.
5. Reliability: Laser Mean Time Between Failure 500,000 hours.

D. Compatibility: directly interchangeable.

2.8 RACK MOUNT CHASSIS

A. Width: Suitable for mounting in EIA Standard 19 inch rack.

B. Height: Not to Exceed 4 Rack Units.

C. Depth: Not to Exceed 300 mm.

D. Capacity: Ten Rack Mount Video Optical Receivers.

E. Engineering:
1. Designed to retain ten rack mount cards and provide clear view of indicators and labels on cards.
2. Designed to provide easy access to all optical and electrical connectors.

F. Power Supply:
1. Suitable for powering ten rack mount video optical receivers.
2. UL listed.
3. Equipped with overcurrent protection, power on indicator lamp, and power on/off switch.

G. Line Cord: 1.8 m IEC Standard.

H. Input Voltage: 90 to 135 VAC.

I. Input Frequency: 47 to 63 Hz.

J. Output Ripple: 120-mV peak to peak maximum.

K. Output Voltage: Compatible with rack mount video optical receivers over full input voltage range.

2.9 RS-232 SIGNAL DISTRIBUTION UNIT

A. General
1. Unit feeds data from one RS-232 input communication port to ten RS-232 serial output data communication ports.
2. Provide looping input for additional signal distribution units.
3. Compatible with all system components.
4. One LED indicator per channel.
5. Maximum Size:200 mm by 65 mm by 140 mm.

B. Environmental
1.. Temperature Range: 10 degrees C to 40 degrees C.
2. Humidity: 0-90 percent non condensing.
3. Weight: Less than 3 kg.

C. Power
1. Input Voltage: Unregulated 15V dc, 800mA.

2. Transformer: 110V ac, 25 watts.

D. Data Communications
1. Data Signal Connectors: DB-9 mating, provided.
2. Data Signal Cable: Belden 8102 or equivalent.
3. Transmission Distance: Up to 300 m at 9600 Baud.
4. Characteristics: 1 RS-232 input with pass through.
5. RS-232 Outputs: 10.

E. Provide standard metal rack mount shelf with unit for installation in existing EIA Standard 19 inch rack.

2.10 TYPE A AND B FIBER OPTIC CABLE SPLICE ENCLOSURE

A. Type A: For locations with more than 48 splices.
1. 150 mm diameter by 560 mm long.
2. One three section (six entry) end plate.
3. One blank end plate.
4. Two or more 36 fiber count fusion splice trays.
5. All required accessories to complete the splice.
6. End plates are suitable for use with Coyote closures.

B. Type B: For locations with up to 48 splices.
1. 150 mm diameter by 430 mm long.
2. One three section (six entry) end plate.
3. One blank end plate.
4. Four 12 fiber count fusion splice trays.
5. All required accessories to complete the splice.
6. End plates are suitable for use with Coyote Pup closures.

C. General Requirements
1. Capable of handling up to six cables in butt configuration without special adapters.
2. Nonfilled (no encapsulate), to prevent water infusion.
3. UL rated.
4. External Shrader valve pressurization port.
5. Able to reenter and reassemble without special tools.
6. Contain mountings for splice organizer assemblies.
7. Contain space for excess or un-spliced cable.
8. Provide one future cable entry kit with each splice closure.

9. Meet Telcordia Technologies/Bellcore Testing Requirements GR771CORE.
10. Corrosion resistant aluminum and stainless steel hardware.
11. Suitable for straight, butt, or branch splices.
12. Packaged with all hardware necessary for completion of splice.
13. Provisions for strain relief around the cable jacket and internal cable strength members.
14. Enclosure accepts loose tube fiber optic cables.
15. Enclosure accepts up to six cable entries in a butt splice configuration and twelve cables for an inline configuration.
16. Enclosure has a permanent neoprene gasket seal.
17. Enclosure is re-enterable without special reentry kits.
18. Enclosure has premolded three section end plates with six cable entries.
19. End plates are interchangeable with each size of closure available from the closure supplier.
20. All closures, with captive closing hardware, are from the same supplier.
21. Provide glassfilled highdensity thermoplastic enclosure shells that effectively withstand corrosion, high impact and freezethaw stresses.
22. Use torque bars to secure, support and align end plates.
23. Provide enclosure with rubber tape for sealing around cables to provide a seal that compensates for expansion and contraction associated with temperature cycling.

2.11 SPLICE ENCLOSURE END PLATE

A. Replace existing plates at splice enclosures that are modified.

B. Suitable for use with Coyote Pup closures.

C. Three section (six entry) end plate.

2.12 FIBER OPTIC JUMPER

A. Single mode fiber.

B. 2.9 mm Kevlar outer jacket.

C. ST connector required on each end.

D. Determine length based on physical distance of run. Minimum length: 2 m.

2.13 JUMPER STORAGE PANEL

A. 2 rack units high.

B. 480 mm wide.

C. Designed for routing of fiber optic jumpers.

D. Matte black finish.

E. Siecor CSP-02U or equivalent.

F. Furnished with cover, mounting hardware, grommets and installation manual.

2.14 RS-422/RS-232 CONVERTER

A. Converts RS-422 data between the CCTV assembly and the video optical transceiver.

B. General
1. Transmits data at distances up to 1000 m.
2. Operate in multipoint applications.
3. 2 or 4-wire operation.
4. Speeds up to 115.2 kbps.
5. Auto-transmitter enable: baud rates up to 64 kbps.
6. Selectable half-duplex turnaround delay.
7. Selectable RTS-CTS turnaround delay.
8. Echo suppression.
9. Bias enable.
10. Terminate/Reconnect option.
11. Externally selectable loop-back test feature.
12. Operation: 4 wire, half or full-duplex, 2-wire, half-duplex.
13. CE Approval: Yes.
14. Connectors: (1) DB25 F; (1) 4-screw terminal.
15. Power: 115 VAC, 60 Hz.
16. Max Size: 220 mm by 150 mm by 50 mm.
17. Max Weight: 0.5 kg.
18. Mean time before failure: 200,000 hours.

C. Environmental
1. Operating Humidity: 0 to 95 percent non-condensing.

2. Operating Temperature: 0 to 50 degrees C.
3. Storage Temperature: -20 to 70 degrees C.

D. Interface A:
1. RS-232 DTE/DCE selectable.
2. Connectors: DB25 Female.
3. Data Rate: Data rate is transparent up to 115 kbps.
4. Distance: Standard EIA specifications apply.
5. Leads: 2 thru 8 and 20.

E. Interface B:
1. RS-232 or RS-485.
2. Connectors: 4 position screw down terminal strip.
3. Data Rate: Transparent.
4. Distance: 1200 m based on 24 AWG UTP low capacitance cable.
5. Leads: TX+, TX-, RX+, RX-.

2.15 FIBER OPTIC SPLITTER

A. Splits the signal from a fiber optic video transmitter to two different destinations, with the following characteristics:
1. Compatible with single mode fiber.
2. 50:50 split of video signal, or weighted ratio as specified.
3. Maximum dB loss of 3.6 dB.
4. ST connectors.

2.16 COMMUNICATION SHELTERS

A. Provide prefabricated controlled environmental shelters with an alarm system for remote monitoring.

B. Construction:
1. Materials: Solid concrete with steel rebar reinforcement. Solid heavy duty steel doors and locks. Reinforcing Steel ASTM A615-85, Grade 60.
2. Structure: No seams below ground level. Minimum concrete compressive strength: 34.5 MPa at 28 days.
3. Design Load: meet or exceed State of Utah Building Codes.
4. Interior Dimensions: 3.5 m wide by 5 m long by 3 m high.
5. Interior Area: 17.5 sq. m^2, 52.5 m^3.
6. Door Opening: 1.5 m wide x 2 m high.

C. Environmental
   1. Air Conditioning: 30,000 BTU HVAC system.
   2. Heater: 10 kW.
   3. Lighting: Interior 4 dual tube fluorescent fixtures, 40W lamps. Exterior 100W incandescent lamp.

D. Electrical
   1. 120/240 volts, single phase, 100 amps with 10 branch circuits.
   2. 100 amp generator input connector.
   3. Auto alarm system for high temp, smoke, power loss, and intrusion.
   4. Alarm terminal block.
   5. Interior copper ground bar assembly with two through wall ground sleeves.
   6. 4 hour timer switch for lighting.

E. Mechanical
   1. In floor cable entry opening.
   2. Magnetic door switch with alarm.
   3. Electro-mechanical environmental control panel with manual override.
   4. Automatic high limit override.
   5. Wall mounted CO2 fire extinguisher.

PART 3 EXECUTION

3.1 INSTALLERS

A. Complete a three-day course on the installation, splicing and testing of fiber optic cable.
   1. Course: conducted by the supplier of the fiber optic product or established education provider.
   2. In house and on the job training is not acceptable.

B. Demonstrate two years total and one year continuous work experience with the splicing, termination, and testing of fiber optic cable.

C. Perform all work with qualified staff.

3.2 FIBER OPTIC CABLE INSTALLATION REQUIREMENTS

A. Notify the Engineer 48 hours in advance of fiber optic cable installation into any existing conduit or building facility.

B. The Engineer will initiate special inspection procedures to verify the condition of existing communications facilities. Such inspection may be observed by the Contractor.

C. Perform all work in facilities (e.g. conduits, junction boxes, cabinets and buildings) containing Department's existing communications equipment only in the presence of Department's representative.

D. Restore Contractor damaged facilities within 48 hours.

E. Lubricate cable with a lubricant designed for fiber optic cable installation.

F. Use shear pins or other failsafe means to prevent exceeding the maximum cable pulling tension specified by the cable manufacturer.

G. Maintain the following minimum bend radiuses:
   1. 20 times Cable Diameter: Short Term During Installation.
   2. 10 times Cable Diameter: Long Term Installed.

H. Maintain the following slack requirements:
   1. Vaults: 20 m.
   2. All Junction Boxes: 10 m.
   3. Cabinets: 5 m.

I. Replace any fiber optic cable segment not meeting the requirements of the specifications in its entirety between splice points shown on the plans.

J. Place the locator wire in the dedicated 19 mm conduit as shown in the plan details.

3.3 FIBER OPTIC CABLE PREPARATION

A. Remove the jacket without damaging buffer tubes.

B. Carefully expose the fibers by removing the buffer tube with a special tool.

C. Clean the fibers and buffer tubes using a solvent designed to remove all water blocking gel from each exposed fiber.

D. Solvent requirements:
   1. Must not remove any color from individual fibers or buffer tubes.

2. Not harmful to the polyethylene cable jacket.

E. Cleave fiber strands using a cleave tool meeting the following requirements:

1. Ability to cut the individual fibers as close to a perfect 90 degree angle as possible.
2. With minimum end angle averages that are less than 0.70 degree with no cuts exceeding 1.5 degrees.

3.4 ENTRY AND REENTRY OF FIBER OPTIC SPLICE CLOSURES

A. Perform all work in a suitable environment free from excess dust and moisture. Acceptable environments to work on splice closures include office type environments in buildings, splice trailers, and splicing tents with floors.

B. Do not perform fiber splicing, testing, or connecting in freezing temperatures.

C. Do not expose open splice closures and fiber ends to rain, snow, or wind-blown dust.

3.5 FUSION SPLICING

A. All fiber splicing: fusion splice method.

B. Connectors: factory made connector and pigtail or drop cable assemblies.

C. Field polishing of connectors: Not acceptable.

D. Perform fusion splices with the following:
1. Equipment with automatic fiber alignment and automatic light injection with detection devices or profile alignment algorithms to estimate splice losses.
2. Provide splice closure as a protection for all splices and stripped cable.
3. House all splices in splice trays or organizers.
4. Use glass capillaries, heat shrink tubing, or silicone sealant to provide additional protection and strain relief.
5. Maximum splice loss allowance is 0.20 dB.

E. Install new splice enclosure end plates at each location where there is a new fusion splice in an existing splice enclosure per manufacturer's recommendations.

3.6 FIELD QUALITY CONTROL TESTING

A. Receiving Test
   1. Fibers Tested: Normally, one strand per buffer tube. Test every strand when evidence of physical damage exists or when any damaged strand is found.
   2. Light Frequency: 1310 nm and 1550 nm.
   3. Direction: Unidirectional.
   4. Location of test: Contractor's yard.
   5. Test after receiving material, before releasing to installation crew.
   6. Tested by: Qualified Contractor Staff.
   7. Cable meets factory attenuation specifications.
      a. Cable attenuation # 0.4 dB/km at 1310 nm.
      b. Cable attenuation # 0.25 dB/km at 1550 nm.
      c. Strand lengths are consistent.
      d. Launch Transition < 6 dB.
      e. No event > 0.30 dB.
   8. Trace available for one strand in every buffer tube in the cable.

B. Post Blowing/Pulling - Pre Splicing Test
   1. Fibers Tested: Normally, one strand per buffer tube. Test every strand when evidence of physical damage, excessive pulling tension, kinks exists, or when any damaged strand is found.
   2. Light Frequency: 1310 nm and 1550 nm.
   3. Direction: Unidirectional.
   4. Location of test: One field location for each cable installed.
   5. Test after installing cable in duct but before splicing.
   6. Tested by: Qualified Contractor Staff.
   7. Witnessed/Approved by: Department inspector may witness and must approve before splicing.
   8. Acceptance Criteria:
      a. Cable attenuation # 0.4 dB/km at 1310 nm.
      b. Cable attenuation # 0.25 dB/km at 1550 nm.
      c. Strand lengths are consistent.
      d. Launch Transition < 6 dB.
      e. No event > 0.30 dB.
   9. Trace available for one strand in every buffer tube in the cable.

3.7 CABLE LABELING REQUIREMENTS

A. Label all fiber optic cables with a high quality permanent label, indicating the street name or location and type of circuit (drop cable, distribution, backbone-96 count).

B. Use Panduit MP-150-C or equivalent.

3.8 INSTALLATION OF HUB FIBER EQUIPMENT

A. Install all Hub equipment in accordance with the plans and the equipment manufacturer's recommendations.
   1. Provide all mounting hardware and incidental materials, including fasteners, shelves, and brackets.
   2. Provide surge protected power strips as needed for all equipment installed in buildings.

B. To gain access to the ATMS Hub, contact the Engineer at least ten working days prior to the time access is needed.

C. The Department may elect to have personnel present in Hub during any activity.

D. Install RS-232 Signal Distribution Unit securely on new shelf on existing rack at location indicated in plans.

E. Install Rack Mount Video Optical Transceivers in rack mount chassis on existing rack at location indicated in plans.

3.9 INSTALL FIELD FIBER COMMUNICATION EQUIPMENT

A. Install field communication equipment in existing signal cabinets as shown in the plans.
   1. Equipment includes stand alone video optical transmitters, field fiber optic data modems, and RS-422/RS-232 converters.
   2. Install equipment in accordance with the equipment manufacturer’s recommendations, including mounting, interconnection wiring, electrical service, all mounting hardware and incidental materials, including fasteners and brackets.
   3. Provide all surge protected power strips for all equipment installed.
   4. Install equipment on existing shelf space in cabinets.

ATMS Fiber Optic Continuity Test Form						
Light Source Location	**Channel**	**Source to Strand Number**	**Power Meter Location**	**Meter to Strand Number**	**Power Meter Reading (dBm)**	**On/Off (yes or no)**

END OF SECTION

End of 1999 CSI Supplemental Specifications

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Change Letter

Document:	Letter Code:
Materials Minimum Sampling and Testing Manual (Contained in 1999 CSI Spec Book)	
Subject:	Effective Date:
Change One	**September 12, 2000**

Summary:

Section 02746, Hydrated Lime replaced, page 46

Section 05120, Structural Steel replaced, page 88

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02746 **(Change 1, Sept 12, 2000)** **Related Items: 02746**	Hydrated Lime Hydrated Lime for Asphalt Mixture	Suppliers must be pre-qualified by The Materials Division through the Quality Management Plan: Hydrated Lime. Select from Materials Division list of pre-qualified sources. Test Report	One per project issued by central lab based on tests performed prior to shipment	Prequalified Source Central Lab	Rejection of product and possible removal from prequalified source list.

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
05120 **(Change 1, Sept 12, 2000)**	Structural Steel Structural Metals High Tensile Strength Nuts, Bolts, and Washers Load Indicator Washers	Test Report	Issued by Central Lab based on tests performed prior to shipment. A test report will accompany the shipment. All pretested material will be tagged with an orange UDOT sticker.	Manufacturer's Plant or Central Lab	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
05822 **Related Items: 05120**	Expansion Bearing Structural Steel	Test Report	Issued by Central Lab based on tests performed prior to shipment. A test report will accompany the shipment. All pretested material will be tagged with an orange UDOT sticker.	Manufacturer's Plant or Central Lab	Rejection

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Change Letter

Document:	Letter Code:
Materials Minimum Sampling and Testing Manual (Contained in 1999 CSI Spec Book)	
Subject:	Effective Date:
Change Two	**February 13, 2001**

Summary:

Section 02745, Asphalt Materials, replaced, page 45

Section 03055, Portland Cement Concrete (continued), replaced, page 102

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02745	Asphalt Materials (continued)				
	PG Asphalt Binders	Check Sample AASHTO MP-1 and UDOT 8-209	One random sample (comprised of three individual one liter, metal cans) per production day at a random time from the mix plant's asphalt tank injection line. Two cans are retained by UDOT and the other by the Contractor. The Contractor and UDOT will witness and certify the sample being taken. The certificate will accompany the sample. This sample represents one binder sublot. Each week's production is a binder lot with a maximum of eight sublots. If two sublots or less are accumulated within a production week, include these in the next week's production. Thus, a binder lot shall consist of at least three (3) sublots. Submit one random sublot sample out of each binder lot to the Central Laboratory (Asphalt Laboratory) for testing or inspection. Retain back up sample along with all other samples until specification verification is completed. (See Materials Manual Part 8 209.4.1. Use forms T-247 and T-281.)	Hot-mix plant site.	Appropriate price reduction UDOT 8-209.5.
	Hot-Pour Bituminous Concrete Crack Sealant	Manufacture's Certificate of Compliance. Select from Materials Division list of pre-qualified sources.	Each shipment	Project Site	Rejection

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02746	Hydrated Lime	Suppliers must be pre-qualified by The Materials Division through the Quality Management Plan: Hydrated Lime. Select from Materials Division list of pre-qualified sources.		Prequalified Source	Rejection of product and possible removal from prequalified source list.
		Test Report	One per project issued by central lab based on tests performed prior to shipment	Central Lab	
Related Items: 02746	Hydrated Lime for Asphalt Mixture				

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
03055	Portland Cement Concrete (continued)	Sieve Analysis - Coarse and Fine Aggregate AASHTO T-11 and T-27	Perform one test per stockpile per week in advance of placement. In addition, one test per stockpile prior to placements greater than 75 m^3.	Stockpile	Rework or replace stockpile.
		Slump Test AASHTO T-119	At the start up and after each failed batch, test every batch until two consecutive batches pass. Then take one test per 38 m^3.	Project Site	Another slump test is taken immediately. If the second slump test fails, the batch is rejected. If the second slump test meets specification, take a third slump test. The batch is then accepted or rejected based on the results of the third test.
		Air Test AASHTO T-152	At the start up and after each failed batch, test every batch until two consecutive batches pass. Then take one test per 38 m^3.	Project Site	Another air test is taken immediately. If the second air test fails, the batch is rejected. If the second air test meets specification, take a third air test. The batch is then accepted or rejected based on the results of the third test.
		Strength Test AASHTO T-22 and T-23	A minimum of one compressive strength test, consisting of one set of three cylinders, will be taken for each 38 m^3, or fraction thereof. If placement is less than 6 m^3, proceed as directed.	Project Site	Appropriate price reduction or removal and replacement with specification material.

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Change Letter

Document:	Letter Code:
Materials Minimum Sampling and Testing Manual (Contained in 1999 CSI Spec Book)	
Subject:	Effective Date:
Change Three	**May 8, 2001**

Summary:

Section 02610, Pipe Culverts, replaced, page 9 - 12

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02455 **Related Items** **03055** **03211**	Driving Piles Concrete Reinforcing Steel	Certified mill test report and test report.	Issued by Central Lab based on tests performed prior to shipment. A test report will accompany the shipment. All pretested material will be tagged with an orange UDOT sticker.	Manufacturer's Plant or Central Lab	Rejection
02466 **Related Items** **03055** **03211**	Drilled Caisson Concrete Reinforcing Steel				

*Performed or approved by Region Lab ** Performed by Contractor and reviewed by Engineer

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02610 **(Change 3, May 8, 2001)**	Pipe Culverts Asphalt Coating	Test Report	Issued by Central Lab (Asphalt/Chemistry Lab) based on tests performed prior to shipment. A test report will be supplied prior to shipment.	Central Lab (Asphalt/Chemistry Lab)	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
	Corrugated Pipe Culverts and Pipe Arch Culverts	Manufacturer's Certificate of Compliance	Each Shipment	Project Site	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
	Smooth-lined Pipe Culverts and pipe Arch Culverts Excluding Concrete Pipe	Manufacturer's Certificate of Compliance	Each Shipment	Project Site	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
	Aluminized Pipe	Manufacturer's Certificate of Compliance	Each Shipment	Project Site	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection

*Performed or approved by Region Lab ** Performed by Contractor and reviewed by Engineer

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02610 **(Change 3, May 8, 2001)**	Pipe Culverts (continued)				
	Reinforced, Non-reinforced, and Elliptical Reinforced Concrete Pipe	Manufacturer's Certificate of Compliance. Attach Quality Control (QC) test report for each production run or lot of pipe represented. The QC test report must include: Load bearing (D-load), compressive strength, permeability and visual inspection pass/fail test results for each production run or lot represented.	Each Shipment	Project Site	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
	Concrete	Per Section 03055 except as follows: Mix design (trial batches) must be submitted and approved by the Region Lab each new calendar year.		Manufacturer's Plant or Central Lab	

*Performed or approved by Region Lab ** Performed by Contractor and reviewed by Engineer

Section	Material Type or Type of Construction	Testing Method/ Acceptance Documentation	Testing Frequency	Point of Acceptance	Required Action for out of Specification Material
02610 **(Change 3, May 8, 2001)**	Pipe Culverts (continued)				
	Structural Plate Pipe and Pipe Arch Culverts	Test Report	Issued by Central Lab based on tests performed prior to shipment. A test report will accompany the shipment. All pretested material will be tagged with an orange UDOT sticker.	Manufacturer's Plant or Central Lab	Rejection
		Visual Inspection	Each Shipment	Project Site	Rejection
02611	Diversion Box Gate and Frame	Manufacturer's Certificate of Compliance	Each Shipment	Project Site	Rejection

*Performed or approved by Region Lab ** Performed by Contractor and reviewed by Engineer

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Change Letter

Document: **Minimum Sampling and Testing Guide - CSI version**	Letter Code: **MST**
Subject: **Change 4**	Effective Date: January 2002

Summary:

Modified Quality Management Plan, Asphalt Binder 509, in the 1999 Metric Standard Specifications - CSI Format.

Replace QMP 509 with the attached document.

509 Asphalt Binder Quality Management System

509.1 Purpose

509.1.1 The Asphalt Binder Quality Management System (ABQMS) provides the Utah Department of Transportation with a quality management program for Performance Graded Asphalt Binders (PGAB) by establishing qualified sources of these materials and verifying the compliance of materials shipped from these sources to paving projects with specification requirements.

The ABQMS is comprised of a Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders, a contractor's Field Quality Control of PGAB program, a PGAB Asphalt Binder Quality Assurance Plan, and a method of addressing non-specification PGAB delivered to paving projects.

509.1.2 All asphalt binder producers and/ or suppliers to UDOT paving projects must be registered by UDOT under the **Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders** as outlined under **Section 509.2.**

509.1.3 The contractor will be responsible for the **Field Quality Control of PGAB** when the binder is delivered to the mix plant, as outlined under **Section 509.3.**

509.1.4 UDOT will accept asphalt binder under it's **Performance Graded Asphalt Binder Quality Assurance Plan** as outlined under **Section 509.4.**

509.1.5 Non-specification PGAB delivered to paving projects will be addressed by the **Calculation and Application of Price Reductions for Non-Specification PGAB** section as outlined under **Sections 509.5 and 509.6**.

509.2 Standard Practice for Certifying Suppliers of Performance Graded Asphalt Binders.

509.2.1 **Scope**

509.2.1.1 This standard specifies requirements and procedures for a certification system that is applicable to all suppliers of performance graded asphalt binders (PGAB). The requirements and procedures cover materials manufactured at refineries and/or materials.

509.2.1.2 *This standard may involve hazardous materials, operations, and equipment. It does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

509.2.2 **Referenced Documents**

509.2.2.1 AASHTO Standards:

MP1 Specifications for Performance Graded Asphalt Binder
PP6 Practice for Grading or Verifying the Performance Grade of an Asphalt Binder
T40 Sampling Bituminous Materials

509.2.2.2 ASTM Standards:

D8 Terminology Relating to Materials for Roads and Pavements

D5801 Toughness and Tenacity Testing Method

D3665 Practice for Random Sampling of Construction Materials

509.2.3 **Terminology**

509.2.3.1 *Asphalt Binder*- An asphalt based cementitious material that is produced from petroleum residue either with or without the addition of non-particulate organic modifiers to quality and consistency for direct use in the manufacture of bituminous pavements.

509.2.3.2 *ASC*- Approved Supplier Certification

509.2.3.3 *PGAB*- Performance Graded Asphalt Binder

509.2.3.4 *DSR*- Dynamic Shear Rheometer

509.2.3.5 *BBR*- Bending Beam Rheometer

509.2.3.6 *Supplier*- A supplier is defined as an individual or an entity who performs the final production, blending, or modification which alters the properties of the PGAB used in the MP1 specification. A supplier could be a refinery, a terminal, or a Hot-Mix Asphalt (HMA) producer. If there is no further alteration of the PGAB after its initial production, the refinery is the supplier and must provide the certification. If there is any grade modification of the PGAB at the terminal, the terminal becomes the supplier and must provide the certification.

NOTE 1- Various refining techniques can produce asphalts of equivalent -grade. These asphalts may be incompatible with each other. Hot-mix producers should consider compatibility before combining different asphalts and/or asphalts from different sources. If different asphalts and/or asphalts from different sources are blended by the user, they become the responsibility of the Hot-mix producer.

509.2.3.7 *Agency*- The Utah Department of Transportation. UDOT's Asphalt Laboratory Engineer will be responsible for the certification of PGAB suppliers and for the final acceptance of the PGAB.

509.2.3.8 *Specification Compliance Testing*- Complete testing according to the AASHTO-MP1 specification requirements. The procedure for verification of grade as described in AASHTO PP6 shall be followed.

509.2.3.9 *QC Testing*- Quality Control testing could be a subset of the MP1 testing that the supplier will select and describe in his Quality Control Plan. The supplier QC plan will have to be approved by the agency or its authorized representative.

NOTE 2- Definitions for various other terms common to asphalt binders can be found in ASTM D8.

509.2.4 **Significance and Use**

509.2.4.1 This standard specifies procedures for minimizing disruption of PGAB shipments caused by testing requirements. This is accomplished by a certification system with quality control and specification compliance tests performed by the supplier on samples obtained prior to shipment.

509.2.4.2 The number of grades available under MP1 may require construction of additional storage facilities to comply with "sample and hold while testing" procedures.

509.2.4.3 This standard provides information and guidelines on the following:

509.2.4.3.1 General requirements that the supplier must satisfy prior to achieving approved supplier status,

509.2.4.3.2 Minimum requirements that must be included in a supplier's quality control plan,

509.2.4.3.3 General requirements that the agency must satisfy prior to certification,

509.2.4.3.4 Procedural requirements for shipment of PGABs under an ASC system,

509.2.4.3.5 Procedural requirements for agency monitoring of an ASC system at the shipping facility.

509.2.5 **Sampling** - All test samples required by this standard shall be obtained in accordance with AASHTO T 40 and ASTM D3665. The use of stratified random sampling procedure is important for the establishment of a valid certification program.

509.2.6 **Testing Requirements**

509.2.6.1 All certification testing required for this standard shall be performed by a laboratory holding current inspection and accreditation certificate from AASHTO Materials Reference Laboratory (AMRL). For suppliers with multiple laboratories, satellite laboratories may be inspected by the supplier's primary AMRL inspected and accredited laboratory staff. The satellite laboratory(ies) must, however, participate in the AMRL Sample

Proficiency Testing Program. The laboratory shall, at a minimum, be equipped with one Bending Beam Rheometer, one Dynamic Shear Rheometer, one Pressure Aging Vessel, one Brookfield Viscometer with Thermocell , one Rolling Thin Film Oven , and one Direct Tension Testing Device.

NOTE 3- Have primary laboratory facilities (test methods and equipment) regularly inspected by AASHTO Materials Reference Laboratory (AMRL). A copy of the AMRL report on the lab inspection shall be provided with the testing results, accompanied by documentation of resolution of any discrepancies in the AMRL report. Cost of this inspection shall be borne by the source of data. Satellite laboratories may be inspected by the sources primary AMRL inspected and accredited laboratory staff. A copy of the source report of the satellite laboratory inspection shall be provided with the test report.

509.2.7 **Supplier Requirements**

509.2.7.1 The supplier shall submit a written request to the agency for authorization to ship PGABs under the ASC system and shall list the grades to which the request applies.

509.2.7.2 The agency (or its representative) shall have access at all times to the supplier's production/shipping facility, to inspect the facility, to observe the supplier's quality control procedures, to obtain samples. and to perform tests.

509.2.7.3 The supplier shall submit to the agency, for approval, a complete quality control (QC) plan which complies with the requirements of **Section 509.2.8**

509.2.7.4 The supplier shall follow the procedures set forth in the approved QC plan.

509.2.7.5 The supplier shall establish and maintain a daily record of all tests required on each grade included in the written request prepared to satisfy the requirements of **Section 509.2.7.1**. This record, if requested, shall be made available to the agency. In addition, the supplier shall forward with the written request, a one liter sample of each grade of PGAB to the agency.

509.2.7.6 The supplier shall submit all reports required by this standard in a format approved by the agency.

509.2.7.7 The supplier shall have a satisfactory record of compliance with specifications.

509.2.8 **Supplier Quality Control (QC) Plan (Minimum Requirements)**

509.2.8.1 The supplier QC plan shall identify:

509.2.8.1.1 the type of facility (i.e., refinery, terminal, etc.)

509.2.8.1.2 the location of the facility,

509.2.8.1.3 the name(s), and telephone number(s) of the employee(s) responsible for quality control at the facility,

509.2.8.1.4 the Quality Control (QC) tests to be performed on each PGAB, and

509.2.8.1.5 the laboratory(ies) performing quality control tests on the binder(s) that are shipped.

509.2.8.2 The supplier QC plan shall include a declaration stating that if a test result indicates non compliance of any shipment with the purchase specifications, the supplier shall (1) immediately notify the agency of the shipment in question, (2) identify the material, (3) cease additional shipment until material is brought back to specification, (4) notify the agency when shipment shall resume, (5) implement any mutually agreed-upon procedures for the disposition of the non compliance material.

509.2.8.3 The supplier QC plan shall describe protocols and frequency for initial testing, QC testing, and specification compliance testing.

509.2.8.3.1 Initial Testing- For each binder grade to be supplied, specification compliance testing (complete AASHTO MP1 testing) shall be performed for at least three consecutive lots. The lot size will be agreed to by the supplier and the agency. A lot is a fixed batch of material. The agency must approve any change to lot sizes.

NOTE 4- In a batch operation used to manufacture the binder, a tank may be defined as a lot. The lot size would be the amount of material batched into the tank (e.g. 100 tons). Do not produce modified binders at the hot-mix production site. Modified binders shall be produced at a refinery or terminal.

509.2.8.3.2 Reduced test frequency for specification compliance- If approved by the agency, the frequency of testing for specification compliance can be reduced to every other lot if the individual AASHTO MP1 and ASTM D5801 test result for every sample of the initial testing meets the following compliance criteria:

Original DSR, G*/Sinδ $1.22 kPa

Original DSR,G* $ 1.56 kPa
Phase angle (rule of 92) # 71E
Phase angle (rule of 98) # 68 E
Original DSR, G*/sinδ $1.65 kPa
RTFO DSR, G*/Sinδ $ 2.68 kPa
PAV DSR, G*(Sinδ) # 3.9 Mpa
S(60sec.)BBR # 250 Mpa
m-value BBR $ 0.312
Failure Strain Direct Tension $2.0%
Failure Stress Direct Tension $5.2 Mpa
Toughness, $100 lb-in
Tenacity, $ 70 lb-in

NOTE 5- The compliance criterion for Failure Stress and Strain in the Direct Tension Test is for those PG Grades having an algebraic difference between the high and low design grade of 92 EC or greater. G* denotes the complex modulus.
NOTE 6 - The compliance criterion for toughness and tenacity is for grades having an algebraic difference of 92EC or greater between the high and low temperature.

With the approval of the agency, the frequency of testing can be further reduced as long as the individual test results continue to meet the above compliance criteria.

If any of the criteria is not met, or if testing is resumed after occurrence of a non-compliance incident or after a plant shut-down, every lot will continue to be tested for the individual AASHTO MP1 or ASTM D5801 property until three consecutive lots meet the above compliance criteria.

509.2.8.3.3 Minimum frequency - Complete AASHTO MP 1 Specification compliance testing including ASTM D5801 shall be run at least once a month for each binder grade produced during that month. This minimum frequency is independent of the test results specified in **Section 509.2.8.3.2**

509.2.8.3.4 Quality Control testing guidelines for manufacturer- At least two AASHTO MP1 test shall be used for monitoring high and low temperature properties of the binder. Manufacturers may use Non-AASHTO MP1 tests approved by the agency. The use of non-AASHTO MP1 tests does not preclude the need to meet AASHTO MP1 specifications or to run complete AASHTO MP1 tests according to the guidelines in **Section 509.2.8.3**

509.2.8.4 The QC plan shall include a statement that the supplier, if requested by the agency, shall prepare and submit quarterly summary reports of all quality control and specification compliance tests performed during that period.

509.2.8.5 In order to prevent contamination of shipments, the supplier QC plan shall provide an outline of the procedure(s) to be followed for inspection of transport vehicles prior to loading. The procedure shall include an entry stating that the transport vehicle inspection report, signed by the responsible inspector, shall be maintained in the supplier's records and will be made available for review by the purchaser/agency upon request.

509.2.9 **Agency Requirements**

509.2.9.1 The agency shall review the QC and may visit the shipping site.

509.2.9.2 The agency, upon receipt of the application for **ASC** status, shall review the application, and if acceptable, notify the supplier of it's approval. The notification shall include a listing of the grades covered.

509.2.9.3 The agency shall verify that the supplier's primary testing laboratory has current AASHTO accreditation and participates in the AMRL proficiency sample testing (**NOTE 3**)

509.2.9.4 The agency shall authorize shipment of each listed performance graded binder under the ASC system only after all requirements of the ASC have been satisfied.

509.2.10 **Requirements for Shipping PGABs by an ASC Supplier**

509.2.10.1 The supplier shall ship PGAB shipments covered by the certification as dictated by shipping schedules (i.e. at any time)

509.2.10.2 Each shipment shall be accompanied by two copies of the shipment bill of lading which shall include (1) the name and location of the supplier, (2) the grade of the material, (3) the quantity of the material shipped, (4) the date of the shipment, (5) a statement certifying that the transport vehicle was presented by the carrier acceptable for the material shipped. Each shipment shall also be accompanied by a complete Material Safety Data Sheet (MSDS) as required by the Code of Federal Regulations.

509.2.10.3 If the specification compliance test results do not conform to the PGAB specifications, the supplier shall remove the non conforming material from the shipping queue as outlined in **Section 509.2.8.2.**

509.2.11 **Split Sample Testing**

509.2.11.1 The agency may test split samples that are obtained at random from the Supplier's facility.

NOTE 7- Split samples shall be obtained from the same general locations from which the Supplier's samples are taken.

509.2.11.2 The agency shall determine the frequency of split sample testing. At least one split sample shall be taken and tested every 60 days.

509.2.11.3 If the split sample data and the Supplier test data are not within the following tolerances, an immediate investigation shall be conducted to determine the cause of the difference between the data:

Original, RTFO, and PAV, DSR:	± 20%
Original DSR G*	± 20%
Original phase angle	$ 2 E
s (60 sec), BBR:	± 10%
m-value, BBR:	± 0.015
Failure Strain, DT:	± 30%
Failure Stress, DT	± 20 %
Toughness	± 30%
Tenacity	± 30%

Unless available facts indicate otherwise, the investigation shall include a review of sampling and testing procedures of both supplier and agency.

509.2.12 **Report and Data Sheets**

509.2.12.1 The supplier shall submit all reports in accordance with the procedure described in **Section 509.2.7.6.** The test results shall be reported in a format that can be easily understood by a technician with minimum training in performance graded binder testing. The system of unit used shall be clearly stated. If test results are presented in a tabular format, the units, where applicable, shall be stated either as part of a column heading or after the description of the physical parameter or after its numerical value. The supplier shall also furnish the raw test data in a floppy diskette either in an ASCII format or in any commonly used spreadsheet format upon request by the agency.

509.2.13 **Withdrawal of ASC Status**

509.2.13.1 The agency may revoke or suspend ASC status under the following conditions:

509.2.13.1.1 The test data provided by the supplier to the agency does not meet the tolerances shown in Section 509.2.11.3 for three consecutive samples.

509.2.13.1.2 Supplier test data can not be verified repeatedly by the agency and the agency deems that it is due to negligence on the part of the supplier.

509.2.13.1.3 The supplier is not following the approved QC plan.

509.2.13.1.4 A visit by the agency's representative to the supplier's facility reveals significant quality control problems.

509.3 Field Quality Control of PGAB

509.3.1 The field quality control of PGAB will be the responsibility of the contractor. Prior to accepting deliveries of PGAB, the contractor will submit a PGAB Quality Control Plan including minimum key elements as listed in Section **509.3.4 .** This plan will be included within the contractor's quality control plan for asphalt concrete or and addendum to it. If the contractor is not using a quality control plan for asphalt concrete, the PGAB quality control plan will be a separate document which is an extension of the project contract. The quality control plan will be submitted at least 15 days prior to commencing paving operations. The purpose of the quality control plan is to describe proper handling techniques for the PGAB to ensure its consistency through transportation and storage operations. The quality control plan will be reviewed by the Project Engineer and paving operations will not begin before the plan has been accepted.

509.3.2 The contents of the PGAB quality control plan shall be contract specific and current to the production and mixture operations. Prior to executing any change to PGAB production, the quality control plan will be revised by written addendum to incorporate the change. Acceptance of the addendum will be required before the change is made to PGAB production. Failure to keep the quality control plan current may affect subsequent decisions, such as those made during failed material reviews and/or the appeal process.

509.3.3 The supplier that manufactures the binder and assigns the designated PGAB must be on UDOT's Approved Supplier Certification System (ASCS).

509.3.4 **Minimum General Requirements of the Contractor's PGAB Quality Control Plan**

509.3.4.1 The quality control plan will have a signature page. The contractor and any subcontractor responsible for handling the PGAB will sign and date such page when the plan is submitted for acceptance.

509.3.4.2 The responsibilities of each party having a role in the quality control plan shall be identified.

509.3.4.3 The commitment towards communicating with UDOT personnel will be stated. Specific circumstances and arrangements for communication shall be identified as appropriate throughout the plan.

509.3.4.4 The anticipated mode of PGAB delivery will be outlined. The process of truck inspection prior to filling will be described to avoid binder contamination. Any sampling and testing to be conducted after delivery will be fully described.

509.3.4.5 The capacity(ies) and methods of agitation within the storage tank(s) will be described. Based on the type of asphalt used to produce the specific grade (i.e., blended asphalt, modified asphalt, etc.), any potential limitations of the PGAB relative to prolonged storage, exposure to prolonged and/or elevated heating, susceptibility to stratification and/or separation, etc. will be fully described.

509.3.4.6 Any special handling or storage requirements of the PGAB will be fully described. Any on-site sampling and testing will be outlined as to location, testing, and control limits.

509.3.4.7 The plan will identify procedures for identifying the PGAB contained in each storage tank.

509.3.4.8 The procedure to continually monitor and record the tank(s) temperature(s) will be described.

509.3.4.9 The procedure to change from one PGAB grade to another grade within a tank will be described.

509.4 Performance Graded Asphalt Binder Quality Assurance Plan

509.4.1 UDOT Sampling

509.4.1.1 Each day that asphalt concrete is being produced, a binder sample, comprised of three (3) individual one (1)quart containers will be taken at random times from the mix plant's asphalt tank injection line. Two of these containers will be for UDOT's use and the other container will be given to the contractor. The contractor will retain these samples until project completion. Each sample will be taken from the sampling valve after sufficient amount of binder is run out and wasted, in order to clear any residual asphalt and/or solvent which builds up in the sampling valve. Each sample will be taken at random times during the production day as determined by UDOT.

509.4.1.2 If mix plant operations are suspended for more than 48 hours, the next binder sample will not be taken randomly; instead, this binder sample will be taken at the resumption of operations.

509.4.1.3 **Lots and Sublots**

509.4.1.3.1 Each day's production shall constitute a binder sublot (represented by one random sample) and each week's production shall constitute a binder lot. A lot, however, will not exceed eight (8) sublots. thus the tonnage of binder may vary from sublot to sublot and from lot to lot. If two (2) production sublots or less are accumulated within a production week, this will not be considered a binder lot. These sublots will be included within the next production week. Thus, a binder lot shall consist of at least three (3) sublots.

509.4.1.3.2 A binder sublot shall include only one grade. Thus, if the grade is changed within a production day, that day will be divided into sublots representing each grade used and one binder sample will be taken for each grade used.

509.4.1.3.3 At the end of the project, the final binder lot may include less than three sublots.

509.4.1.3.4 All sublot samples will be sampled and/or witnessed by a representative of the contractor and UDOT. A sample identification form will be signed by both parties, signifying each sample's acceptability. UDOT will take control of it's portion of the sample once obtained. The contractor will take control of and retain it's portion of the sample as per Section 509.4.1.1.

509.4.2 UDOT Testing

509.4.2.1 UDOT's AASHTO accredited laboratory will randomly choose one (1) sublot from each lot, and either completely or partially test the selected sample at its discretion. If the tested grade complies with the specified grade, the binder lot will be accepted. If the grade does not comply with the specified grade, the Resident Engineer will be notified of the failure by means of a test report . This test report will also be sent by registered mail to the Binder Supplier. A price reduction will be assessed or the material will be removed and replaced as specified in Section 509.5.

509.4.2.2 **Guidelines for Appeal Procedure**

509.4.2.2.1 If the contractor wishes to appeal the test results of a lot, the contractor shall submit a written appeal request within 21 calendar days of the reported test results to the Supplier (as per Section 509.4.2.1). The appeal must state the grounds or the circumstances of the appeal and if the test results are in-question, the appeal must be accompanied by all of the quality control test results which represents the lot in question and a complete binder test series ,on the contractor's retained and disputed sub-lot sample which was taken during the lot in question. (see Section 509.4.1.1) This sample must be tested by an AASHTO accredited laboratory, independent from the supplier, and mutually acceptable to the contractor and UDOT. The contractor will be responsible for testing costs. The contractor will be held responsible for all penalties assessed if the contractor's part of the sample can not be furnished. The binder supplier is not to be held liable in this case.

509.4.2.2.2 The appeal request and the submitted test results will be reviewed by UDOT. If the appeal has merit and/or the contractor's binder test results from the mix plant indicate a significant difference between UDOT's binder test results, the appeal will be accepted by UDOT.

509.4.2.2.3 When an appeal is accepted, the agency will conduct additional binder tests on two(2) additional sublot samples from the lot in question. The two additional sublot samples will be randomly chosen and will be tested for those test parameters which significantly differ between UDOT and the contractor. Any invalid test results will be disregarded. The initial and additional test results for each test will be averaged and the average value for each test will be considered the final lot value. Thus, the final lot values will be used to determine compliance or non-compliance.. Compliance or non-compliance will be acted upon as outlined in **Section 509.5**. The contractor will be notified in writing of the additional test results, the final lot values, and the appeal conclusions.

509.4.2.2.4 If the appeal is not accepted, UDOT will submit a denial letter to the contractor, stating the grounds for the denial.

509.4.2.2.5 The contractor may request referee testing on final assessed price reductions . The contractor will agree to have the available back-up sublot samples retained by UDOT, from the lot in question, tested by an AASHTO accredited laboratory mutually acceptable to the contractor and UDOT. All specification parameters in contention will be tested on each sublot sample. The contractor will agree to bear the costs of testing each sublot sample if the referee tests verify non specification compliance on any one sublot sample. UDOT will bear the costs of testing if all sub-lot samples are in compliance to the specifications. The AASHTO accredited laboratory will report the results to UDOT. The results of the tests will be binding to both parties. These test results for the test parameter(s) in contention will be averaged. This average value(s) will be considered the final lot value. This final lot value(s) will be used to determine compliance/non-compliance to the specifications as outlined in Section 509.5.

509.5 Calculation and Application of Price Reductions for Non-Specification PGAB

509.5.1 Table 1. Compliance and rejection limits for price rejection calculations for PGAB.

Property	Compliance Limit for Price Reduction of 0 %	Rejection Limit Price Reduction 25 %
G*/sinδ of the original PGAB at high grade temp, (kPa)	0.84 Min.	0.70 Min.
G* of the original PGAB at high grade Temperature, (kPa)	1.20 Min.	1.06 Min.
δ (phase angle) of the original PGAB at high grade Temp. (Rule of 92), degrees	76 Max.	78 Max
δ (phase angle) of the orginal PGAB at high grade Temp. (Rule of 98), degrees	73 Max	75 Max
G*/Sinδ or RTFO Residue at high temperature, (kPa)	1.87 Min.	1.53 Min.
Stiffness of the PAV residue at Low Grade temp. + 10 EC, (Mpa)	311 Max.	355 Max.
Slope (m-value) of the Creep Curve at Low Grade temp. +10 EC	0.295 Min.	0.266 Min.

Failure Strain of PAV Residue in Direct Tension at Low Grade Temp. + 10 EC [1], %	1.4 Min.	1.2 Min.
Failure Stress of PAV Residue in Direct Tension at Low Grade Temp. + 10 EC [1], Mpa	4.0 Min	3.5 Min
Toughness of original PGAB , lb.in [1]	68 Min.	49 Min.
Tenacity of original PGAB, lb in. [1]	45 Min.	32 Min.

[1] Use only for binders whose high and low temperature algebraic difference is 92 EC or greater

509.5.2 If the value of the measured properties meet the compliance limit of table 1, the price reduction is 0% for each individual test property. The price reduction for each individual property will be 25% at the rejection limit. If any measured property is outside the rejection limit, i.e., greater than 25%, the mixture will be rejected. For each property whose value lies between the compliance limit and the rejection limit, the price reduction will be calculated assuming a linear variation between 0 and 25. For example, if the measured m value is 0.270, the per cent price reduction for the m-value will be calculated as follows:

$$\%\text{Price reduction for m-value} = 25 \times \frac{(0.295-0.270)}{(0.295-0.266)} = 21.55$$

509.5.3 For a particular sample having more than one parameter out of specification, the composite price reduction for the PGAB will be calculated by summing the reduction of each individual property calculated as described above.

509.5.4 The PGAB shall be accepted with reduced composite price reduction if none of the critical properties are outside the rejection limit and the composite price reduction is 25% or less. The material will be rejected if one or more of the measured properties fall outside the rejection limit or if the composite price reduction is more than 25%.

509.6 Basis of Payment

509.6.1 The amount of price reduction made to the contractor will be based on the hot mix asphalt price quoted in the contractor's bid. If the price per ton is un-balanced then the applicable previous year average bid price per ton will be used.

Price Reduction = Line item price for HMA x PR_{PGAB} x Number of tons HMA

Utah Department of Transportation

Master Bid List for Metric Standard Specifications

For Road and Bridge Construction

CSI Format

1999

12/17/01	Master Bid List - Metric		
Item Numbers	**Description**	**Unit**	**Payment**
	00830 Equal Opportunity Training		
00830001U	Equal Opportunity Training	h	Hour
	01285 Mobilization		
012850010	Mobilization	Lump	Lump sum
	01315 Public Information Services		
013150010	Public Information Services	Lump	Lump sum
	01554 Traffic Control		
015540005	Traffic Control	Lump	Lump sum
015540010	Traffic Control Maintainer	Cal d	Calendar day
015540015	Pilot Car	h	Hour
015540020	Flagging ((State Projects))	h	Hour
015540022	Flagging (Federal Projects)	h	Hour
015540025	Construction Sign	m^2-day	Square meter day
015540030	Plastic Barrels	Dev-d	Device Day
015540035	Barricades - Type I	Dev-d	Device Day
015540040	Barricades - Type II	Dev-d	Device Day
015540045	Barricades - Type III	m-d	Meter day
015540050	Vertical Panel	Dev-d	Device Day
015540055	Advance Warning Arrow Panel - Type B -Stationary	h	Hour
015540060	Advance Warning Arrow Panel - Type C -Stationary	h	Hour
015540065	Advance Warning Arrow Panel - Type B -Moving	h	Hour
015540070	Advance Warning Arrow Panel - Type C -Moving	h	Hour
	01558 Temporary Traffic Striping		
015580010	Temporary Traffic Striping	m	Meter
015580015	Temporary Pavement Markings	m	Meter
015580020	Temporary Pavement Markers	m	Meter

	01561 Temporary Environmental Fence		
015610010	Environmental Fence	m	Meter
	01571 Temporary Environmental Control		
015710010	Check Dam (Straw or Hay Bale)	m	Meter
015710020	Check Dam (Stone)	m^3	Cubic meter
015710030	Silt Fence	m	Meter
015710040	Slope Drain	m	Meter
015710050	Drop-Inlet Barriers (Straw or Hay Bale)	m	Meter
015710060	Drop-Inlet Barriers (Stone)	m^3	Cubic meter
015710070	Drop-Inlet Barriers (Silt Fence)	m	Meter
015710080	Sediment Trap	m^3	Cubic meter
015710090	Temporary Berm	m	Meter
015710100	Curb Inlet Barrier	Each	Each
	01572 Dust Control and Watering		
015720010	Dust Control and Watering	kL	Kiloliter
	01721 Survey		
01721000*	Survey (Speciality Item)	Lump	Lump Sum
	01891 Move Street Signs and Mail		
	Box Assemblies		
018910010	Move Street Sign	Each	Each
018910020	Move Mailbox	Each	Each
018910030	Mailbox Assembly	Each	Each
	01892 Reconstruct Catch Basin, Cleanout,		
	Meter, Valve, Manhole and Monument Boxes		
018920010	Reconstruct Catch Basin	Each	Each
018920020	Reconstruct Cleanout Box	Each	Each
018920030	Reconstruct Meter Box	Each	Each
018920040	Reconstruct Valve Box	Each	Each
018920050	Reconstruct Manhole	Each	Each

018920060	Reconstruct Monument Box	Each	Each
	02056 Common Fill		
020560005	Borrow	m^3	Cubic meter
020560010	Borrow	Mg	Megagram
020560015	Granular Borrow	m^3	Cubic meter
020560020	Granular Borrow	Mg	Megagram
020560025	Granular Backfill Borrow	m^3	Cubic meter
020560030	Granular Backfill Borrow	Mg	Megagram
020560035	Sand	m^3	Cubic meter
020560040	Sand	Mg	Megagram
020560045	Clay	m^3	Cubic meter
020560050	Clay	Mg	Megagram
	02061 Select Aggregate		
020610010	Free Draining Granular Backfill Borrow	Mg	Megagram
020610020	Free Draining Granular Backfill Borrow	m^3	Cubic meter
020610030	Underdrain Granular Backfill	Mg	Megagram
020610040	Underdrain Granular Backfill	m^3	Cubic meter
	02075 Geotextiles		
020750010	Geotextiles - Separation	m^2	Square meter
020750020	Geotextiles - Erosion Control	m^2	Square meter
020750030	Geotextiles - Drainage	m^2	Square meter
020750040	Geotextiles - Weed Barrier	m^2	Square meter
020750050	Geotextiles - Stabilization	m^2	Square meter
	02078 Asphalt Overlay Fabric		
020780010	Asphalt Fabric	m^2	Square meter
	02082 Water Meter		
020820010	Water Meter, Contractor Furnished	Each	Each
020820020	Relocate Water Meter	Each	Each
	02221 Remove Structure and Obstruction		
02221001D	Remove Building, Basement,		

	and Foundation Parcel #_____	Parcel	Parcel
02221002D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221003D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221004D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221005D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221006D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221007D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
02221008D	Remove Building, Basement,		
	and Foundation Parcel #_____	Parcel	Parcel
022210015	Remove Bridge	Each	Each
022210020	Remove Box Culvert	Each	Each
022210025	Remove Manhole	Each	Each
022210030	Remove Catch Basin	Each	Each
022210035	Remove Diversion Box	Each	Each
022210040	Remove Cleanout Box	Each	Each
022210045	Remove Cattle Guard	Each	Each
022210050	Remove Tree	Each	Each
022210055	Remove Concrete Headwall	Each	Each
022210056	Remove Concrete Headwall 300 mm - 900 mm pipe	Each	Each
022210057	Remove Concrete Headwall 910 mm - 1500 mm pipe	Each	Each
022210058	Remove Concrete Headwall 1510 mm - 2100 mm pipe	Each	Each
022210059	Remove Concrete Headwall Greater than 2110 mm pipe	Each	Each
022210060	Remove Septic Tank	Each	Each
022210065	Remove Underground Tank	Each	Each
022210070	Remove Buried Fuel Tank	Each	Each
022210075	Remove Guardrail	m	Meter
022210080	Remove Fence	m	Meter
022210085	Remove Railroad Track	m	Meter
022210090	Remove Utility Pole	Each	Each
022210095	Remove Pipe Culvert	m	Meter

	02222 Site Demolition - Pavement		
022220005	Remove Concrete Sidewalk	m^2	Square meter
022220010	Remove Concrete Driveway	m^2	Square meter
022220015	Remove Concrete Curb	m	Meter
022220020	Remove Concrete Curb and Gutter	m	Meter
022220025	Remove Bituminous Curb	m	Meter
022220030	Remove Raised Island	m	Meter
022220035	Remove Concrete Pavement	m^2	Square meter
022220040	Remove Asphalt Pavement	m^2	Square meter
022220045	Obliterate Road	m	Meter
	02225 Asphalt Surfacing Removal (Structures)		
022250010	Asphalt Surfacing Removal (Structures)	m^2	Square meter
	02226 Remove Concrete Slope Protection		
022260010	Remove Concrete Slope Protection	m^2	Square meter
	02231 Site Clearing and Grubbing		
022310010	Clearing and Grubbing	Lump	Lump sum
022310020	Clearing and Grubbing	ha	Hectare
	02312 Grading for Landscapes		
023120010	Landscape Grading	m^2	Square meter
	02316 Roadway Excavation		
023160010	Roadway Excavation	m^3	Cubic meter
023160020	Roadway Excavation (Plan Quantity)	m^3	Cubic meter
	02318 Ditch Excavation		
023180010	Small Ditch Excavation	m^3	Cubic meter
023180020	Surface Ditch	m	Meter

	02332 Embankment for Bridge		
023320010	Embankment for Bridge	m^3	Cubic meter
023320020	Embankment for Bridge	Mg	Megagram
	02338 Refinish Subgrade		
023380010	Refinish Subgrade	m^2	Square meter
	02372 Wire Enclosed Riprap		
023720010	Wire Enclosed Riprap	m^3	Cubic meter
	02373 Riprap		
023730010	Loose Riprap	m^3	Cubic meter
023730020	Hand-Placed Riprap	m^3	Cubic meter
023730030	Compacted Riprap	m^3	Cubic meter
023730040	Keying Riprap	m^2	Square meter
	02376 Erosion Control Blankets/		
	Channel Liners		
023760010	Erosion Control Blanket	m^2	Square meter
023760020	Flexible Channel Liner Type A	m^2	Square meter
	02455 Driving Piles		
024550010	Pile Driving Equipment	Lump	Lump sum
024550020	Driven Piles 324 mm	m	Meter
02455003D	Driven Piles _____ mm	m	Meter
02455004D	Driven Piles HP _____ X _____	m	Meter
	02466 Drilled Caisson		
02466001D	Drilled Caissons, _____ mm	m	Meter
024660020	Drilled Caissons, 300 mm	m	Meter
024660030	Drilled Caissons, 600 mm	m	Meter
024660040	Drilled Caissons, 750 mm	m	Meter
024660050	Drilled Caissons, 900 mm	m	Meter
024660060	Drilled Caissons, 1050 mm	m	Meter

024660070	Drilled Caissons, 1200 mm	m	Meter
024660080	Drilled Caissons, 1350 mm	m	Meter
024660090	Drilled Caissons, 1800 mm	m	Meter
	02610 Pipe Culverts		
026100002	300 mm Pipe Culvert Class A	m	Meter
026100004	450 mm Pipe Culvert Class A	m	Meter
026100006	600 mm Pipe Culvert Class A	m	Meter
026100008	750 mm Pipe Culvert Class A	m	Meter
026100010	900 mm Pipe Culvert Class A	m	Meter
026100012	1050 mm Pipe Culvert Class A	m	Meter
026100014	1200 mm Pipe Culvert Class A	m	Meter
026100016	300 mm Pipe Culvert Class B	m	Meter
026100018	450 mm Pipe Culvert Class B	m	Meter
026100020	600 mm Pipe Culvert Class B	m	Meter
026100022	750 mm Pipe Culvert Class B	m	Meter
026100024	900 mm Pipe Culvert Class B	m	Meter
026100026	1050 mm Pipe Culvert Class B	m	Meter
026100028	1200 mm Pipe Culvert Class B	m	Meter
026100030	300 mm Pipe Culvert Class C	m	Meter
026100032	450 mm Pipe Culvert Class C	m	Meter
026100034	600 mm Pipe Culvert Class C	m	Meter
026100036	750 mm Pipe Culvert Class C	m	Meter
026100038	900 mm Pipe Culvert Class C	m	Meter
026100040	1050 mm Pipe Culvert Class C	m	Meter
026100042	1200 mm Pipe Culvert Class C	m	Meter
026100044	300 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100046	450 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100048	600 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100050	750 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100052	900 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter

026100054	1050 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100056	1200 mm Corrugated Steel Pipe		
	Culvert Class A	m	Meter
026100058	300 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100060	450 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100062	600 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100064	750 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100066	900 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100068	1050 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100070	1200 mm Corrugated Steel Pipe		
	Culvert Class B	m	Meter
026100072	300 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100074	450 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100076	600 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100078	750 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100080	900 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100082	1050 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100084	1200 mm Corrugated Steel Pipe		
	Culvert Class C	m	Meter
026100086	430 mm x 330 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100088	530 mm x 380 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100090	710 mm x 510 mm Corrugated Steel Pipe Arch		

	Culvert Class A	m	Meter
026100092	885 mm x 610 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100094	1060 mm x 740 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100096	1240 mm x 840 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100098	1440 mm x 970 mm Corrugated Steel Pipe Arch		
	Culvert Class A	m	Meter
026100100	430 mm x 330 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100102	530 mm x 380 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100104	710 mm x 510 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100106	885 mm x 610 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100108	1060 mm x 740 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100110	1240 mm x 840 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100112	1440 mm x 970 mm Corrugated Steel Pipe Arch		
	Culvert Class B	m	Meter
026100114	430 mm x 330 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100116	530 mm x 380 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100118	710 mm x 510 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100120	885 mm x 610 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100122	1060 mm x 740 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100124	1240 mm x 840 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter
026100126	1440 mm x 970 mm Corrugated Steel Pipe Arch		
	Culvert Class C	m	Meter

026100128	300 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100130	450 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100132	600 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100134	750 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100136	900 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100138	1050 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100140	1200 mm Corrugated Aluminum Pipe		
	Culvert Class C	m	Meter
026100142	430 mm x 330 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100144	530 mm x 380 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100146	710 mm x 510 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100148	885mm x 610 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100150	1060mm x 740 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100152	1240 mm x 840 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100154	1440 mm x 970 mm Corrugated Aluminum Pipe		
	Arch Culvert Class C	m	Meter
026100156	300 mm Corrugated Polyethylene (HDPE)		
	Pipe Culvert Class C	m	Meter
026100158	450 mm Corrugated Polyethylene (HDPE)		
	Pipe Culvert Class C	m	Meter
026100160	600 mm Corrugated Polyethylene (HDPE)		
	Pipe Culvert Class C	m	Meter
026100162	750 mm Corrugated Polyethylene (HDPE)		
	Pipe Culvert Class C	m	Meter
026100164	900 mm Corrugated Polyethylene (HDPE)		
	Pipe Culvert Class C	m	Meter

026100166	300 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100168	450 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100170	600 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100172	750 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100174	900 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100176	1050 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100178	1200 mm Smooth Lined Pipe Culvert Class A	m	Meter
026100180	300 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100182	450 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100184	600 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100186	750 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100188	900 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100190	1050 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100192	1200 mm Smooth Lined Pipe Culvert Class B	m	Meter
026100194	300 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100196	450 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100198	600 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100200	750 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100202	900 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100204	1050 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100206	1200 mm Smooth Lined Pipe Culvert Class C	m	Meter
026100208	300 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100210	450 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100212	600 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100214	750 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100216	900 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100218	1050 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100220	1200 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class A	m	Meter
026100222	300 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100224	450 mm Concrete Lined Corrugated Steel		

	Pipe Culvert Class B	m	Meter
026100226	600 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100228	750 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100230	900 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100232	1050 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100234	1200 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class B	m	Meter
026100236	300 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100238	450 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100240	600 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100242	750 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100244	900 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100246	1050 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100248	1200 mm Concrete Lined Corrugated Steel		
	Pipe Culvert Class C	m	Meter
026100250	300 mm Smooth Lined Polyethylene Pipe		
	Culvert Class C	m	Meter
026100252	450 mm Smooth Lined Polyethylene Pipe		
	Culvert Class C	m	Meter
026100254	600 mm Smooth Lined Polyethylene Pipe		
	Culvert Class C	m	Meter
026100256	750 mm Smooth Lined Polyethylene Pipe		
	Culvert Class C	m	Meter
026100258	900 mm Smooth Lined Polyethylene Pipe		
	Culvert Class C	m	Meter
026100260	300 mm Smooth Lined Polyethylene Chloride		
	(PVC) Pipe Culvert Class C	m	Meter

026100262	450 mm Smooth Lined Polyethylene Chloride		
	(PVC) Pipe Culvert Class C	m	Meter
026100264	600 mm Smooth Lined Polyethylene Chloride		
	(PVC) Pipe Culvert Class C	m	Meter
026100266	750 mm Smooth Lined Polyethylene Chloride		
	(PVC) Pipe Culvert Class C	m	Meter
026100268	900 mm Smooth Lined Polyethylene Chloride		
	(PVC) Pipe Culvert Class C	m	Meter
026100270	300 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100272	450 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100274	600 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100276	750 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100278	900 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100280	1050 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100282	1200 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class A	m	Meter
026100284	300 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100286	450 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100288	600 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100290	750 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100292	900 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100294	1050 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100296	1200 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class B	m	Meter
026100298	300 mm Bituminous Smooth Lined Corrugated		

	Steel Pipe Culvert Class C	m	Meter
026100300	450 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100302	600 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100304	750 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100306	900 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100308	1050 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100310	1200 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Culvert Class C	m	Meter
026100312	430 mm x 330 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100314	530 mm x 380 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100316	710 mm x 510 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100318	885 mm x 610 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100320	1060 mm x 740 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100322	1240 mm x 840 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100324	1440 mm x 970 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class A	m	Meter
026100326	430 mm x 330 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100328	530 mm x 380 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100330	710 mm x 510 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100332	885 mm x 610 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100334	1060 mm x 740 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100336	1240 mm x 840 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter

026100338	1440 mm x 970 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class B	m	Meter
026100340	430 mm x 330 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100342	530 mm x 380 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100344	710 mm x 510 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100346	885 mm x 610 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100348	1060 mm x 740 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100350	1240 mm x 840 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100352	1440 mm x 970 mm Bituminous Smooth Lined Corrugated		
	Steel Pipe Arch Culvert Class C	m	Meter
026100354	300 mm Spiral Rib Steel Pipe Culvert Class A	m	Meter
026100356	450 mm Spiral Rib Steel Pipe Culvert Class A	m	Meter
026100358	600 mm Spiral Rib Steel Pipe Culvert Class A	m	Meter
026100360	750 mm Spiral Rib Steel Pipe Culvert Class A	m	Meter
026100362	900 mm Spiral Rib Steel Pipe Culvert Class A	m	Meter
026100364	1050 mm Spiral Rib Steel Pipe		
	Culvert Class A	m	Meter
026100366	1200 mm Spiral Rib Steel Pipe		
	Culvert Class A	m	Meter
026100368	300 mm Spiral Rib Steel Pipe Culvert Class B	m	Meter
026100370	450 mm Spiral Rib Steel Pipe Culvert Class B	m	Meter
026100372	600 mm Spiral Rib Steel Pipe Culvert Class B	m	Meter
026100374	750 mm Spiral Rib Steel Pipe Culvert Class B	m	Meter
026100376	900 mm Spiral Rib Steel Pipe Culvert Class B	m	Meter
026100378	1050 mm Spiral Rib Steel Pipe		
	Culvert Class B	m	Meter
026100380	1200 mm Spiral Rib Steel Pipe		
	Culvert Class B	m	Meter
026100382	300 mm Spiral Rib Steel Pipe Culvert Class C	m	Meter

026100384	450 mm Spiral Rib Steel Pipe Culvert Class C	m	Meter
026100386	600 mm Spiral Rib Steel Pipe Culvert Class C	m	Meter
026100388	750 mm Spiral Rib Steel Pipe Culvert Class C	m	Meter
026100390	900 mm Spiral Rib Steel Pipe Culvert Class C	m	Meter
026100392	1050 mm Spiral Rib Steel Pipe		
	Culvert Class C	m	Meter
026100394	1200 mm Spiral Rib Steel Pipe		
	Culvert Class C	m	Meter
026100396	300 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100398	450 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100400	600 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100402	750 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100404	900 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100406	1050 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100408	1200 mm Spiral Rib Aluminum Pipe		
	Culvert Class C	m	Meter
026100410	300 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100412	450 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100414	600 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100416	750 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100418	900 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100420	1050 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100422	1200 mm Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100424	300 mm Reinforced Concrete Pipe		

	Culvert Class C	m	Meter
026100426	450 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100428	600 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100430	750 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100432	900 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100434	1050 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100436	1200 mm Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100438	450 mm Non-Reinforced Concrete		
	Pipe Culvert Class B	m	Meter
026100440	600 mm Non-Reinforced Concrete		
	Pipe Culvert Class B	m	Meter
026100442	750 mm Non-Reinforced Concrete		
	Pipe Culvert Class B	m	Meter
026100444	900 mm Non-Reinforced Concrete		
	Pipe Culvert Class B	m	Meter
026100446	450 mm Non-Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100448	600 mm Non-Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100450	750 mm Non-Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100452	900 mm Non-Reinforced Concrete Pipe		
	Culvert Class C	m	Meter
026100454	300 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100456	450 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100458	600 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100460	750 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter

026100462	900 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100464	1050 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100466	1200 mm Elliptical Reinforced Concrete Pipe		
	Culvert Class B	m	Meter
026100468	300 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100470	450 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100472	600 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100474	750 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100476	900 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100478	1050 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100480	1200 mm Elliptical Reinforced Concrete		
	Pipe Culvert Class C	m	Meter
026100482	1800 mm Structural Steel Plate Pipe Culvert Class D	m	Meter
026100484	2100 mm Structural Steel Plate Pipe Culvert Class D	m	Meter
026100486	2400 mm Structural Steel Plate Pipe Culvert Class D	m	Meter
026100488	2700 mm Structural Steel Plate Pipe Culvert Class D	m	Meter
02610048D	____ mm Structural Steel Plate Pipe Culvert Class D	m	Meter
026100490	1800 mm Structural Steel Plate Pipe Culvert Class E	m	Meter
026100492	2100 mm Structural Steel Plate Pipe Culvert Class E	m	Meter
026100494	2400 mm Structural Steel Plate Pipe Culvert Class E	m	Meter
026100496	2700 mm Structural Steel Plate Pipe Culvert Class E	m	Meter
02610049D	____ mm Structural Steel Plate Pipe Culvert Class E	m	Meter
026100498	2050 mm x 1500 mm Structural Steel Plate Pipe Arch		
	Culvert Class D	m	Meter
026100500	2400 mm x 1720 mm Structural Steel Plate Pipe Arch		
	Culvert Class D	m	Meter
026100502	2840 mm x 1920 mm Structural Steel Plate Pipe Arch		
	Culvert Class D	m	Meter
026100504	3240 mm x 2120 mm Structural Steel Plate Pipe Arch		

	Culvert Class D	m	Meter
02610050D	____ mm x ____ mm Structural Steel Plate Pipe Arch		
	Culvert Class D	m	Meter
026100506	2050 mm x 1500 mm Structural Steel Plate Pipe Arch		
	Culvert Class E	m	Meter
026100508	2400 mm x 1720 mm Structural Steel Plate Pipe Arch		
	Culvert Class E	m	Meter
026100510	2840mm x 1920 mm Structural Steel Plate Pipe Arch		
	Culvert Class E	m	Meter
026100512	3240 mm x 2120 mm Structural Steel Plate Pipe Arch		
	Culvert Class E	m	Meter
02610051D	____ mm x ____mm Structural Steel Plate Pipe Arch		
	Culvert Class E	m	Meter
026100514	1800 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class D	m	Meter
026100516	2100 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class D	m	Meter
026100518	2400 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class D	m	Meter
026100520	2700 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class D	m	Meter
02610052D	____ mm x ____mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class D	m	Meter
026100522	1800 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class E	m	Meter
026100524	2100 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class E	m	Meter
026100526	2400 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class E	m	Meter
026100528	2700 mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class E	m	Meter
02610053D	____ mm x ____mm Aluminum Alloy Structural Plate		
	Pipe Culvert Class E	m	Meter
026100530	2050 mm x 1500 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class D	m	Meter
026100532	2400 mm x 1720 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class D	m	Meter
026100534	2840 mm x 1920 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class D	m	Meter

026100536	3240 mm x 2120 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class D	m	Meter
02610054D	____ mm x ____ mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class D	m	Meter
026100538	2050 mm x 1500 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class E	m	Meter
026100540	2400 mm x 1720 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class E	m	Meter
026100542	2840 mm x 1920 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class E	m	Meter
026100544	3240 mm x 2120 mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class E	m	Meter
02610055D	____ mm x ____mm Aluminum Alloy Structural Plate		
	Pipe Arch Culvert Class E	m	Meter
026100546	300 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100548	450 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100550	600 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100552	750 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100554	900 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100556	1050 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100558	1200 mm Corrugated Metal Pipe Culvert Class A	m	Meter
026100560	300 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100562	450 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100564	600 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100566	750 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100568	900 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100570	1050 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100572	1200 mm Corrugated Metal Pipe Culvert Class B	m	Meter
026100574	300 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100576	450 mm Corrugated Metal Steel Pipe Culvert Class C	m	Meter
026100578	600 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100580	750 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100582	900 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100584	1050 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100586	1200 mm Corrugated Metal Pipe Culvert Class C	m	Meter
026100588	430 mm x 330 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100590	530 mm x 380 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100592	710 mm x 510 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100594	885 mm x 610 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100596	1060 mm x 740 mm Corrugated Metal Pipe Arch		

	Culvert Class A	m	Meter
026100598	1240 mm x 840 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100600	1440 mm x 970 mm Corrugated Metal Pipe Arch		
	Culvert Class A	m	Meter
026100602	430 mm x 330 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100604	530 mm x 380 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100606	710 mm x 510 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100608	885 mm x 610 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100610	1060 mm x 740 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100612	1240 mm x 840 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100614	1440 mm x 970 mm Corrugated Metal Pipe Arch		
	Culvert Class B	m	Meter
026100616	430 mm x 330 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100618	530 mm x 380 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100620	710 mm x 510 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100622	885 mm x 610 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100624	1060 mm x 740 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100626	1240 mm x 840 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100628	1440 mm x 970 mm Corrugated Metal Pipe Arch		
	Culvert Class C	m	Meter
026100630	300 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100632	450 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100634	600 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100636	750 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100638	900 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100640	1050 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter
026100642	1200 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class A	m	Meter

026100644	300 mm Concrete Lined Corrugated Metal	m	Meter
	Pipe Culvert Class B		
026100646	450 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100648	600 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100650	750 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100652	900 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100654	1050 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100656	1200 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class B	m	Meter
026100658	300 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100660	450 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100662	600 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100664	750 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100666	900 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100668	1050 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
026100670	1200 mm Concrete Lined Corrugated Metal		
	Pipe Culvert Class C	m	Meter
	02611 Diversion Box Gate & Frame		
026110010	Hand-slide Gate 300 mm	Each	Each
026110015	Hand-slide Gate 450 mm	Each	Each
026110020	Hand-slide Gate 600 mm	Each	Each
026110025	Hand-slide Gate 750 mm	Each	Each
026110030	Hand-slide Gate 900 mm	Each	Each
026110035	Hand-slide Gate 1050 mm	Each	Each
026110040	Hand-slide Gate 1200 mm	Each	Each
026110045	Screw Gate and Frame 300 mm	Each	Each
026110050	Screw Gate and Frame 400 mm	Each	Each
026110055	Screw Gate and Frame 600 mm	Each	Each
026110060	Screw Gate and Frame 750 mm	Each	Each
026110065	Screw Gate and Frame 900 mm	Each	Each
026110070	Screw Gate and Frame 1050 mm	Each	Each
026110075	Screw Gate and Frame 1200 mm	Each	Each

	02613 Culvert End Sections		
026130020	Culvert End Sections 300 mm	Each	Each
026130030	Culvert End Sections 450 mm	Each	Each
026130040	Culvert End Sections 600 mm	Each	Each
026130050	Culvert End Sections 750 mm	Each	Each
026130060	Culvert End Sections 900 mm	Each	Each
02613001D	Culvert End Sections _____ mm	Each	Each
026130070	Culvert End Sections 1050 mm	Each	Each
029130080	Culvert End Sections 1200 mm	Each	Each
	02614 Salvage and/or Relay Pipe Culvert		
	and End Sections		
026140010	Salvage Pipe Culvert	m	Meter
026140020	Salvage and Relay Pipe Culvert	m	Meter
026140030	Salvage Culvert End Section	Each	Each
026140040	Salvage and Relay Culvert End Section	Each	Each
	02622 Underdrain		
026220020	Underdrain, 300 mm	m	Meter
026220030	Underdrain, 450 mm	m	Meter
026220040	Underdrain, 600 mm	m	Meter
02622001D	Underdrain, _____ mm	m	Meter
	02624 Approach Slab Catch Basin		
026240010	Approach Slab Catch Basin	Each	Each
	02625 Approach Slab Drain Frame Modification		
026250010	Approach Slab Drain Frame Modification	Each	Each
	02626 Deck Drain Modification and Closure		
026260010	Deck Drain Modification	Each	Each
026260020	Deck Drain Closure	Each	Each

	02635 Grates, Solid Covers, Frames and Manhole		
	Steps		
026350005	Diversion Box Solid Cover and Frame Type A		
	Std Dwg 1562	Each	Each
026350010	Diversion Box Solid Cover and Frame Type B		
	Std Dwg 1562	Each	Each
026350015	Diversion Box Solid Cover and Frame Type C		
	Std Dwg 1562	Each	Each
026350020	Solid Cover and Frame, Std Dwg 1567	Each	Each
025350025	Manhole Frame and Grated Cover Std Dwg 1701	Each	Each
026350030	Manhole Frame and Solid Cover, Std Dwg 1702	Each	Each
026350035	Rectangular Grate and Frame (Standard Grating)		
	Std Dwg 1703	Each	Each
026350040	Rectangular Grate And Frame (Bicycle Safe Grating)		
	Std Dwg 1703	Each	Each
026350045	Solid Cover aand Frame , Std Dwg 1705	Each	Each
026350050	Manhole Steps, Std Dwg 1706	Each	Each
	02643 Concrete-Lined Ditch		
026430010	Concrete-Lined Ditch	cu yd	Cubic Yard
	02645 Precast Concrete Box Culvert		
026450010	Precast Concrete Box Culvert	Lump	Lump sum
	02705 Pavement Sawing		
027050010	Asphalt Pavement Sawing	mm-m	Millimeter-Meter
027050015	Asphalt Pavement Sawing	m	Meter
027050020	Concrete Pavement Sawing	imm-m	Millimeter-Meter
027050025	Concrete Pavement Sawing	m	Meter
027050030	Concrete Sawing	mm-m	Millimeter-Meter
027050035	Concrete Sawing	m	Meter
	02712 Lean Concrete Base Course		
027120010	Lean Concrete Base Course, 100 mm thick	m^2	Square meter

	02715 Hydrated Lime Treated Roadbed		
027150010	Hydrated Lime Treated Roadbed	m^2	Square meter
	02721 Untreated Base Course (UTBC)		
027210010	Untreated Base Course 37.5 mm Max	Mg	Megagram
027210020	Untreated Base Course 37.5 mm Max	m^3	Cubic meter
027210030	Untreated Base Course 25 mm Max	Mg	Megagram
027210040	Untreated Base Course 25 mm Max	m^3	Cubic meter
027210050	Untreated Base Course 19 mm Max	Mg	Megagram
027210060	Untreated Base Course 19 mm Max	m^3	Cubic yard
027210070	Untreated Base Course 19 mm or 25 mm Max	Mg	Megagram
027210080	Untreated Base Course 19 mm or 25 mm Max	m^3	Cubic meter
	02741 Hot Mix Asphalt		
027410005	HMA - 9.5 mm		
027410010	HMA - 12.5 mm	Mg	Megagram
027410020	HMA - 19.0 mm	Mg	Megagram
027410030	HMA - 25.0 mm	Mg	Megagram
	02743 Hot Mix Asphalt - Small Projects /		
	Bike and Pedestrian Paths		
027430010	HMA Mix - Small Projects 12.5 mm	Mg	Megagram
027430020	HMA Mix - Bike/Ped Path 9.5 mm	Mg	Megagram
027430030	Rejuvinator, Type “B” modified	Mg	Megagram
	02744 Hot Mix Asphalt - Procurement		
027440010	HMA Mix - Procurement Laydown 9.5 mm	Mg	Megagram
027440020	HMA Mix - Procurement Laydown 12.5 mm	Mg	Megagram
027440030	HMA Mix - Procurement Blade Work 9.5 mm	Mg	Megagram
027440040	HMA Mix - Procurement Blade Work 12.5 mm	Mg	Megagram

	02747 Road Mix Asphalt Surface Course		
027470010	Road Mix Asphalt Surface Course	Mg	Megagram
	02748 Prime Coat/Tack Coat		
027480010	Liquid Asphalt MC-70 or MC-250	Mg	Megagram
027480030	Emulsified Asphalt SS-1	Mg	Megagram
027480040	Emulsified Asphalt CSS-1	Mg	Megagram
027480050	Emulsified Asphalt SS-1H	Mg	Megagram
027480060	Emulsified Asphalt CSS-1H	Mg	Megagram
027480070	Emulsified Asphalt CRS-2A	Mg	Megagram
	02749 Asphalt Driveway		
027490010	Asphalt Concrete Driveway	Each	Each
	02752 Portland Cement Concrete Pavement		
027520010	Portland Cement Concrete Pavement		
	175 mm Thick	m^2	Square meter
027520020	Portland Cement Concrete Pavement		
	225 mm Thick	m^2	Square meter
027520030	Portland Cement Concrete Pavement		
	275 mm Thick	m^2	Square meter
	02753 Full Depth Slab Replacement for Concrete Pavement		
027530010	Full Depth Slab Replacement	m^2	Square meter
	02755 Concrete Slab Jacking		
027550010	Concrete Slab Jacking	m^3	Cubic meter
	02761 Scored Shoulder		
027610010	Scored Shoulder	m	Meter
	02762 Plowable Pavement Marker		
027620010	Plowable Pavement Marker - One Way White	Each	Each
027620020	Plowable Pavement Marker - One Way Yellow	Each	Each

027620030	Plowable Pavement Marker - Two Way Yellow	Each	Each
027620040	Plowable Pavement Marker	Each	Each
	02765 Pavement Marking Paint		
027650005	Traffic Striping Paint	L	Liter
027650010	Traffic Striping Paint	m	Meter
027650020	Pavement Message Paint	Each	Each
027650025	Pavement Marking Paint (Stop Bars, Cross Walks - 300 mm)	m	Meter
027650030	Remove Pavement Markings	m	Meter
027650040	Remove Pavement Markings	Each	Each
	02768 Pavement Marking Materials		
	(Warranty Specification)		
027680005	100 mm Pavement Marking Tape - White	m	Meter
027680010	200 mm Pavement Marking Tape - White	m	Meter
027680015	100 mm Pavement Marking Tape - Yellow	m	Meter
027680020	200 mm Pavement Marking Tape - Yellow	m	Meter
027680025	Pavement Message (Tape)	Each	Each
027680030	100 mm Pavement Marking Epoxy - White, Type 1	m	Meter
027680035	200 mm Pavement Marking Epoxy - White, Type 1	m	Meter
027680040	100 mm Pavement Marking Epoxy - Yellow, Type 1	m	Meter
027680045	200 mm Pavement Marking Epoxy - Yellow, Type 1	m	Meter
027680050	100 mm Pavement Marking Epoxy - White, Type 2	m	Meter
027680055	200 mm Pavement Marking Epoxy - White, Type 2	m	Meter
027680060	100 mm Pavement Marking Epoxy - Yellow, Type 2	m	Meter
027680065	200 mm Pavement Marking Epoxy - Yellow, Type 2	m	Meter
027680070	Pavement Message (Epoxy) Type 1	Each	Each
027680075	Pavement Message (Epoxy) Type 2	Each	Each
027680080	100 mm Pavement Marking Acrylic - White	m	Meter
027680085	200 mm Pavement Marking Acrylic - White	m	Meter
027680090	100 mm Pavement Marking Acrylic - Yellow	m	Meter
027680095	200 mm Pavement Marking Acrylic - Yellow	m	Meter
027680100	Pavement Message (Acrylic)	Each	Each

027680105	Pavement Message (Preformed Thermoplastic)	Each	Each
	02771 Curbs, Gutters, Driveways,		
	Disabled Pedestrian Ramps, and Plowable		
	End Sections		
027710005	Concrete Gutter	m	Meter
027710010	Concrete Curb Type B3	m	Meter
027710015	Concrete Curb Type B4	m	Meter
027710020	Concrete Curb Type M2	m	Meter
027710025	Concrete Curb and Gutter Type B1	m	Meter
027710030	Concrete Curb and Gutter Type B2	m	Meter
027710035	Concrete Curb and Gutter Type M1	m	Meter
027710040	Concrete Driveway Flared 150 mm Thick	m^2	Square meter
027710045	Concrete Driveway Flared 175 mm Thick	m^2	Square meter
027710050	Concrete Driveway Open 150 mm Thick	m^2	Square meter
027710055	Concrete Driveway Open 175 mm Thick	m^2	Square meter
027710060	Disabled Pedestrian Ramp Type A	m^2	Square meter
027710065	Disabled Pedestrian Ramp Type B	m^2	Square meter
027710070	Disabled Pedestrian Ramp Type C	m^2	Square meter
027710075	Disabled Pedestrian Ramp Type D	m^2	Square meter
027710080	Disabled Pedestrian Ramp Type E	m^2	Square meter
027710085	Disabled Pedestrian Ramp Type G	m^2	Square meter
027710090	Disabled Pedestrian Ramp Type H	m^2	Square meter
027710100	Plowable End Section	Each	Each
	02773 Asphalt Concrete Curb		
027730010	Asphalt Concrete Curb	m	Meter
	02776 Concrete Sidewalk, Median		
	Filler and Flatwork		
027760010	Concrete Sidewalk	m^2	Square meter
027760020	Concrete Median Filler	m^2	Square meter
027760030	Concrete Flatwork 100 mm thick	m^2	Square meter
027760040	Concrete Flatwork 150 mm thick	m^2	Square meter
027760050	Concrete Flatwork 175 mm thick	m^2	Square meter
027760060	Concrete Flatwork 200 mm thick	m^2	Square meter

	02785 Chip Seal Coat		
027850010	Chip Seal Coat, Type A	m^2	Square meter
027850020	Chip Seal Coat, Type B	m^2	Square meter
027850030	Chip Seal Coat, Type C	m^2	Square meter
027850040	Emulsified Asphalt RS-2	Mg	Megagram
027850045	Emulsified Asphalt CRS-2A	Mg	Megagram
027850050	Emulsified Asphalt CRS-2B	Mg	Megagram
027850055	Emulsified Asphalt CRS-2P	Mg	Megagram
027850060	Emulsified Asphalt LMCRS-2	Mg	Megagram
027850065	Emulsifed Asphalt HFRS-2P	Mg	Megagram
027850070	Emulsified Asphalt HFMS-2	Mg	Megagram
027850075	Emulsified Asphalt HFMS-2P	Mg	Megagram
	02786 Plant Mix Seal Coat (Open-Graded)		
027860010	Plant Mix Seal Coat	Mg	Megagram
027860020	Asphalt Cement PG 64-34	Mg	Megagram
027860030	Asphalt Cement PG 70-28	Mg	Megagram
027860040	Asphalt Cement PG 70-34	Mg	Megagram
027860050	Asphalt Cement PG 64-28	Mg	Megagram
	02812 Pressurized Irrigation System		
028120010	Pressurized Irrigation System	Lump	Lump sum
02812002D	____ PVC Pipe Schedule_____	m	Meter
	02821 Chain Link Fencing and Gates		
028210002	0.9 m Chain Link Fence, Type I	m	Meter
028210004	1.2 m Chain Link Fence, Type I	m	Meter
028210006	1.5 m Chain Link Fence, Type I	m	Meter
028210008	1.8 m Chain Link Fence, Type I	m	Meter
028210010	2.2 m Chain Link Fence, Type I	m	Meter
028210012	0.9 m Chain Link Fence, Type II	m	Meter
028210014	1.2 m Chain Link Fence, Type II	m	Meter
028210016	1.5 m Chain Link Fence, Type II	m	Meter
028210018	1.8 m Chain Link Fence, Type II	m	Meter
028210020	2.2 m Chain Link Fence, Type II	m	Meter
028210022	0.9 m Chain Link Fence, Type III	m	Meter
028210024	1.2 m Chain Link Fence, Type III	m	Meter
028210026	1.5 m Chain Link Fence, Type III	m	Meter

028210028	1.8 m Chain Link Fence, Type III	m	Meter
028210030	2.2 m Chain Link Fence, Type III	m	Meter
028210032	0.9 m Chain Link Fence, Type IV	m	Meter
028210034	1.2 m Chain Link Fence, Type IV	m	Meter
028210036	1.5 m Chain Link Fence, Type IV	m	Meter
028210038	1.8 m Chain Link Fence, Type IV	m	Meter
028210040	2.2 m Chain Link Fence, Type IV	m	Meter
028210042	Chain Link Fence Type I with Barb Wire Arm	m	Meter
028210044	Chain Link Brace Post	Each	Each
028210046	Chain Link Gate H- 0.9 m X W- 1.2 m	Each	Each
028210048	Chain Link Gate H- 1.2 m X W- 1.2 m	Each	Each
028210050	Chain Link Gate H- 1.5 m X W- 1.2 m	Each	Each
028210052	Chain Link Gate H- 1.8 m X W- 1.2 m	Each	Each
028210054	Chain Link Gate H- 0.9 m X W- 1.8 m	Each	Each
028210056	Chain Link Gate H- 1.2 m X W- 1.8 m	Each	Each
028210058	Chain Link Gate H- 1.5 m X W- 1.8 m	Each	Each
028210060	Chain Link Gate H- 1.8 m X W- 1.8 m	Each	Each
028210062	Chain Link Gate H- 0.9 m X W- 2.4 m	Each	Each
028210064	Chain Link Gate H- 1.2 m X W- 2.4 m	Each	Each
028210066	Chain Link Gate H- 1.5 m X W- 2.4 m	Each	Each
028210068	Chain Link Gate H- 1.8 m X W- 2.4 m	Each	Each
028210070	Chain Link Gate H- 0.9 m X W- 3.0 m	Each	Each
028210072	Chain Link Gate H- 1.2 m X W- 3.0 m	Each	Each
028210074	Chain Link Gate H- 1.5 m X W- 3.0 m	Each	Each
028210076	Chain Link Gate H- 1.8 m X W- 3.0 m	Each	Each
028210078	Chain Link Gate H- 0.9 m X W- 3.6 m	Each	Each
028210080	Chain Link Gate H- 1.2 m X W- 3.6 m	Each	Each
028210082	Chain Link Gate H- 1.5 m X W- 3.6 m	Each	Each
028210084	Chain Link Gate H- 1.8 m X W- 3.6 m	Each	Each
028210086	Chain Link Gate H- 0.9 m X W- 4.3 m	Each	Each
028210088	Chain Link Gate H- 1.2 m X W- 4.3 m	Each	Each
028210090	Chain Link Gate H- 1.5 m X W- 4.3 m	Each	Each
028210092	Chain Link Gate H- 1.8 m X W- 4.3 m	Each	Each
028210094	Chain Link Gate H- 0.9 m X W- 4.9 m	Each	Each
028210096	Chain Link Gate H- 1.2 m X W- 4.9 m	Each	Each
028210098	Chain Link Gate H- 1.5 m X W- 4.9 m	Each	Each
028210100	Chain Link Gate H- 1.8 m X W- 4.9 m	Each	Each
	02822 Right-of-Way Fence and Gate		

028220005	Right-of-Way Fence, Type A (Wood Post)	m	Meter
028220010	Right-of-Way Fence, Type A (Metal Post)	m	Meter
028220015	Right-of-Way Fence, Type B (Wood Post)	m	Meter
028220020	Right-of-Way Fence, Type B (Metal Post)	m	Meter
028220025	Right-of-Way Fence, Type D (Wood Post)	m	Meter
028220030	Right-of-Way Fence, Type D (Metal Post)	m	Meter
028220035	Right-of-Way Fence, Type E (Wood Post)	m	Meter
028220040	Right-of-Way Fence, Type E (Metal Post)	m	Meter
028220045	Right-of-Way Fence, Type F (Wood Post)	m	Meter
028220050	Right-of-Way Fence, Type F (Metal Post)	m	Meter
028220055	Right-of-Way Fence, Type G (Wood Post)	m	Meter
028220060	Right-of-Way Fence, Type G (Metal Post)	m	Meter
028220065	Right-of-Way Gate 1.2 m	Each	Each
028220070	Right-of-Way Gate 1.8 m	Each	Each
028220075	Right-of-Way Gate 2.4 m	Each	Each
028220080	Right-of-Way Gate 3.0 m	Each	Each
028220085	Right-of-Way Gate 3.7 m	Each	Each
028220090	Right-of-Way Gate 4.3 m	Each	Each
028220095	Right-of-Way Deer Gate	Each	Each
028220100	Swing Gate	Each	Each
028220105	Right-of-Way Brace Post	Each	Each
	02825 Cattle Guard		
028250010	Precast Concrete Cattle Guard	Each	Each
	02841 Traffic Barriers		
028410010	Beam Guardrail	m	Meter
028410020	Double Beam Guardrail	m	Meter
028410030	Guardrail Transition Elements	Each	Each
028410040	Precast Concrete Barrier	m	Meter
028410050	Precast Concrete Barrier (Half Section)	m	Meter
028410060	Traffic Control Cable	m	Meter
028410070	Barrier Reflector	Each	Each
028410080	Cast-in-Place Constant Slope Barrier	m	Meter
	02842 Delineators		

028420010	Delineator Type I	Each	Each
028420020	Delineator Type II	Each	Each
028420030	Delineator - Culvert Marker	Each	Each
028420040	Delineator - Maintenance Marker	Each	Each
028420050	Delineator - Freeway Turn Around	Each	Each
	02843 Attenuation/End Section		
028430005	Attenuator Type A	Each	Each
028430010	Attenuator Type B	Each	Each
028430015	Attenuator Type C	Each	Each
028430020	Attenuator Type D	Each	Each
028430025	Attenuator Type E	Each	Each
028430030	End Section Type F	Each	Each
028430035	End Section Type G	Each	Each
028430040	End Section Type H		
028430045	Marker Post and Mounting Hardware	Each	Each
028430050	Object Marker Sheeting or Marker Plate Hardware	Each	Each
	02861 Precast Retaining/Noise Walls		
028610005	Precast Noise Wall 1.00 m	m	Meter
028610010	Precast Noise Wall 1.25 m	m	Meter
028610015	Precast Noise Wall 1.50 m	m	Meter
028610020	Precast Noise Wall 1.75 m	m	Meter
028610025	Precast Noise Wall 2.00 m	m	Meter
028610030	Precast Noise Wall 2.25 m	m	Meter
028610035	Precast Noise Wall 2.50 m	m	Meter
028610040	Precast Noise Wall 2.75 m	m	Meter
028610045	Precast Noise Wall 3.00 m	m	Meter
028610050	Precast Noise Wall 3.25 m	m	Meter
028610055	Precast Noise Wall 3.50 m	m	Meter
028610060	Precast Noise Wall 3.75 m	m	Meter
028610065	Precast Noise Wall 4.00 m	m	Meter
028610070	Precast Noise Wall 4.25 m	m	Meter
028610075	Precast Noise Wall 4.50 m	m	Meter
028610080	Precast Noise Wall 4.75 m	m	Meter
028610085	Precast Noise Wall 5.00 m	m	Meter
028610090	Precast Retaining/Noise Wall 2.25 m	m	Meter
028610095	Precast Retaining/Noise Wall 3.25 m	m	Meter
028610100	Precast Retaining/Noise Wall 3.50 m	m	Meter

028610105	Precast Retaining/Noise Wall 3.75 m	m	Meter
028610110	Precast Retaining/Noise Wall 4.00 m	m	Meter
028610115	Precast Retaining/Noise Wall 4.25 m	m	Meter
028610120	Precast Retaining/Noise Wall 4.50 m	m	Meter
028610125	Precast Retaining/Noise Wall 4.75 m	m	Meter
028610130	Precast Retaining/Noise Wall 5.00 m	m	Meter
028610135	Precast Retaining/Noise Wall 5.25 m	m	Meter
028610140	Precast Retaining/Noise Wall 5.50 m	m	Meter
028610145	Precast Retaining/Noise Wall 5.75 m	m	Meter
	02891 Traffic Signs		
028910005	Remove Sign	Each	Each
028910010	Relocate Sign	Each	Each
028910022	Sign Type A-1	m^2	Square meter
028910020	Auxiliary Sign Type A-I	m^2	Square meter
028910025	Sign Type A-I 305 mm X 457 mm	Each	Each
028910030	Sign Type A-I 508 mm X 381 mm	Each	Each
028910035	Sign Type A-I 610 mm	Each	Each
028910040	Sign Type A-I 610 mm X 305 mm	Each	Each
028910045	Sign Type A-I 610 mm X 610 mm	Each	Each
028910050	Sign Type A-I 610 mm X 762 mm	Each	Each
028910055	Sign Type A-I 762 mm X 610 mm	Each	Each
028910060	Sign Type A-I 762 mm X 762 mm	Each	Each
028910065	Sign Type A-I 910 mm X 910 mm	Each	Each
028910070	Sign Type A-I 1219 mm X 1219 mm	Each	Each
028910075	Auxiliary Sign Type A-2	m^2	Square meter
028910080	Sign Type A-2 305 mm X 457 mm	Each	Each
028910085	Sign Type A-2 508 mm X 381 mm	Each	Each
028910090	Sign Type A-2 610 mm	Each	Each
028910095	Sign Type A-2 610 mm X 305 mm	Each	Each
028910100	Sign Type A-2 610 mm X 610 mm	Each	Each
028910105	Sign Type A-2 610 mm X 762 mm	Each	Each
028910110	Sign Type A-2 762 mm X 610 mm	Each	Each
028910115	Sign Type A-2 762 mm X 762 mm	Each	Each
028910120	Sign Type A-2 910 mm X 910 mm	Each	Each
028910125	Sign Type A-2 1219 mm X 1219 mm	Each	Each
028910130	Auxiliary Sign Type P-I	m^2	Square meter
028910132	Sign Type P-1	m^2	Square meter

028910135	Sign Type P-1 305 mm X 457 mm	Each	Each
028910140	Sign Type P-1 508 mm X 381 mm	Each	Each
028910145	Sign Type P-1 610 mm	Each	Each
028910150	Sign Type P-1 610 mm X 305 mm	Each	Each
028910155	Sign Type P-1 610 mm X 610 mm	Each	Each
028910160	Sign Type P-1 610 mm X 762 mm	Each	Each
028910165	Sign Type P-1 762 mm X 610 mm	Each	Each
028910170	Sign Type P-1 762 mm X 762 mm	Each	Each
028910175	Sign Type P-1 910 mm X 910 mm	Each	Each
028910180	Sign Type P-1 1219 mm X 1219 mm	Each	Each
028910185	Auxiliary Sign Type P-2	m^2	Square meter
028910190	Sign Type P-2 305 mm X 457 mm	Each	Each
028910195	Sign Type P-2 508 mm X 381 mm	Each	Each
028910200	Sign Type P-2 610 mm	Each	Each
028910205	Sign Type P-2 610 mm X 305 mm	Each	Each
028910210	Sign Type P-2 610 mm X 610 mm	Each	Each
028910215	Sign Type P-2 610 mm X 762 mm	Each	Each
028910220	Sign Type P-2 762 mm X 610 mm	Each	Each
028910225	Sign Type P-2 762 mm X 762 mm	Each	Each
028910230	Sign Type P-2 910 mm X 910 mm	Each	Each
028910235	Sign Type P-2 1219 mm X 1219 mm	Each	Each
028910240	Panel Overlay	m^2	Square meter
028910245	Panel Replacement	m^2	Square meter
028910250	Overhead Sign Structure	Each	Each
028910255	Sign Foundation	Each	Each
028910260	Temporary Sign Covering	Each	Each
	02892 Traffic Signal		
02892001D	Traffic Signal System _____	Lump	Lump sum
02892002D	Traffic Signal System _____	Lump	Lump sum
02892003D	Traffic Signal System _____	Lump	Lump sum
02892004D	Traffic Signal System _____	Lump	Lump sum
02892005D	Traffic Signal System _____	Lump	Lump sum
02892006D	Traffic Signal System _____	Lump	Lump sum
028920015	Signal Power Source	Each	Each
028920020	Installation of State Furnished Material	Lump	Lump Sum
028920025	Installation of State Furnished Mast Arm Mounted		
	Sign	Each	Each
028920030	Traffic Counting Loop Detector	Each	Each

02892040D	____ PVC Conduit Schedule_____	m	Meter
	State Furnished Items		
028920050	Mast Arm Signal Pole (7.6 m to 13.7 m)	Each	Each
028920052	Mast Arm Signal Pole (15.2 m to 16.8 m)	Each	Each
028920054	Mast Arm Signal Pole (18.3 m to 19.8 m)	Each	Each
028920056	Dual Mast Arm Signal Pole	Each	Each
028920058	7.6 m Mast Arm	Each	Each
028920060	9.1 m Mast Arm	Each	Each
028920062	10.7 m Mast Arm	Each	Each
028920064	12.2 m Mast Arm	Each	Each
028920066	13.7 m Mast Arm	Each	Each
028920068	15.2 m Mast Arm	Each	Each
028920070	16.8 m mast Arm	Each	Each
028920072	18.3 m Mast Arm	Each	Each
028920074	19.8 m Mast Arm	Each	Each
028920076	9.1 m Light Pole Extension with 3.0 m Arm	Each	Each
028920078	12.2 m Light Pole Extension with 3.0 m Arm	Each	Each
028920080	Mast Arm Mounted Sign with Mounting Brackets	Each	Each
028920082	50 mm Diameter Anchor Bolt Set	Each	Each
028920084	Eight Phase Controller with M Cabinet	Each	Each
028920086	Eight Phase Controller with P-1 Cabinet	Each	Each
028920088	LED Module - Red Ball	Each	Each
028920090	LED Module - Yellow Ball	Each	Each
028920092	LED Module - Green Ball	Each	Each
028920094	LED Module - Red Arrow	Each	Each
028920096	LED Module - Yellow Arrow	Each	Each
028920098	LED Module - Green Arrow	Each	Each
028920100	LED Pedestrain Module	Each	Each
028920102	TS-2 Type 1-8 Phase P44 Cabinet	Each	Each
028920104	Video Detection Assemblies	Each	Each
028920106	Video Detection Controller	Each	Each
028920108	Video Detection Cable Assembly	Each	Each
028920110	Video Processing Module	Each	Each
028920112	State Force Account Labor for Eight Phase Controller	Each	Each
	02896 Boundary Survey		
028960010	Boundary Survey and Survey Plat	Lump	Lump sum
028960020	Right-of-Way Markers	Each	Each
	02911 Mulch		

029110010	Cellulose Fiber Mulch	ha	Hectare
029110020	Straw Mulch	ha	Hectare
	02912 Topsoil		
029120010	Contractor Furnished Topsoil	m^2	Square meter
029120020	Contractor Furnished Topsoil	Mg	Megagram
029120030	Strip and Stockpile Topsoil	m^3	Cubic meter
029120040	Spread Stockpiled Topsoil	m^2	Square meter
	02922 Seed, Turf Seed, and Turf Sod		
029220010	Drill Seed	ha	Hectare
029220020	Turf Seed	100-m^2	Square meter, Hundred
29220030	Broadcast Seed	ha	Hectare
029220040	Broadcast Seed	100-m^2	Square meter, Hundred
029220050	Broadcast Turf Seed	100-m^2	Square meter, Hundred
029220060	Turf Sod	m^2	Square meter
	02931 Pole Plantings/Willow Cuttings		
029310010	Pole Planting	Each	Each
029310020	Willow Planting	Each	Each
	02932 Trees, Shrubs, and Groundcovers		
029320010	Plant - Tubeling	Each	Each
029320030	Plant - No 1 Container	Each	Each
029320050	Plant - No 5 Container	Each	Each
02932006D	Plant - No ____ Container	Each	Each
029320070	Plant - 32 mm Caliper	Each	Each
02932008D	Plant - ____mm Caliper	Each	Each
029320090	Plant - 38 mm Caliper	Each	Each
029320110	Plant - 1.2 m	Each	Each
029320130	Plant - 1.5 m	Each	Each
02932014D	Plant - ____m	Each	Each
	02936 Vegetation Establishment Period		

029360010	Establishment Period	Lump	Lump sum
	02938 Tree Pruning		
029380010	Tree Pruning	Each	Each
	02961 Rotomilling		
029610010	Rotomilling	m^2	Square meter
029610020	Rotomilling - 25 mm	m^2	Square meter
029610025	Rotomilling - 40 mm	m^2	Square meter
029610030	Rotomilling - 50 mm	m^2	Square meter
029610040	Rotomilling - 75 mm	m^2	Square meter
029610050	Rotomilling - 100 mm	m^2	Square meter
029610060	Rotomilling - 125 mm	m^2	Square meter
029610070	Rotomilling - 150 mm	m^2	Square meter
	02962 In-Place Cold Recycled Asphaltic Base		
029620010	In-place Cold Recycled Asphaltic Base	m^2	Square meter
	02963 Profile Rotomilling		
029630010	Profile Rotomilling	m^2	Square meter
	02966 Recycled Surface		
029660010	Recycled Surface	m^2	Square meter
029660020	Rejuvenating Agent	Mg	Megagram
	02967 Surface Repaving		
029670010	Surface Repaving	m^2	Square meter
029670020	Rejuvenating Agent	Mg	Megagram
	03211 Reinforcing Steel and Welded Wire		
032110010	Reinforcing Steel - Coated	Kg	Kilograms
032110020	Reinforcing Steel	Kg	Kilograms

	03310 Structural Concrete		
03310001D	Structural Concrete (Est. Qty_____m3)	Lump	Lump sum
033100020	Concrete- Small Structure	m^3	Cubic Meter
033100030	Concrete Slope Protection	m^2	Square meter
	03311 Joint Closure		
033110010	Joint Closure	m^2	Square meter
	03392 Penetrating Concrete Sealer		
033920010	Penetrating Concrete Sealer	m^2	Square meter
	03412 Prestressed Concrete		
03412001D	Prestressed Concrete Member		
	___m-___ mm Type ___ (Specialty Item)	Each	Each
	03575 Flowable Fill		
035750010	Flowable Fill	m^3	Cubic meter
	03605 Approach Slab Jacking		
036050010	Approach Slab Jacking	m^3	Cubic meter
	03921 Parapet Surface Repair and Sealing		
039210010	Parapet Surface Repair	m	Meter
039210020	Parapet Sealing	m	Meter
	03923 Column Sealing		
039230010	Column Sealing	Each	Each
	03924 Structural Concrete Repair		
039240010	Column Repair	Each	Each
039240020	Pedestal Repair	Each	Each
039240030	Bent Cap Repair	Each	Each
039240040	Pier Cap Repair	Each	Each
039240050	Diaphragm Repair	Each	Each
039240060	Wingwall Repair	Each	Each

039240070	Abutment Backwall Repair	Each	Each
039240080	Beam End Repair	Each	Each
	03932 Concrete Slope Protection Repair		
039320010	Concrete Slope Protection Repair	m^2	Square meter
	03933 Parpet Rehabilitation		
039330010	Parapet Modification	Meter	Meter
039330020	Parapet End Modification	Each	Each
	03934 Pothole Patching		
039340010	Pothole Patching	m^2	Square meter
	05120 Structural Steel		
051200010	Structural Steel (Est. Qty_____kg) (Specialty Item)	Lump	Lump sum
051200020	Structural Steel	Kg	Kilograms
	05831 Expansion Joint Modification		
058310010	Expansion Joint Modification	Meter	Meter
	05832 Expansion Joint		
058320010	Expansion Joint	m	Meter
	07105 Waterproofing Membrane		
071050010	Waterproofing Membrane	m^2	Square meter
	07921 Sealing Existing Concrete Slope Protection		
	Joints		
079210010	Sealing Existing Concrete Slope Protection Joints	m	Meter
	07922 Relief Joint Crack Sealing		
079220010	Relief Joint Crack Sealing	m	Meter

	09991 Cleaning and Repainting Structural Steel		
099910010	Cleaning and Repainting Structural Steel	Lump	Lump sum
	09992 Cleaning and Overcoating Structural Steel		
099920010	Cleaning and Overcoating Structural Steel	Lump	Lump sum
	13552 Ramp Meter Signals and Signing		
135520010	Ramp meter signals and signing systems	Lump	Lump sum
	13553 ATMS Conduit		
135530010	Ramp meter signals and signing systems	m	Meter
	13554 Polymer Concrete Junction Box		
135540010	Ramp meter signals and signing systems	Lump	Lump sum
	13555 ATMS Cabinet		
135550010	ATMS Cabinet	Each	Each
	13556 Closed Circuit Television (CCTV)		
135560010	Closed Circuit Television (CCTV) System	Lump	Lump sum
	13557 Variable Message Sign		
135570010	Variable Message Sign System	Lump	Lump sum
	13591 Traffic Monitoring Detector Loop		
135910010	Traffic Monitoring Detector Loop	Each	Each
	13592 Road Weather Information System		
135920010	Road Weather Information System	Lump	Lump sum
	13593 Weigh in Motion		
135930010	Weigh in Motion System	Lump	Lump sum
	13594 Fiber Optic Communication		
135940010	Fiber Optic Communication System	Lump	Lump sum
	16135 Electrical Junction Boxes		

161350010	Plastic Type I Junction Box	Each	Each
161350020	Plastic Type I Double Junction Box	Each	Each
161350030	Plastic Type II Junction Box	Each	Each
161350040	Plastic Type II Double Junction Box	Each	Each
161350050	Plastic Junction Box Extension Type I	Each	Each
161350060	Plastic Junction Box Extension Type II	Each	Each
161350070	Steel Junction Box	Each	Each
161350080	Maintenance Marker	Each	Each
	16525 Highway Lighting		
16525001D	Highway Lighting System _____	Lump	Lump sum
16525002D	Highway Lighting System _____	Lump	Lump sum
16525003D	Highway Lighting System _____	Lump	Lump sum
16525004D	Highway Lighting System _____	Lump	Lump sum
165250050	Lighting Power Source	Each	Each
	16526 Electrical Work Bridges		
165260010	Electrical Work Bridges	Lump	Lump sum

Utah Department of Transportation

Measurement and Payment for Metric Standard Specifications

For Road and Bridge Construction

CSI Format

1999

February 26, 2002

CSI Measurement and Payment Instructions

The project-specific CSI Measurement and Payment information is currently required in a project's bid package. However, the Utah Department of Transportation's "1999 Metric Standard Specifications For Road and Bridge Construction CSI Format" book does not contain the Measurement and Payment information for Construction Specification Institute (CSI) items.

A Word Perfect macro in the Engineer's Estimate Report window creates the required preliminary, project-specific Measurement and Payment document from the item list you create in the Engineer's Estimate.

To create the Measurement and Payment document:

1. Finish creating the Engineer's Estimate according to directions.

2. Save the list file.

In the Engineer's Estimate Report screen:

- Click on "File." Select the "Export Measurement and Payment List" option from the dropdown list.
- At the prompt, select the file type as a "text" file.
- Specify a location where the list file is to be saved.

The following are examples of how to select the "Export Measurement and Payment List" option from the "File" menu and the "Save As" window with the "Save as type" set to "Text":

3. Start the WordPerfect macro.

- Start WordPerfect
- Click on "Tools."
  - Select "Macro."
    - Click on "Play."

- At the prompt, find the macro csimp.wcm and click on the macro name.
  The macro should be located on the network shared drive (either R or W) in the "Shared" directory, "SpecBook" sub-directory, "1999Book.CSI" sub-directory. For example: "R:\Shared\Specbook\1999Book.CSI\csimp.wcm".

- When the csimp.wcm macro starts, select "Yes" at the prompt to continue the macro or "No" to cancel the macro when the following message is displayed:

If you select "yes," the macro closes all open WordPerfect documents so that only a new document, "Document 1", is open.

The macro prompts you for the location of two files. At the prompts:

- Enter the file name and location of the "CSI item number" list file you created in

step 2.

- Enter the file name and location of the CSI Standard Item "Measurement and Payment" WordPerfect file.

This file should be located on the network shared drive (either R or W), "Shared" directory, "SpecBook" sub-directory, "1999Book.CSI" sub-directory. For example: R:\Shared\Specbook\1999Book.MeasurementPaymentDocument.wpd.

After entering the two file names and locations, the macro creates the preliminary project-specific Measurement and Payment document. The document contains information associated with each CSI standard item, and a "place holder" for each non-standard item in the list file you generated from the Engineer's Estimate in step 2.

4. Save the Measurement and Payment document.

- At the prompt:
  - Enter a file name for the Measurement and Payment document.
  - Enter a location where you will save the Measurement and Payment document.

After saving the document, you will see the following message:

"The CSI Measurement and Payment output file was created successfully. CSI Measurement and Payment macro ending."

- Click on the "OK" button to exit the macro.

Notes:

- If the Engineer's Estimate is later updated and another item added to the project, you must completely recreate this list file and a new Measurement and Payment document since the item sequence numbers in the Estimate may have changed.

- If you cannot find a CSI standard item number in the CSI Standard Item "Measurement and Payment" WordPerfect file, the macro may fail. If the macro failed because of an error condition, please note the "Corel PerfectScript" error message, contact PDBS support, and select "Quit" to exit the macro.

If you have questions about this document, the items it contains, or if you find discrepancies, please notify Farrell Wright 965-4289 in the UDOT Engineering Services Division.

Property of Utah Department of Transportation

MEASUREMENT AND PAYMENT

The Department will measure and pay for each bid item as detailed in this section. Payment is contingent upon acceptance by the Department.

Items are listed by Specification and in tables as follows:

Section XXXXX: Section Name

Item #	**Bid item number**	**Bid Item Name**	**Unit of measurement and payment**
Additional information goes here.			

Section 00830: Equal Opportunity Training

#	**00830001U**	**Equal Opportunity Training**	**Hour**

Section 01285: Mobilization

#	**012850010**	**Mobilization**	**Lump sum**
	Payment	**Amount Paid**	**When Paid**
	First	The lesser of 25% of mobilization or 2.5% of contract	With first estimate
	Second	The lesser of 25% of mobilization or 2.5% of contract	With estimate following completion of 5% of contract
	Third	The lesser of 25% of mobilization or 2.5% of contract	With estimate following completion of 10% of contract
	Fourth	The lesser of 25% of mobilization or 2.5% of contract	With estimate following completion of 20% of contract
	Final	Amount bid in excess of 10% of contract price.	Upon substantial completion

Section 01315: Public Information Services

#	013150010	Public Information Services	Lump Sum

A. Includes compensation for:
   1. All fliers, public information office, telephone lines, and all other labor and materials required to complete the item.
   2. All costs for materials, installation, maintenance, and removal of the public information services signs.

B. The ENGINEER will monitor the PIM and all public information services.
   1. When the CONTRACTOR provides acceptable public information services in accordance with these specifications, partial payments for the pay item "Public Information Services" will be made as the work progresses.
   2. Failure to provide acceptable public information services will result in withholding of payment for this item.
   3. Partial payments made as follows:

% of Original Contract Earned	% of amount bid item	
5	25	
10	40	less all previous payments
25	50	less all previous payments
75	75	less all previous payments
100	100	less all previous payments

C. The term "original Contract amount" as used above means the amount bid for the construction items on this Contract, not including the amounts bid for Public Information Services and Mobilization.

Section 01554: Traffic Control

#	015540005	Traffic Control	Lump sum:

A. Partial Payment: Based on the percentage of the project completed, excluding the cost of the traffic control.

If paid by individual item:

#	015540010	Traffic Control Maintainer	Calendar day

Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.

#	015540015	Pilot Car	Hour	In use

#	015540020	Flagging - State Projects	Hour

A. Increase or decrease in the estimated quantities for Flagging is not cause for a unit price adjustment.
B. Unit bid price for "Flagging" is from $6.00 per hour minimum to $16.00 per hour maximum.
C. The Department will adjust any bid proposal for "Flagging" less than $6.00 per hour up to this minimum amount, and any bid proposal greater than $16.00 per hour down to this maximum amount by the Department.
   1. The Department will consider the adjusted bid item for flagging the Contractor's bid for the item "Flagging", recalculate the Contractor's bid, and use the revised total to compare with other bids to determine the low bid for award.
   2. The Department will pay the adjusted unit price for flagging.

#	015540022	Flagging - Federal Projects	Hour

A. An increase or decrease in the estimated quantities for Flagging is not cause for a unit price adjustment.
B. Unit bid price for "Flagging" is from $8.25 per hour minimum to $16.00 per hour maximum.
C. The Department will adjust any bid proposal for "Flagging" less than $8.25 per hour up to this minimum amount, and any bid proposal greater than $16.00 per hour down to this maximum amount.
   1. The Department will consider the adjusted bid item for flagging the Contractor's bid for the item "Flagging", recalculate the Contractor's bid, and use the revised total to compare with other bids to determine the low bid for award.
   2. The Department will pay the adjust unit price for flagging.

#	015540025	Construction Sign	Square Meter Day	In place

A. The number of square meters of each sign face will be computed to the nearest tenth of a square meter.
B. Each day the sum of the area of all the in-place sign faces will be rounded to the next whole square meter for payment purposes.

#	015540030	Plastic Barrels	Device day

A. Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.
B. Device day: The number of devices used to control, direct, or warn traffic per calendar day or part of a calendar day.

#	015540035	Barricades, Type I	Device day

A. Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.
B. Device day: The number of devices used to control, direct, or warn traffic per calendar day or part of a calendar day.

#	015540040	Barricades, Type II	Device day
A. Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR. B. Device day: The number of devices used to control, direct, or warn traffic per calendar day or part of a calendar day.			

#	015540045	Barricades, Type III	Meter day
A. Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR. B. Meter Day: The length of device measure per meter used to control, direct or warn traffic per meter day or part of a meter day.			

#	015540050	Vertical Panel	Device day
A. Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR. B. Device day: The number of devices used to control, direct, or warn traffic per calendar day or part of a calendar day.			

#	015540055	Advance Warning Arrow Panel, Type B, Stationary	Hour
Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.			

#	015540060	Advance Warning Arrow Panel, Type C, Stationary	Hour
Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.			

#	015540065	Advance Warning Arrow Panel, Type B, Moving	Hour
Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.			

#	015540070	Advance Warning Arrow Panel, Type C, Moving	Hour
Deduct all DEPARTMENT costs of corrective action against monies due to CONTRACTOR.			

Section 01558: Temporary Traffic Striping

#	015580005	Temporary Pavement Markings	Meter	In place

#	015580010	Temporary Traffic Striping	Meter, of 100 mm wide stripe	In place

#	015580020	Temporary Pavement Markers	Meter	In place

Section 01561: Temporary Environmental Fence

#	015610010	Environmental Fence	Meter	In place

Section 01571: Temporary Environmental Control

#	015710010	Check Dam (Straw or Hay Bale)	Meter	Of check dam constructed

#	015710020	Check Dam (Stone)	Cubic Meter	Per structure, in place

#	015710030	Silt Fence	Meter	In place

#	015710040	Slope Drain	Meter	In place

#	015710050	Drop-inlet Barriers (Straw or Hay Bale)	Meter	Along the center line of bales, in place

#	015710060	Drop-inlet Barriers (Stone)	Cubic Meter	In place

#	015710070	Drop-inlet Barriers (Silt Fence)	Meter	Along the silt fence, in place

#	015710080	Sediment Trap	Cubic meter	Of material excavated

#	015710090	Temporary Berm	Meter	Along the center line of the berm, in place

#	015710100	Curb inlet Barrier	Each	In place

Section 01572: Dust Control and Watering

#	015720010	Dust Control and Watering	Kiloliter

A. Reapply water at no additional cost to the DEPARTMENT when material containing natural or applied water is allowed to dry due to the CONTRACTOR's inattention or neglect.
B. The DEPARTMENT will not pay separately for furnishing or applying water used in:
   1. Hot plant wet collectors.
   2. Areas around all HMA and PCC plants, pits, and crusher operations.
   3. Roads used to haul materials to and from project site.
   4. Rotomilling, sawing, or grinding operations.
   5. Maintaining plant life.
   6. Lean concrete base and Portland Cement Concrete pavement.
   7. Aggregate washing.
   8. Wetting foundations before concrete work.
   9. Concrete curing.
   10. Other items of work for which water is specified as incidental to and included in payment.

Section 01721: Survey

#	017210010	Survey (Specialty Item)	Lump sum

Partial payment based on the percentage of the contract complete.

Section 01891: Move Street Signs and Mail Box Assemblies

#	018910010	Move Street Sign	Each	In place

#	018910020	Move Mailbox	Each	In place

DEPARTMENT will not pay for temporary mailbox installation or removal.

#	018910030	Mailbox Assembly	Each	In place

Section 01892: Reconstruct Catch Basin, Cleanout, Meter, Valve, Manhole and Monument Boxes

#	018920010	Reconstruct Catch Basin	Each	In place

#	018920020	Reconstruct Cleanout Box	Each	In place

#	018920030	Reconstruct Meter Box	Each	In place

#	018920040	Reconstruct Valve Box	Each	In place

#	**018920050**	**Reconstruct Manhole**	**Each**	**In place**

#	**018920060**	**Reconstruct Monument Box**	**Each**	**In place**

Section 02056: Common Fill

#	**020560005**	**Borrow**	**Cubic meter**
In original position based on average end area. Refer to Section 01280 "Measurement."			

#	**020560010**	**Borrow**	**Megagram**
Refer to Section 01280 "Measurement."			

#	**020560015**	**Granular Borrow**	**Cubic Meter**
In original position based on average end area per Section 01280 "Measurement."			

#	**020560020**	**Granular Borrow**	**Megagram**
Refer to Section 01280 "Measurement."			

#	**020560025**	**Granular Backfill Borrow**	**Cubic meter**

A. In final position. Refer to Section 01280 "Measurement."
B. At abutments, DEPARTMENT will not pay for Granular Backfill Borrow placed outside an area which is bounded by vertical planes 1.0 m inside the abutment backwall and 0.6 m inside the wing walls.
C. DEPARTMENT will not pay separately for material placed outside the above limitation, but will include it on Other Items of Work.

#	**020560030**	**Granular Backfill Borrow**	**Megagram**

A. In final position based on average end area. Refer to Section 01280 "Measurement"
B. At abutments, DEPARTMENT will not pay for borrow placed outside an area which is bounded by vertical planes 1.0 m inside the abutment backwall and 0.6 m inside the wing walls.
C. DEPARTMENT will not pay separately for material placed outside the above limitation, but will include it on Other Items of Work.

#	**020560035**	**Sand**	**Cubic meter**	**In original position based on average end area**

#	**020560040**	**Sand**	**Megagram**	**In final position**

#	**020560045**	**Clay**	**Cubic meter**	**In original position based on average end area**

#	020560050	Clay	Megagram	In final position

Section 02061: Select Aggregate

#	020610010	Free Draining Granular Backfill Borrow	Megagram	In final position

#	020610020	Free Draining Granular Backfill Borrow	Cubic Meter	In original position

#	020610030	Underdrain Granular Backfill	Megagram	In final position

#	020610040	Underdrain Granular Backfill	Cubic Meter	In original position

Section 02075: Geotextiles

#	020750010	Geotextiles, Separation	Square meter	In place
DEPARTMENT will not pay for overlaps.				

#	020750020	Geotextiles, Erosion Control	Square meter	In place
DEPARTMENT will not pay for overlaps.				

#	020750030	Geotextiles, Drainage	Square meter	In place
DEPARTMENT will not pay for overlaps.				

#	020750040	Geotextiles, Weed Barrier	Square meter	In place
Include posts and ties. DEPARTMENT will not pay for overlaps.				

#	020750050	Geotextiles, Stabilization	Square meter	In place
DEPARTMENT will not pay for overlaps.				

Section 02078: Asphalt Overlay Fabric

#	020780010	Asphalt Fabric	Square meter	In place
A. DEPARTMENT will not pay for double overlaps in the measurements used for payment. B. DEPARTMENT will pay for tack coat separately.				

Section 02082: Water Meter

#	**020820010**	**Water Meter, Contractor Furnished**	**Each**	**In place**

#	**020820020**	**Relocate Water Meter**	**Each**	**In place**

Section 02221: Remove Structure and Obstruction

#	**02221001D**	**Remove Building, Basement, and Foundation, Parcel #_____**	**Parcel**

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.
2. DEPARTMENT will pay for removal of obstructions not visible or not designated on plans or special provision as extra work.
3. DEPARTMENT will include obstructions shown on the plans for removal but not having a pay item in other items of work.
4. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.

#	**02221002D**	**Remove Building, Basement, and Foundation, Parcel #_____**	**Parcel**

B. Including any remaining out-buildings and incidental obstructions.
C. DEPARTMENT pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221003D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will measure and pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221004D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221005D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221006D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221007D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	02221008D	Remove Building, Basement, and Foundation, Parcel #_____	Parcel

A. Including any remaining out-buildings and incidental obstructions.
B. DEPARTMENT will pay separately for material used for backfilling basements and other depressions as "Roadway Excavation" or "Borrow." When no appropriate material item is included in the proposal, consider that item incidental to the work.

Price Adjustments:

1. **The DEPARTMENT is not responsible for any vandalism or theft that occurs to the building or its contents which reduces the value of the salvage or increases the cost of removal after the award of the Contract.**
2. **Removal of obstructions not visible or not designated on plans or special provision will be paid for as extra work.**
3. **Obstructions shown on the plans for removal but not having a pay item will be included in other items of work.**
4. **Material used for backfilling basements and other depressions will be measured and paid for separately as "Roadway Excavation," or "Borrow." If no appropriate material item is included in the proposal, it will be considered incidental to the work.**

#	022210015	Remove Bridge	Each	Removed

#	022210020	Remove Box Culvert	Each	Removed

#	022210025	Remove Manhole	Each	Removed

#	022210030	Remove Catch Basin	Each	Removed

#	022210035	Remove Diversion Box	Each	Removed

#	022210040	Remove Cleanout Box	Each	Removed

#	022210045	Remove Cattle Guard	Each	Removed

#	022210050	Remove Tree	Each	Removed
Refer to Standard Specification 02221, PART 3, paragraph: Tree Removal.				

#	022210055	Remove Concrete Headwall	Each	Removed

#	022210056	Remove Concrete Headwall	Each	Removed

#	022210057	Remove Concrete Headwall 910 mm - 1500 mm pipe	Each	Removed

#	022210058	Remove Concrete Headwall 1510 mm - 2100 mm pipe	Each	Removed

#	022210059	Remove Concrete Headwall Greater than 2110 mm pipe	Each	Removed

#	022210060	Remove Septic Tank	Each	Removed
Include removal of dry well or drain field which is part of the disposal system.				

#	022210065	Remove Underground Tank	Each	Removed

#	022210070	Remove Buried Fuel Tank	Each	Removed
Refer to Section 01355: Environmental Protection.				

#	022210075	Remove Guardrail	Meter	Including end section and anchorages

#	022210080	Remove Fence	Meter	Removed

#	022210085	Remove Railroad Track	Meter	Of single track lines (two rails)

#	022210090	Remove Utility Pole	Each	Including all attached parts and connections

#	022210095	Remove Pipe Culvert	Meter

#	022210100	Remove Culvert End Section	Each	Each

Section 02222: Site Demolition - Pavement

#	022220005	Remove Concrete Sidewalk	Square meter
Area of steps will be based on the area of the horizontal projection.			

#	022220010	Remove Concrete Driveway	Square meter

#	022220015	Remove Concrete Curb	Meter

#	022220020	Remove Concrete Curb and Gutter	Meter

#	022220025	Remove Bituminous Curb	Meter

#	022220030	Remove Raised Island	Meter

#	022220035	Remove Concrete Pavement	Square Meter

Regardless of the depth encountered.

A. Do not measure discontinued roads within the limits of the new roadbed or roads that are disturbed in performing other items of work.
B. DEPARTMENT will pay for material placed to cover pavements or fill depressions under “Roadway Excavation,” or “Borrow.”
C. DEPARTMENT will pay for concrete curb and concrete curb and gutter integral to the concrete pavement to be removed under “Remove Concrete Pavement.”

#	022220040	Remove Asphalt Pavement	Square Meter

Regardless of the depth or number of courses encountered.

A. Do not measure discontinued roads within the limits of the new roadbed or roads that are disturbed in performing other items of work.
B. DEPARTMENT will pay for material placed to cover pavements or fill depressions under “Roadway Excavation,” or “Borrow.”
C. DEPARTMENT will pay for concrete curb and concrete curb and gutter integral to the concrete pavement to be removed under “Remove Concrete Pavement.”

#	022220045	Obliterate Road	Meter	Along the center line of the road
A. DEPARTMENT will not measure discontinued roads within the limits of the new roadbed or roads that are disturbed in performing other items of work. B. DEPARTMENT will measure material placed to cover pavements or fill depressions under "Roadway Excavation," or "Borrow."				

Section 02225: Asphalt Surfacing Removal (Structures)

#	022250010	Asphalt Surfacing Removal (Structures)	Square Meter

Section 02226: Remove Concrete Slope Protection

#	022260010	Remove Concrete Slope Protection	Square Meter

Section 02231: Site Clearing and Grubbing

#	022310010	Clearing and Grubbing	Lump sum

#	022310020	Clearing and Grubbing	Hectare
A. Measurement: Measured to the nearest 400 m^2. Calculated by width (slope stake to slope stake) X length (station to station) along each alignment as shown in the summary sheets. 1. Independent alignments will be considered separate lengths, with no exclusions. 2. Obliteration of roads, areas designated to remain such as cultivated fields, etc., will not be included. B. Payment: 1. Any overlapping areas will be paid for only once. 2. Additional areas for payment outside the roadbed will be specified or designated by the Engineer. 3. Materials used for filling depressions will be measured and paid for separately as "Roadway Excavation" or "Borrow." If "Roadway Excavation" or "Borrow" is not included in the proposal, it will be considered incidental to the work.			

Section 02312: Grading for Landscapes

#	023120010	Landscape Grading	Square Meter
A. Material needed for re-grading will be paid for in other items of work. B. Material used for additional grading will be included in other items of work "Borrow" and "Topsoil," etc.			

Section 02316: Roadway Excavation

#	023160010	Roadway Excavation	Cubic meter
A. In original position, computed by the method of average end areas **B. Department will authorize cross sections or modifications including excavation below subgrade, unstable slopes, unpreventable slides and terracing.** **C. DEPARTMENT will not pay for excavation in excess of that authorized.** **D. The DEPARTMENT will pay for re-handing or additional haul when it is directed in writing as "Extra Work."**			

#	023160020	Roadway Excavation (Plan Quantity)	Cubic meter
A. Plan quantity, in original position, computed by the method of average end areas. **B. Department will authorize cross sections or modifications including excavation below subgrade, unstable slopes, unpreventable slides and terracing.** **C. DEPARTMENT will not measure or pay for excavation in excess of that authorized.** **D. The DEPARTMENT will pay for re-handing or additional haul when it is directed in writing as "Extra Work."**			

Section 02318: Ditch Excavation

#	023180010	Small Ditch Excavation	Cubic meter
Department will not pay for excavation beyond the cross-section shown on the plans.			

#	023180020	Surface Ditch	Meter
A. Measured along the ditch center line, in place. B. DEPARTMENT will pay for "Surface Ditch" as "Roadway Excavation" when the contract does not contain a pay item for "Surface Ditch."			

Section 02332: Embankment for Bridge

#	023320010	Embankment for Bridge	Cubic meter	In place

#	023320020	Embankment for Bridge	Megagram

Section 02338: Refinish Subgrade

#	023380010	Refinish Subgrade	Square meter	In place
DEPARTMENT will pay for the following as Extra Work: A. Corrective action taken when the existing subgrade is more than 90 mm below designed subgrade elevation. B. Removing soft spots and replacing material.				

Section 02372: Wire Enclosed Riprap

#	023720010	Wire Enclosed Riprap	Cubic Meter	In place
Computed from the specified thickness and cross-sectional area of the wire baskets.				

Section 02373: Riprap

#	023730010	Loose Riprap	Cubic Meter	In place
Computed using the in-place surface area and specified thickness.				

#	023730020	Hand-Placed Riprap	Cubic Meter	In place
Computed using the in-place surface area and specified thickness.				

#	023730030	Compacted Riprap	Cubic Meter
Computed using the in-place surface area and specified thickness.			

#	023730040	Keying Riprap	Square Meter	Of surface area, in place

Section 02376: Erosion Control Blankets/Channel Liners

#	023760010	Erosion Control Blanket	Square Meter	In place. Do not measure overlaps.

#	023760020	Flexible Channel Liner, Type A	Square Meter	In place. Do not measure overlaps.

Section 02455: Driving Piles

#	024550010	Pile Driving Equipment	Lump sum

A. Payment will be made in two increments.
1. **Sixty percent will be paid at the time the pile driving equipment is moved into location.**
2. **Forty percent will be paid after all piles have been driven and the pile driving equipment is removed.**

#	024550020	Driven Piles, 324 mm	Meter	In place

A. The price will be full compensation for all work including pre-drilling.
B. DEPARTMENT will not pay separately for down time for dynamic testing equipment installation.
C. DEPARTMENT will include payment for dynamic testing in the Driven Piles pay items.
D. A maximum of one additional splice per pile will be measured and paid as additional length of pile, only when the required length of pile driven exceeds the estimated length shown on the drawings by at least 2 m. Additional splices determined as such, will be paid as an additional equivalent length of pile of 1 meter each.
E. Adjustment for under-strength concrete.
  1. Sixty-five dollars per cubic meter will be used in the price reduction determination.
  2. The computed lump sum pay reduction will be subtracted from the payment for this item.

Price Adjustments for Strength

A. When concrete is below specified strength:
  1. DEPARTMENT may accept item at a reduced price
  2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
  3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	02455003D	Driven Piles _____ mm	Meter	In place

A. The price will be full compensation for all work including pre-drilling.
B. DEPARTMENT will not pay separately for down time for dynamic testing equipment installation.
C. DEPARTMENT will include payment for dynamic testing in the Driven Piles pay items.
D. A maximum of one additional splice per pile will be measured and paid as additional length of pile, only when the required length of pile driven exceeds the estimated length shown on the drawings by at least 2 m. Additional splices determined as such, will be paid as an additional equivalent length of pile of 1 meter each.
E. Adjustment for under-strength concrete.
  1. Sixty-five dollars per cubic meter will be used in the price reduction determination.
  2. The computed lump sum pay reduction will be subtracted from the payment for this item.

Price Adjustments for Strength

A. When concrete is below specified strength:
  1. DEPARTMENT may accept item at a reduced price
  2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
  3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	02455004D	Driven Piles HP _____ X _____	Meter	In place

A. DEPARTMENT will not pay separately for down time for dynamic testing equipment installation.
B. DEPARTMENT will include payment for dynamic testing in the Driven Piles pay items.

Section 02466: Drilled Caisson

#	02466001D	Drilled Caissons _____mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.
B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.
  1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.
  2. The Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660020	Drilled Caissons, 300 mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.

B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.

1. **The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.**
2. **The Department will calculate the pay factor as follows:**

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660030	Drilled Caissons, 600 mm	Meter, in place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.

B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.

1. **The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.**
2. **The Department will calculate the pay factor as follows:**

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660040	Drilled Caissons, 750 mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.

B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.

1. **The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.**
2. **The Department will calculate the pay factor as follows:**

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660050	Drilled Caissons, 900 mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.
B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.
1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.
2. The Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660060	Drilled Caissons, 1050 mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.
B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.
1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.
2. The Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660070	Drilled Caissons, 1200 mm	Meter	In place

A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing.
B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.
1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.
2. The Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701-1400	0.94
1401-2100	0.88
2101-2800	0.80
More than 2800	0.50 or Engineer may reject

#	024660080	Drilled Caissons, 1350 mm	Meter	In place
A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing. **B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.** **1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.** **2. The Department will calculate the pay factor as follows:**				
		kPa below specified strength: **1 - 700** **701-1400** **1401-2100** **2101-2800** **More than 2800**	**Pay Factor:** **0.98** **0.94** **0.88** **0.80** **0.50 or Engineer may reject**	

#	024660090	Drilled Caissons, 1800 mm	Meter	In place
A. The price will be full compensation for all work including de-watering, placing concrete under water, and providing casing. **B. Drilled caissons may be accepted at a reduced price when the concrete strength is below that specified.** **1. The Department will apply the pay factor to the total length of any caisson containing concrete with strength tests falling below that specified.** **2. The Department will calculate the pay factor as follows:**				
		kPa below specified strength: **1 - 700** **701-1400** **1401-2100** **2101-2800** **More than 2800**	**Pay Factor:** **0.98** **0.94** **0.88** **0.80** **0.50 or Engineer may reject**	

Section 02610: Pipe Culverts

#	026100002	300 mm Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100004	450 mm Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100006	600 mm Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100008	750 mm Pipe Culvert, Class A	Meter

Measured parallel to the center line from barrel end to barrel end, in place.

#	**026100010**	**900 mm Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100012**	**1050 mm Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100014**	**1200 mm Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100016**	**300 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100018**	**450 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100020**	**600 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100022**	**750 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100024**	**900 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100026**	**1050 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100028**	**1200 mm Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100030**	**300 mm Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100032	450 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100034	600 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100036	750 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100038	900 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100040	1050 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100042	1200 mm Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

Corrugated Steel Pipe Culvert

#	026100044	300 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100046	450 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100048	600 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100050	750 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100052	900 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100054	1050 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100056	1200 mm Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100058	300 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100060	450 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100062	600 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100064	750 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100066	900 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100068	1050 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100070	1200 mm Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100072	300 mm Corrugated Steel Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100074	450 mm Corrugated Steel Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100076	600 mm Corrugated Steel Pipe Culvert, Class C	Meter

Measured parallel to the center line from barrel end to barrel end, in place.

#	**026100078**	**750 mm Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100080**	**900 mm Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100082**	**1050 mm Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100084**	**1200 mm Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Corrugated Steel Pipe Arch Culvert

#	**026100086**	**430 mm x 330 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100088**	**530 mm x 380 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100090**	**710 mm x 510 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100092**	**885 mm x 610 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100094**	**1060 mmx740 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100096**	**1240 mmx840 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100098**	**1440 mmx970 mm Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**

Measured parallel to the center line from barrel end to barrel end, in place.

#	**026100100**	**430 mm x 330 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100102**	**530 mm x 380 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100104**	**710 mm x 510 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100106**	**885 mm x 610 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100108**	**1060 mm x 740 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100110**	**1240 mm x 840 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100112**	**1440 mm x 970 mm Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100114**	**430 mm x 330 mm Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100116**	**530 mm x 380 mm Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100118**	**710 mm x 510 mm Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100120**	**885 mm x 610 Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100122	1060 mm x 740 mm Corrugated Steel Pipe Arch Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100124	1240 mm x 840 mm Corrugated Steel Pipe Arch Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100126	1440 mm x 970 mm Corrugated Steel Pipe Arch Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

Corrugated Aluminum Pipe Culvert

#	026100128	300 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100130	450 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100132	600 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100134	750 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100136	900 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100138	1050 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100140	1200 mm Corrugated Aluminum Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100142	430 mm x 330 Corrugated Aluminum Pipe Arch Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100144**	**530 mm x 380 Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100146**	**710 mm x 510 mm Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100148**	**885 mm x 610 mm Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100150**	**1060 mm x 740 mm Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100152**	**1240 mm x 840 mm Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100154**	**1440 mm x 970 mm Corrugated Aluminum Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Corrugated Polyethylene (HDPE) Pipe Culvert

#	**026100156**	**300 mm Corrugated Polyethylene (HDPE) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100158**	**450 mm Corrugated Polyethylene (HDPE) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100160**	**600 mm Corrugated Polyethylene (HDPE) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100162**	**750 mm Corrugated Polyethylene (HDPE) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100164**	**900 mm Corrugated Polyethylene (HDPE) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Smooth Lined Pipe Culvert

#	**026100166**	**300 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100168**	**450 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100170**	**600 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100172**	**750 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100174**	**900 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100176**	**1050 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100178**	**1200 mm Smooth Lined Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100180**	**300 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100182**	**450 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100184**	**600 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100186**	**750 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100188**	**900 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100190**	**1050 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100192**	**1200 mm Smooth Lined Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100194**	**300 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100196**	**450 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100198**	**600 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100200**	**750 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100202**	**900 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100204**	**1050 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100206**	**1200 mm Smooth Lined Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Concrete Lined Corrugated Steel Pipe Culvert

#	026100208	300 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100210	450 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100212	600 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100214	750 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100216	900 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100218	1050 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100220	1200 mm Concrete Lined Corrugated Steel Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100222	300 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100224	450 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100226	600 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100228	750 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100230	900 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100232**	**1050 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100234**	**1200 mm Concrete Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100236**	**300 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100238**	**450 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100240**	**600 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100242**	**750 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100244**	**900 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100246**	**1050 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100248**	**1200 mm Concrete Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Smooth Lined Polyethylene Pipe

#	**026100250**	**300 mm Smooth Lined Polyethylene Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100252**	**450 mm Smooth Lined Polyethylene Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100254**	**600 mm Smooth Lined Polyethylene Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100256**	**750 mm Smooth Lined Polyethylene Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100258**	**900 mm Smooth Lined Polyethylene Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100260**	**300 mm Smooth Lined Polyethylene Chloride (PVC) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100262**	**450 mm Smooth Lined Polyethylene Chloride (PVC) Pipe Culvert Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100264**	**600 mm Smooth Lined Polyethylene Chloride (PVC) Pipe Culvert Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100266**	**750 mm Smooth Lined Polyethylene Chloride (PVC) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100268**	**900 mm Smooth Lined Polyethylene Chloride (PVC) Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Bituminous Smooth Lined Corrugated Steel Pipe

#	**026100270**	**300 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100272**	**450 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100274**	**600 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100276**	**750 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100278**	**900 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100280**	**1050 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100282**	**1200 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100284**	**300 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100286**	**450 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100288**	**600 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100290**	**750 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**

Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100292**	**900 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100294**	**1050 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100296**	**1200 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100298**	**300 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100300**	**450 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100302**	**600 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100304**	**750 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100306**	**900 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100308**	**1050 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100310**	**1200 mm Bituminous Smooth Lined Corrugated Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert

#	**026100312**	**430 mm x 330 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100314**	**530 mm x 380 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100316**	**710 mm x 510 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100318**	**885 mm x 610 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100320**	**1060 mm x 740 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100322**	**1240 mm x 840 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100324**	**1440 mm x 970 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100326**	**430 mm x 330 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100328**	**530 mm x 380 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100330**	**710 mm x 510 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100332**	**885 mm x 610 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100334**	**1060 mm x 740 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100336**	**1240 mm x 840 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100338**	**1440 mm x 970 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100340**	**430 mm x 330 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100342**	**530 mm x 380 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100344**	**710 mm x 510 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100346**	**885 mm x 610 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100348**	**1060 mm x 740 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100350**	**1240 mm x 840 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100352**	**1440 mm x 970 mm Bituminous Smooth Lined Corrugated Steel Pipe Arch Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Spiral Rib Steel or Aluminum Pipe

#	**026100354**	**300 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100356**	**450 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100358**	**600 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100360**	**750 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100362**	**900 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100364**	**1050 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100366**	**1200 mm Spiral Rib Steel Pipe Culvert, Class A**	**Meter**

Measured parallel to the center line from barrel end to barrel end, in place.

#	**026100368**	**300 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100370**	**450 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100372**	**600 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100374**	**750 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100376**	**900 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100378**	**1050 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100380**	**1200 mm Spiral Rib Steel Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100382**	**300 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100384**	**450 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100386**	**600 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100388**	**750 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100390**	**900 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100392**	**1050 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100394**	**1200 mm Spiral Rib Steel Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100396**	**300 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100398**	**450 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100400**	**600 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100402**	**750 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100404**	**900 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100406**	**1050 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100408**	**1200 mm Spiral Rib Aluminum Pipe Culvert, Class C**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Reinforced Concrete Pipe

#	**026100410**	**300 mm Reinforced Concrete Pipe Culvert, Class B**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100412	450 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100414	600 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100416	750 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100418	900 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100420	1050 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100422	1200 mm Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100424	300 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100426	450 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100428	600 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100430	750 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100432	900 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100434	1050 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100436	1200 mm Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

Non-Reinforced Concrete Pipe

#	026100438	450 mm Non-Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100440	600 mm Non-Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100442	750 mm Non-Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100444	900 mm Non-Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100446	450 mm Non-Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100448	600 mm Non-Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100450	750 mm Non-Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100452	900 mm Non-Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

Elliptical Reinforced Concrete Pipe

#	026100454	300 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100456	450 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100458	600 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100460	750 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100462	900 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100464	1050 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100466	1200 mm Elliptical Reinforced Concrete Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100468	300 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100470	450 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100472	600 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100474	750 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100476	900 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100478	1050 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100480	1200 mm Elliptical Reinforced Concrete Pipe Culvert, Class C	Meter

Measured parallel to the center line from barrel end to barrel end, in place.

Structural Plate

#	**026100482**	**1800 mm Structural Steel Plate Pipe Culvert Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100484**	**2100 mm Structural Steel Plate Pipe Culvert Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100486**	**2400 mm Structural Steel Plate Pipe Culvert Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100488**	**2700 mm Structural Steel Plate Pipe Culvert Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610048D**	**_____ mm Structural Steel Plate Pipe Culvert Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100490**	**1800 mm Structural Steel Plate Pipe Culvert Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100492**	**2100 mm Structural Steel Plate Pipe Culvert Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100494**	**2400 mm Structural Steel Plate Pipe Culvert Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100496**	**2700 mm Structural Steel Plate Pipe Culvert Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610049D**	**____ mm Structural Steel Plate Pipe Culvert Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100498**	**2050 mm x 1500 mm Structural Steel Plate Pipe Arch Culvert, Class D**	**Meter**

Measured parallel to the center line from barrel end to barrel end, in place.

#	**026100500**	**2400 mm x 1720 mm Structural Steel Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100502**	**2840 mm x 1920 mm Structural Steel Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100504**	**3240 mm x 2120 mm Structural Steel Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610050D**	**_____mm x _____ mm Structural Steel Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100506**	**2050 mm x 1500 mm Structural Steel Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100508**	**2400 mm x 1720 mm Structural Steel Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100510**	**2840 mm x 1920 mm Structural Steel Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100512**	**3240 mm x 2120 mm Structural Steel Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610051D**	**_____ mm x _____ mm Structural Steel Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

Aluminum Alloy Structural Plate

#	**026100514**	**1800 mm Aluminum Alloy Structural Plate Pipe Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100516**	**2100 mm Aluminum Alloy Structural Plate Pipe Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100518**	**2400 mm Aluminum Alloy Structural Plate Pipe Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100520**	**2700 mm Aluminum Alloy Structural Plate Pipe Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610052D**	**____ mm Aluminum Alloy Structural Plate Pipe Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100522**	**1800 mm Aluminum Alloy Structural Plate Pipe Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100524**	**2100 mm Aluminum Alloy Structural Plate Pipe Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100526**	**2400 mm Aluminum Alloy Structural Plate Pipe Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100528**	**2700 mm Aluminum Alloy Structural Plate Pipe Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610053D**	**___ mm Aluminum Alloy Structural Plate Pipe Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100530**	**2050 mm x 1500 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100532**	**2400 mm x 1720 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100534**	**2840 mm x 1920 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100536**	**3240 mm x 2120 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610054D**	**____ mm x _____ mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class D**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100538**	**2050 mm x 1500 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100540**	**2400 mm x 1720 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100542**	**2840 mm x 1920 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**026100544**	**3240 mm x 2120 mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

#	**02610055D**	**____ mm x _____mm Aluminum Alloy Structural Plate Pipe Arch Culvert, Class E**	**Meter**
Measured parallel to the center line from barrel end to barrel end, in place.			

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#	026100546	300 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100548	450 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100550	600 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100552	750 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100554	900 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100556	1050 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100558	1200 Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100560	300 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100562	450 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100564	600 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100566	750 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100568	900 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100570	1050 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100572	1200 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100574	300 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100576	450 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100578	600 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100580	750 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100582	900 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100584	1050 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100586	1200 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100588	430 mm x 330 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100590	530 mm x 380 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100592	710 mm x 510 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100594	885 mm x 610 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100596	1060 mm x 740 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100598	1240 mm x 840 mm Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100600	1440 mm x 970 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100602	430 mm x 330 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100604	530 mm x 380 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100606	710 x 510 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100608	884 mm x 610 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100610	1060 mm x 740 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100612	1240 mm x 840 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100614	1440 mm x 790 mm Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100616	430 mm x 330 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100618	530 mm x 380 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100620	710 mm x 510 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100622	885 mm x 610 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100624	1060 mm x 740 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100626	1240 mm x 840 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100628	1440 mm x 970 mm Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100630	300 mm Concrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100632	450 mm Concrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100634	600 mmConcrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100636	750 mmConcrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100638	900 mm Concrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100640	1050 mm Concrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100642	1200 mm Concrete Lined Corrugated Metal Pipe Culvert, Class A	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100644	300 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100646	450 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100648	600 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100650	750 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100652	900 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100654	1050 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100656	1200 mm Concrete Lined Corrugated Metal Pipe Culvert, Class B	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100658	300 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100660	450 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100662	600 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100664	750 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100666	900 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100668	1050 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

#	026100670	1200 mm Concrete Lined Corrugated Metal Pipe Culvert, Class C	Meter
Measured parallel to the center line from barrel end to barrel end, in place.			

Section 02611: Diversion Box Gate and Frame

#	026110010	Hand-Slide Gate 300 mm	Each	In place

#	026110015	Hand-Slide Gate 450 mm	Each	In place

#	026110020	Hand-Slide Gate 600 mm	Each	In place

#	026110025	Hand-Slide Gate 750 mm	Each	In place

#	026110030	Hand-Slide Gate 900 mm	Each	In place

#	026110035	Hand-Slide Gate 1050 mm	Each	In place
#	026110040	Hand-Slide Gate 1200 mm	Each	In place
#	02611004D	Hand-Slide Gate _____mm	Each	In place
#	026110045	Screw Gate and Frame 300 mm	Each	In place
#	026110050	Screw Gate and Frame 450 mm	Each	In place
#	026110055	Screw Gate and Frame 600 mm	Each	In place
#	026110060	Screw Gate and Frame 750 mm	Each	In place
#	026110065	Screw Gate and Frame 900 mm	Each	In place
#	026110070	Screw Gate and Frame 1050 mm	Each	In place
#	026110075	Screw Gate and Frame 1200 mm	Each	In place
#	02611008D	Screw Gate and Frame _____ mm	Each	In place

Section 02613: Culvert End Sections

#	026130020	Culvert End Sections 300 mm	Each	In place
#	026130030	Culvert End Sections 450 mm	Each	In place
#	026130040	Culvert End Sections 600 mm	Each	In place
#	026130050	Culvert End Sections 750 mm	Each	In place
#	026130060	Culvert End Sections 900 mm	Each	In place
#	02613001D	Culvert End Sections _____ mm	Each	In place

#	**026130070**	**Culvert End Sections 1050 mm**	**Each**	**In place**

#	**026130080**	**Culvert End Sections 1200 mm**	**Each**	**In place**

Section 02614: Salvage and/or Relay Pipe Culvert and End Sections

#	**026140010**	**Salvage Pipe Culvert**		**Meter**

#	**026140020**	**Salvage and Relay Pipe Culvert**	**Meter**	**In place**

#	**026140030**	**Salvage Culvert End Section**		**Each**

#	**026140040**	**Salvage and Relay Culvert End Section**	**Each**	**In place**

Section 02622: Underdrain

#	**026220020**	**Underdrain, 300 mm**	**Meter**	**In place**
Measured parallel to the center line from barrel end to barrel end.				

#	**026220030**	**Underdrain, 450 mm**	**Meter**	**In place**
Measured parallel to the center line from barrel end to barrel end.				

#	**026220040**	**Underdrain, 600 mm**	**Meter**	**In place**
Measured parallel to the center line from barrel end to barrel end.				

#	**02622001D**	**Underdrain, _____ mm**	**Meter**	**In place**
Measured parallel to the center line from barrel end to barrel end.				

Section 02624: Approach Slab Catch Basin

#	**026240010**	**Approach Slab Catch Basin**	**Each**

Section 02625: Approach Slab Drain Frame Modification

#	**026250010**	**Approach Slab Drain Frame Modification**	**Each**

Section 02626: Deck Drain Modification and Closure

#	026260010	Deck Drain Modification	Each

#	026260020	Deck Drain Closure	Each

Section 02635: Grates, Solid Covers, Frames, and Manhole Steps

#	026350005	Diversion Box Solid Cover and Frame Type A, Std Dwg 1562	Each	In place

#	026350010	Diversion Box Solid Cover and Frame Type B, Std Dwg 1562	Each	In place

#	026350015	Diversion Box Solid Cover and Frame Type C, Std Dwg 1562	Each	In place

#	026350020	Solid Cover and Frame, Std Dwg 1567	Each	In place

#	026350025	Manhole Frame and Grated Cover, Std Dwg 1701	Each	In place

#	026350030	Manhole Frame and Solid Cover, Std Dwg 1702	Each	In place

#	026350035	Rectangular Grate and Frame, (Standard Grating), Std Dwg 1703	Each	In place

#	026350040	Rectangular Grate and Frame, (Bicycle Safe Grating), Std Dwg 1703	Each	In place

#	026350045	Solid Cover and Frame, Std Dwg 1705	Each	In place

#	026350050	Manhole Steps, Std Dwg 1706	Each	In place

Section 02643: Concrete-lined Ditch

#	026430010	Concrete-Lined Ditch	Cubic Meter

Computed from the typical section and measured length.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

Section 02645: Precast Concrete Box Culvert

#	026450010	Precast Concrete Box Culvert	Lump Sum

Measured in place by the lump sum basis for the total length specified on the plans.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

Section 02705: Pavement Sawing

#	027050010	Asphalt Pavement Sawing	Millimeter-Meter

Measurement: Average depth in millimeters times length in meters.
Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.

#	027050015	Asphalt Pavement Sawing	Meter

Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.

#	027050020	Concrete Pavement Sawing	Millimeter-Meter
Measurement: Average depth in millimeters times length in meters. Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.			

#	027050025	Concrete Pavement Sawing	Meter
Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.			

#	027050030	Concrete Sawing	Millimeter-Meter
Measurement: Average depth in millimeters times length in meters. Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.			

#	027050035	Concrete Sawing	Meter
Payment: When no depth is shown, payment will be based on a depth of 150 mm. If the average depth exceeds the plan depth by 50 mm or more, the unit price will increase by 20 percent.			

Section 02712: Lean Concrete Base Course

#	027120010	Lean Concrete Base Course, 100 mm thick	Square Meter	In place
A. Calculated from measured length multiplied by measured width, not to exceed plan width. B. Department will not pay for placing an additional width of lean concrete based greater than shown on the typical section. C. Department will assess reductions for thickness and cement content separately. Refer to Table 02712-1 for Payment Reductions for Thickness. Price adjustment for cement content under 98 percent of mix design requirements will be assessed at 1.5 times the FOB Batch Plant price for cement.				

Table 02712-1 Payment Reductions for Thickness		
	Thickness	**Pay Factor (Project)**
$ $ 95 mm	[Any core less than 90 mm will be included in $ determination and also have a price adjustment under sublot.]	1.00
90 < $ < 95 mm	[Any core less than 90 mm will be included in $ determination and also have a price adjustment under sublot.]	0.90
$#90		0.75
		Pay Factor (Sublot)
Sublot with core 90 to 75 mm.		0.75
Sublots with cores less than 75 mm.		0.50 or replace as directed by the Engineer.

Section 02715: Hydrated Lime Treated Roadbed

#	027150010	Hydrated Lime Treated Roadbed	Square Meter
Average width of course times the length. Include Asphalt Cement and Hydrated lime.			

Section 02721: Untreated Base Course (UTBC)

#	027210010	Untreated Base Course 37.5 mm Max	Megagram	In place

Price Adjustments - Density

Pay Factor Per Lot	**% of Maximum Laboratory Density**
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210020	Untreated Base Course 37.5 mm Max	Cubic Meter	In place

Price Adjustments - Density

Pay Factor Per Lot	**% of Maximum Laboratory Density**
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210030	Untreated Base Course 25 mm Max	Megagram	In place

Price Adjustments - Density

Pay Factor Per Lot	% of Maximum Laboratory Density
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210040	Untreated Base Course 25 mm Max	Cubic Meter	In place

Price Adjustments - Density:

Pay Factor Per Lot	% of Maximum Laboratory Density
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210050	Untreated Base Course 19 mm Max	Megagram	In place

Price Adjustments - Density:

Pay Factor Per Lot	% of Maximum Laboratory Density
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210060	Untreated Base Course 19 mm Max	Cubic Meter	In place

Price Adjustments - Density:

Pay Factor Per Lot	**% of Maximum Laboratory Density**
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210070	Untreated Base Course 19 mm or 25 mm Max	Megagram	In place

Price Adjustments - Density:

Pay Factor Per Lot	% of Maximum Laboratory Density
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

#	027210080	Untreated Base Course 19 mm or 25 mm Max	Cubic Meter	In place

Price Adjustments - Density:

Pay Factor Per Lot	% of Maximum Laboratory Density
1.00	$ 97
0.90	94 # Density < 97

Price Adjustments - Gradation:

A. Based upon sublot size and the minimum pay factor.

B. Pay factors for noncomplying aggregate gradation when tested in accordance with AASHTO T 27 are indicated in Table 02721-1.

C. If the Mean of the Deviations of test results vary from the Combined Aggregate Target more than the minimum shown under the 0.70 pay factors of Table 02721-1, the pay factor for material allowed to remain is 0.50. This applies only if ENGINEER does not order correction or removal of any or all of the material represented by the tests.

Table 02721-1 Pay Factors for Noncomplying Aggregate Gradation

Mean of The Deviations of Sieve Gradation Results From The Combined Aggregate Target - Expressed in Percentage Points						
SIEVE SIZES	**Pay Factor**	**1 TEST Max-min**	**2 TESTS Max-Min**	**3 TESTS Max-Min**	**4 TESTS Max-Min**	**5 TESTS or More Max - Min**
12.5 mm and larger	**1.00**	0 - 15	0.0 - 12.1	0.0 - 10.8	0.0 - 10.0	0.0 - 9.5
	0.95	16 - 17	12.2 - 13.9	10.9 - 12.4	10.1 - 11.5	9.6 - 11.0
	0.90	18 - 19	14.0 - 15.1	12.5 - 13.5	11.6 - 12.5	11.1 - 11.9
	0.80	20 - 21	15.2 - 17.2	13.6 - 15.3	12.6 - 14.2	12.0 - 13.5
	0.70	22 - 23	17.3 - 18.8	15.4 - 16.7	14.3 - 15.5	13.6 - 14.7
9.5 mm	**1.00**	0 - 15	0.0 - 11.5	0.0 - 9.8	0.0 - 8.8	0.0 - 8.0
	0.95	16 - 17	11.6 - 13.3	9.9 - 11.3	8.9 - 10.1	8.1 - 9.2
	0.90	18 - 19	13.3 - 14.4	11.4 - 12.3	10.2 - 11.0	9.3 - 10.0
	0.80	20 - 21	14.5 - 16.3	12.4 - 13.9	11.1 - 12.5	10.1 - 11.4
	0.70	22 - 23	16.4 - 17.9	14.0 - 15.2	12.6 - 13.6	11.5 - 12.4
4.75 mm	**1.00**	0 - 14	0.0 - 10.5	0.0 - 8.8	0.0 - 7.8	0.0 - 7.0
	0.95	15 - 17	10.6 - 12.1	8.9 - 10.1	7.9 - 9.0	7.1 - 8.0
	0.90	18	12.2 - 13.1	10.2 - 11.0	9.1 - 9.8	8.1 - 8.7
	0.80	19 - 20	13.2 - 14.9	11.1 - 12.5	9.9 - 11.1	8.8 - 10.0
	0.70	21 - 22	15.0 - 16.3	12.6 - 13.6	11.2 - 12.1	10.1 - 10.8
1.18 mm	**1.00**	0 - 11	0.0 - 8.2	0.0 - 6.9	0.0 - 6.2	0.0 - 5.6
	0.95	12 - 13	8.3 - 9.4	7.0 - 7.9	6.3 - 7.1	5.7 - 6.4
	0.90	14	9.5 - 10.3	8.0 - 8.6	7.2 - 7.8	6.5 - 7.0
	0.80	15 - 16	10.4 - 11.6	8.7 - 9.8	7.9 - 8.8	7.1 - 8.0
	0.70	17	11.7 - 12.7	9.9 - 10.7	11.7 - 12.7	8.1 - 8.7
300 Fm	**1.00**	0 - 9	0.0 - 7.0	0.0 - 6.1	0.0 - 5.5	0.0 - 5.2
	0.95	10	7.1 - 9.0	6.2 - 7.0	5.6 - 6.3	5.3 - 6.0
	0.90	11	9.1 - 8.8	7.1 - 7.6	6.4 - 6.9	6.1 - 6.5
	0.80	12 - 13	8.9 - 10.0	7.7 - 8.7	7.0 - 7.8	6.6 - 7.4
	0.70	14	10.1 - 10.9	8.8 - 9.5	7.9 - 8.5	7.5 - 8.1
75 Fm	**1.00**	0 - 4.5	0.0 - 3.4	0.0 - 2.9	00 - 2.5	0.0 - 2.3
	0.95	4.6 - 5.2	3.5 - 3.9	3.0 - 3.3	2.6 - 2.9	2.4 - 2.6
	0.90	5.3 - 5.6	4.0 - 4.3	3.4 - 3.6	3.0 - 3.1	2.7 - 2.9
	0.80	5.7 - 6.4	4.4 - 4.8	3.7 - 4.1	3.2 - 3.6	3.0 - 3.3
	0.70	6.5 - 7.0	4.9 - 5.3	4.2 - 4.5	3.7 - 3.9	3.5 - 3.6

Section 02741: HMA (Hot Mix Asphalt)

#	027410005	HMA - 9.5 mm	Megagram
Includes aggregates, asphalt binder, hydrated lime, other additives, etc. The Department will not pay separately for asphalt binder, hydrated lime, additives, etc.			

#	027410010	HMA - 12.5 mm	Megagram
Includes aggregates, asphalt binder, hydrated lime, other additives, etc. The Department will not pay separately for asphalt binder, hydrated lime, additives, etc.			

#	027410020	HMA - 19.0 mm	Megagram
Includes aggregates, asphalt binder, hydrated lime, other additives, etc. The Department will not pay separately for asphalt binder, hydrated lime, additives, etc.			

#	027410030	HMA - 25.0 mm	Megagram
Includes aggregates, asphalt binder, hydrated lime, other additives, etc. The Department will not pay separately for asphalt binder, hydrated lime, additives, etc.			

Section 02743: Hot Mix Asphalt - Small Projects/Bike and Pedestrian Paths

#	027430010	HMA Mix - Small Projects 12.5 mm	Megagram

A. Include aggregates, asphalt cement, hydrated lime, additives, etc. used in the mix.
B. Base pay adjustment on Standard Specifications, Section 02743, paragraph 2.2 "Aggregate" Table 2 and paragraph 2.4 "Job-Mix Design Requirements."

If certification program is found to be contrary, use the following:

Pay Adjustments:

A. The Department rejects the lot if the percent within limits for any individual measurement is less than 60 percent.
B. If the lot is rejected, the CONTRACTOR may submit an engineering analysis requesting that the pavement remain in place.
   1. Include in the analysis: Data and engineering principles that indicate why the pavement should remain in place.
   2. The ENGINEER, Region Materials Engineer, and Region Construction Engineer will review the analysis for acceptance, denial, or revision.
   3. If the request is denied, remove the rejected material from the project within 72 hours and replace it with an acceptable material.
   4. If rotomilling is required, agree on removal time period.
   5. DEPARTMENT will deduct $15.00 per megagram if a rejected lot is allowed to remain in place.

Bonus or Deduction for Gradation, Asphalt Content, and Compaction:

A. Based on assessed HMA quantities in Table 02743-1. Base adjustments on Percent Within Limits computation using Tables 02743-2, 02743-3 and 02743-4.
B. The pay adjustment will be the lowest single combined adjustment for gradation (for each of the sieves) and asphalt cement content.

Table 02743-1 Pay Adjustments - HMA Small Projects/Bike Ped Path			
Gradation			
Gradation, Asphalt Cement Content		**Density**	
PT Based on Four Samples	**Bonus or Deduction (Dollars/ Megagram)**	**PT Based on Ten Samples**	**Bonus or Deduction (Dollars/Megagram)**
> 99	0.91	> 99	0.91
96-99	0.74	96-99	0.74
92-95	0.41	92-95	0.41
88-91	0.07	88-91	0.07
84-87	-0.26	84-87	-0.26
80-83	-0.60	80-83	-0.60
76-79	-0.93	76-79	-0.93
72-75	-1.27	72-75	-1.27
68-71	-1.60	68-71	-1.60
64-67	-1.93	64-67	-1.93
60-63	-2.27	60-63	-2.27
<60	Reject	<60	Reject

VMA Pay Adjustments	
PT Based on Minimum Three Samples	**Bonus or Deduction, Dollars/megagram**
>99	0.54
96-99	0.43
92-95	0.20
88-91	-0.03
84-87	-0.26
80-83	-0.48
76-79	-0.71
72-75	-0.94
68-71	-1.17
64-67	-1.40
60-63	-1.62
<60	Reject

Table 02743-2 Upper and Lower Limit Determination HMA Small Projects/Bike Ped Path	
Parameter	**UL and LL**
9.5 mm sieve or larger	Target Value ± 6.0%
4.75 mm sieve	Target Value ± 5.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ±0.35%
Density	Lower Limit: Target Value - 2.0% No Upper Limit

Table 02743-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02743-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 and 3 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

#	027430020	HMA Mix - Bike/Ped Path 9.5 mm	Megagram

A. Include aggregates, asphalt cement, hydrated lime, additives, etc. used in the mix.
B. Base pay adjustment on Standard Specifications, Section 02743, paragraph 2.2 "Aggregate" Table 2 and paragraph 2.4 "Job-Mix Design Requirements."

If certification program is found to be contrary, use the following:

Pay Adjustments:

A. The Department rejects the lot if the percent within limits for any individual measurement is less than 60 percent.
B. If the lot is rejected, the CONTRACTOR may submit an engineering analysis requesting that the pavement remain in place.
   1. Include in the analysis: Data and engineering principles that indicate why the pavement should remain in place.
   2. The ENGINEER, Region Materials Engineer, and Region Construction Engineer will review the analysis for acceptance, denial, or revision.
   3. If the request is denied, remove the rejected material from the project within 72 hours and replace it with an acceptable material.
   4. If rotomilling is required, agree on removal time period.
   5. DEPARTMENT will deduct $15.00 per megagram if a rejected lot is allowed to remain in place.

Bonus or Deduction for Gradation, Asphalt Content, and Compaction:

A. Based on assessed HMA quantities in Table 02743-1. Base adjustments on Percent Within Limits computation using Tables 02743-2, 02743-3 and 02743-4.
B. The pay adjustment will be the lowest single combined adjustment for gradation (for each of the sieves) and asphalt cement content.

Table 02743-1 Pay Adjustments - HMA Thin Lifts			
Gradation			
Gradation, Asphalt Cement Content		**Density**	
PT Based on Four Samples	**Bonus or Deduction (Dollars/ Megagram)**	**PT Based on Ten Samples**	**Bonus or Deduction (Dollars/Megagram)**
> 99	0.91	> 99	0.91
96-99	0.74	96-99	0.74
92-95	0.41	92-95	0.41
88-91	0.07	88-91	0.07
84-87	-0.26	84-87	-0.26
80-83	-0.60	80-83	-0.60
76-79	-0.93	76-79	-0.93
72-75	-1.27	72-75	-1.27
68-71	-1.60	68-71	-1.60
64-67	-1.93	64-67	-1.93
60-63	-2.27	60-63	-2.27
<60	Reject	<60	Reject

VMA Pay Adjustments	
PT Based on Minimum Three Samples	**Bonus or Deduction, Dollars/megagram**
>99	0.54
96-99	0.43
92-95	0.20
88-91	-0.03
84-87	-0.26
80-83	-0.48
76-79	-0.71
72-75	-0.94
68-71	-1.17
64-67	-1.40
60-63	-1.62
<60	Reject

Table 02743-2 Upper and Lower Limit Determination - HMA Thin Lifts	
Parameter	**UL and LL**
9.5 mm sieve or larger	Target Value ± 6.0%
4.75 mm sieve	Target Value ± 5.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ±0.35%
Density	Lower Limit: Target Value - 2.0% No Upper Limit

Table 02743-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02743-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 and 3 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

#	027430030	Rejuvinator, Type "B" Modified	Megagram
Include water used for dilution.			

Section 02744: Hot Mix Asphalt - Procurement

#	027440010	HMA Mix - Procurement Laydown 9.5 mm	Megagram

Measurement:

A. Include aggregates, asphalt cement, lime, additives, etc., used in the mix.

B. Adjust the weighed units by the following formula to obtain the final pay units for all HMA Mix.

$$\text{Pay megagrams} = \frac{2.50 \times W}{Ga}$$

W = Weighed megagrams of HMA

Ga = Average specific gravity of the mix

(Rice Method - Current consecutive running average of up to three tests) AASHTO T 209

Payment:

A. DEPARTMENT will not pay separately for asphalt cement, hydrated lime, additives, etc.

B. If a lot has un-designated asphalt grade which is allowed to remain in place, DEPARTMENT will apply $15.00/megagram deduction.

C. Pay adjustments for gradation, asphalt content are based on Table 02744-1 and determined in accordance with Tables 02744-3 and 02744-4 (Hot Mix Asphalt).

D. DEPARTMENT will provide a single combined pay adjustment for gradation and asphalt cement content, which will be either:

1. The lowest adjustment for each of the sieves, or
2. The adjustment for asphalt cement content, whichever is the lowest.

Table 02744-1 Pay Adjustments	
Gradation, Asphalt Cement Content	
PT Based on Three Samples	**Deduction (Dollars/megagram)**
> 88	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject or 50% Pay

Table 02744-2 Upper and Lower Limit Determination	
Parameter	**UL and LL**
9.5 mm sieve or Larger	Target Value ± 6.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ± 0.35%

Table 02744-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02744-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

#	027440020	HMA Mix - Procurement Laydown 12.5 mm	Megagram

Measurement:

A. Include aggregates, asphalt cement, lime, additives, etc., used in the mix.

B. Adjust the weighed units by the following formula to obtain the final pay units for all HMA Mix.

$$\text{Pay megagrams} = \frac{2.50 \times W}{Ga}$$

W = Weighed megagrams of HMA

Ga = Average specific gravity of the mix

(Rice Method - Current consecutive running average of up to three tests) AASHTO T 209.

Payment:

A. DEPARTMENT will not pay separately for asphalt cement, hydrated lime, additives, etc.

B. If a lot has un-designated asphalt grade which is allowed to remain in place, DEPARTMENT will apply $15.00/megagram deduction.

C. Pay adjustments for gradation, asphalt content are based on Table 02744-1 and determined in accordance with Tables 02744-3 and 02744-4 (Hot Mix Asphalt).

D. DEPARTMENT will provide a single combined pay adjustment for gradation and asphalt cement content, which will be either:

1. The lowest adjustment for each of the sieves, or
2. The adjustment for asphalt cement content, whichever is the lowest.

Table 02744-1 Pay Adjustments

Gradation, Asphalt Cement Content

PT Based on Three Samples	Deduction (Dollars/megagram)
> 88	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject or 50% Pay

Table 02744-2 Upper and Lower Limit Determination

Parameter	UL and LL
9.5 mm sieve or Larger	Target Value ± 6.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ± 0.35%

Table 02744-3 Quality Index Values for Estimating Percent Within Limits

PU/PL	n=3	n=4	n=5	n=6	n=7	n=8	n=10	n=12	n=15	n=20
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02744-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

#	027440030	HMA Mix - Procurement Blade Work 9.5 mm	Megagram

Measurement:

A. Include aggregates, asphalt cement, lime, additives, etc., used in the mix.

B. Adjust the weighed units by the following formula to obtain the final pay units for all HMA Mix.

$$\text{Pay megagrams} = \frac{2.50 \times W}{Ga}$$

W = Weighed megagrams of HMA

Ga = Average specific gravity of the mix

(Rice Method - Current consecutive running average of up to three tests) AASHTO T 209.

Payment:

A. DEPARTMENT will not pay separately for asphalt cement, hydrated lime, additives, etc.

B. If a lot has un-designated asphalt grade which is allowed to remain in place, DEPARTMENT will apply $15.00/megagram deduction.

C. Pay adjustments for gradation, asphalt content are based on Table 02744-1 and determined in accordance with Tables 02741-3 and 02741-4 (Hot Mix Asphalt).

D. DEPARTMENT will provide a single combined pay adjustment for gradation and asphalt cement content, which will be either:

1. The lowest adjustment for each of the sieves, or
2. The adjustment for asphalt cement content, whichever is the lowest.

Table 02744-1 Pay Adjustments

Gradation, Asphalt Cement Content

PT Based on Three Samples	Deduction (Dollars/megagram)
> 88	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject or 50% Pay

Table 02744-2 Upper and Lower Limit Determination

Parameter	UL and LL
9.5 mm sieve or Larger	Target Value ± 6.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ± 0.35%

Table 02744-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02744-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

#	027440040	HMA Mix - Procurement Blade Work 12.5 mm	Megagram

Measurement:

A. Include aggregates, asphalt cement, lime, additives, etc., used in the mix.

B. Adjust the weighed units by the following formula to obtain the final pay units for all HMA Mix.

$$\text{Pay megagrams} = \frac{2.50 \times W}{Ga}$$

W = Weighed megagrams of HMA

Ga = Average specific gravity of the mix

(Rice Method - Current consecutive running average of up to three tests) AASHTO T 209.

Payment:

A. DEPARTMENT will not pay separately for asphalt cement, hydrated lime, additives, etc.

B. If a lot has un-designated asphalt grade which is allowed to remain in place, DEPARTMENT will apply $15.00/megagram deduction.

C. Pay adjustments for gradation, asphalt content are based on Table 02744-1 and determined in accordance with Tables 02741-3 and 02741-4 (Hot Mix Asphalt).

D. DEPARTMENT will provide a single combined pay adjustment for gradation and asphalt cement content, which will be either:

1. The lowest adjustment for each of the sieves, or
2. The adjustment for asphalt cement content, whichever is the lowest.

Table 02744-1 Pay Adjustments	
Gradation, Asphalt Cement Content	
PT Based on Three Samples	**Deduction (Dollars/megagram)**
> 88	0.00
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject or 50% Pay

Table 02744-2 Upper and Lower Limit Determination	
Parameter	**UL and LL**
9.5 mm sieve or Larger	Target Value ± 6.0%
2.36 mm sieve	Target Value ± 5.0%
1.18 mm sieve	Target Value ± 5.0%
0.30 mm sieve	Target Value ± 3.0%
0.075 mm sieve	Target Value ± 2.0%
Asphalt Content	Target Value ± 0.35%

Table 02744-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02744-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

Section 02747: Road Mix Asphalt Surface Course

#	027470010	Road Mix Asphalt Surface Course	Megagram
A. Include aggregates, asphalt cement, lime and additives in the mix. B. If the Contractor uses a mineral aggregate with a specific gravity greater than 2.70, the Department will reduce the contract unit price per megagram by 2 percent for every 0.05 increment in excess of 2.70.			

Section 02748: Prime Coat/Tack Coat

#	027480010	Liquid Asphalt MC-70 or MC-250	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

#	027480030	Emulsified Asphalt SS-1	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

#	027480040	Emulsified Asphalt CSS-1	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

#	027480050	Emulsified Asphalt SS-1H	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

#	027480060	Emulsified Asphalt CSS-1H	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

#	027480070	Emulsified Asphalt CRS-2A	Megagram
Do not measure water added in excess of the specified amount in Standard Specification 02745.			

Section 02749: Asphalt Driveway

#	027490010	Asphalt Concrete Driveway	Each
The Department will pay for untreated base course under Section 02721, and Hot Mix Asphalt under the appropriate section.			

Section 02752: Portland Cement Concrete Pavement

#	027520010	Portland Cement Concrete Pavement 175 mm Thick	Square Meter	In place

Measured width not to exceed plan width.
Payment:

A. DEPARTMENT will assess price adjustments for strength, thickness, and surface smoothness separately on the contract bid price.

B. DEPARTMENT will use Table 02752-1 to determine price adjustments for concrete compressive strength.
   1. **The price adjustment will apply to the test lot represented by the strength test.**
   2. **The ENGINEER will evaluate all concrete with a compressive strength of more than 2800 kPa below specification to determine capability of the material to maintain the integrity of the structure for payment. This concrete may be accepted at 50 percent pay factor or required to be replaced.**

Price reductions for deficient thickness:

A. Over new surfaces: Table 02752-2.

B. Over existing surfaces: Table 02752-3.

C. The ENGINEER may accept pavement deficient by more than 20 mm at 50 percent pay or require removal and replacement.

D. Make all corrections, including removal and replacement at no additional cost to the DEPARTMENT.

Surface Smoothness Bonus

A. The DEPARTMENT will not pay a bonus:
   1. **For any pavement in a day's production in which there is grinding in over three locations, or where the area ground exceeds 30 m^2 per traffic lane. Required hand placement area will not be included in the ground area calculations.**
   2. **On Class III pavement, (refer to Table 3 in Section 01452, paragraph 3.4, Testing Portland Cement Concrete Pavement).**

B. The DEPARTMENT will pay a bonus for any mainline pavement sections of 0.2 km with a Profile Index less than the required millimeter per kilometer if the above criteria are not exceeded. Refer to Section 01452 for smoothness requirements.
   1. **Bonuses paid will be computed by the following formula:**
      $0.015 {(Required millimeters per kilometer) - (Profile Index)} =
      Incentive per square meter (Including shoulder areas and hand placement areas) to a $1.00 maximum.

Quantity adjustments

A. Will be made when the following occurs:
   1. **Pavement is placed over existing road surfaces.**
   2. **Accepted batched volume (total batched material adjusted to design yield minus rejected or wasted material) of concrete either overruns or underruns the computed neat-line volume (plan width x plan thickness x length placed).**

B. Make the quantity adjustment before any price adjustment for non-specification material.

C. At the time of placement, the CONTRACTOR and ENGINEER must agree to the quantity of concrete wasted or rejected when transit mix trucks are used. The formula for overrun/underrun is:

$$QA = 0.5 \left(\frac{V_a - V_n}{V_n} \right) Q_m$$

QA = Adjustment quantity in square meters

Table 02752-1 Pay Adjustments for Compressive Strength Based on 28 days	
kPa below 28 000 kPa	**Pay Factor**
1 to 700	0.95
701 to 1400	0.90
1401 to 2100	0.85
2101 to 2800	0.80

Table 02752 - 2 Price Reductions for Deficient Thickness Over New Surfaces	
Deficient Thickness (in millimeters)	**Pay Factor**
0.0 to 3.0	1.00
3.0+ to 6.2	0.90
6.2+ to 12.5	0.75
12.5+ to 20.0	0.60

Table 02752 - 3 Price Reductions for Deficient Thickness over Existing Surfaces	
Deviations Below Profile (in millimeters)	**Pay Factor**
0.0 to 6.0	1.00
6.0 to 12.0	.90
12.0+ to 20.0	.60

#	027520020	Portland Cement Concrete Pavement 225 mm Thick	Square Meter	In place

Measured width not to exceed plan width.

Payment:

A. DEPARTMENT will assess price adjustments for strength, thickness, and surface smoothness separately on the contract bid price.

B. DEPARTMENT will use Table 02752-1 to determine price adjustments for concrete compressive strength.
   1. The price adjustment will apply to the test lot represented by the strength test.
   2. The ENGINEER will evaluate all concrete with a compressive strength of more than 2800 kPa below specification to determine capability of the material to maintain the integrity of the structure for payment. This concrete may be accepted at 50 percent pay factor or required to be replaced.

Price reductions for deficient thickness:

A. Over new surfaces: Table 02752-2.

B. Over existing surfaces: Table 02752-3.

C. The ENGINEER may accept pavement deficient by more than 20 mm at 50 percent pay or require removal and replacement.

D. Make all corrections, including removal and replacement at no additional cost to the DEPARTMENT.

Surface Smoothness Bonus

A. The DEPARTMENT will not pay a bonus:
   1. For any pavement in a day's production in which there is grinding in over three locations, or where the area ground exceeds 30 m^2 per traffic lane. Required hand placement area will not be included in the ground area calculations.
   2. On Class III pavement, (refer to Table 3 in Section 01452, paragraph 3.4, Testing Portland Cement Concrete Pavement).

B. The DEPARTMENT will pay a bonus for any mainline pavement sections of 0.2 km with a Profile Index less than the required millimeter per kilometer if the above criteria are not exceeded. Refer to Section 01452 for smoothness requirements.
   1. Bonuses paid will be computed by the following formula:
      $0.015 {(Required millimeters per kilometer) - (Profile Index)} =
      Incentive per square meter (Including shoulder areas and hand placement areas) to a $1.00 maximum.

Quantity adjustments

A. Will be made when the following occurs:
   1. Pavement is placed over existing road surfaces.
   2. Accepted batched volume (total batched material adjusted to design yield minus rejected or wasted material) of concrete either overruns or underruns the computed neat-line volume (plan width x plan thickness x length placed).

B. Make the quantity adjustment before any price adjustment for non-specification material.

C. At the time of placement, the CONTRACTOR and ENGINEER must agree to the quantity of concrete wasted or rejected when transit mix trucks are used. The formula for overrun/underrun is:

$$QA = 0.5 \left(\frac{V_a - V_n}{V_n} \right) Q_m$$

QA = Adjustment quantity in square meters

V_a = Accepted Volume

V_n = Neat-line Volume

Q_m = Measured quantity in square meters

Table 02752-1 Pay Adjustments for Compressive Strength Based on 28 days	
kPa below 28 000 kPa	**Pay Factor**
1 to 700	0.95
701 to 1400	0.90
1401 to 2100	0.85
2101 to 2800	0.80

Table 02752 - 2 Price Reductions for Deficient Thickness Over New Surfaces	
Deficient Thickness (in millimeters)	**Pay Factor**
0.0 to 3.0	1.00
3.0+ to 6.2	0.90
6.2+ to 12.5	0.75
12.5+ to 20.0	0.60

Table 02752 - 3 Price Reductions for Deficient Thickness over Existing Surfaces	
Deviations Below Profile (in millimeters)	**Pay Factor**
0.0 to 6.0	1.00
6.0 to 12.0	.90
12.0+ to 20.0	.60

#	027520030	Portland Cement Concrete Pavement 275 mm Thick	Square Meter	In place

Measured width not to exceed plan width.

Payment:

A. DEPARTMENT will assess price adjustments for strength, thickness, and surface smoothness separately on the contract bid price.

B. DEPARTMENT will use Table 02752-1 to determine price adjustments for concrete compressive strength.
   1. The price adjustment will apply to the test lot represented by the strength test.
   2. The ENGINEER will evaluate all concrete with a compressive strength of more than 2800 kPa below specification to determine capability of the material to maintain the integrity of the structure for payment. This concrete may be accepted at 50 percent pay factor or required to be replaced.

Price reductions for deficient thickness:

A. Over new surfaces: Table 02752-2.

B. Over existing surfaces: Table 02752-3.

C. The ENGINEER may accept pavement deficient by more than 20 mm at 50 percent pay or require removal and replacement.

D. Make all corrections, including removal and replacement at no additional cost to the DEPARTMENT.

Surface Smoothness Bonus

A. The DEPARTMENT will not pay a bonus:
   1. For any pavement in a day's production in which there is grinding in over three locations, or where the area ground exceeds 30 m^2 per traffic lane. Required hand placement area will not be included in the ground area calculations.
   2. On Class III pavement, (refer to Table 3 in Section 01452, paragraph 3.4, Testing Portland Cement Concrete Pavement).

B. The DEPARTMENT will pay a bonus for any mainline pavement sections of 0.2 km with a Profile Index less than the required millimeter per kilometer if the above criteria are not exceeded. Refer to Section 01452 for smoothness requirements.
   1. Bonuses paid will be computed by the following formula:
      $0.015 {(Required millimeters per kilometer) - (Profile Index)} =
      Incentive per square meter (Including shoulder areas and hand placement areas) to a $1.00 maximum.

Quantity adjustments

A. Will be made when the following occurs:
   1. Pavement is placed over existing road surfaces.
   2. Accepted batched volume (total batched material adjusted to design yield minus rejected or wasted material) of concrete either overruns or underruns the computed neat-line volume (plan width x plan thickness x length placed).

B. Make the quantity adjustment before any price adjustment for non-specification material.

C. At the time of placement, the CONTRACTOR and ENGINEER must agree to the quantity of concrete wasted or rejected when transit mix ~~trucks~~ are used. The formula for overrun/underrun is:

$$QA = 0.5 \left(\frac{V_a - V_n}{V_n} \right) Q_m$$

QA = Adjustment quantity in square meters

V_a = Accepted Volume

V_n = Neat-line Volume

Q_m = Measured quantity in square meters

Table 02752-1 Pay Adjustments for Compressive Strength Based on 28 days	
kPa below 28 000 kPa	**Pay Factor**
1 to 700	0.95
701 to 1400	0.90
1401 to 2100	0.85
2101 to 2800	0.80

Table 02752 - 2 Price Reductions for Deficient Thickness Over New Surfaces	
Deficient Thickness (in millimeters)	**Pay Factor**
0.0 to 3.0	1.00
3.0+ to 6.2	0.90
6.2+ to 12.5	0.75
12.5+ to 20.0	0.60

Table 02752 - 3 Price Reductions for Deficient Thickness over Existing Surfaces	
Deviations Below Profile (in millimeters)	**Pay Factor**
0.0 to 6.0	1.00
6.0 to 12.0	.90
12.0+ to 20.0	.60

Section 02753: Full Depth Slab Replacement for Concrete Pavement

#	**027530010**	**Full Depth Slab Replacement**	**Square Meter**

Section 02755: Concrete Slab Jacking

#	**027550010**	**Concrete Slab Jacking**	**Cubic Meter**
Measure liquid quantities using a calibrated meter.			

Section 02761: Longitudinal Rumble Strip

#	**027610010**	**Scored Shoulder**	**Meter**
Measured along the edge of the shoulder.			

#	**027610020**	**Longitudinal Rumble Strip**	**Meter**
Measured along the edge of the shoulder.			

Section 02762: Plowable Pavement Marker

#	**027620010**	**Plowable Pavement Marker - One Way White**	**Each**	**In place**

#	**027620020**	**Plowable Pavement Marker - One Way Yellow**	**Each**	**In place**

#	**027620030**	**Plowable Pavement Marker - Two Way Yellow**	**Each**	**In place**

#	**027620040**	**Plowable Pavement Marker**	**Each**	**In place**

Section 02765: Pavement Marking Paint

#	**027650005**	**Traffic Striping Paint**	**Liter**	**In place**

Payment:

A. The Department will not pay for removal of unauthorized, smeared, or damaged markings.

B. Price reduction for paint application rate:

Rate	**Pay Factor**
At the specified rate	1.0
1-10 percent below the specified rate	0.75
11-15 percent below the specified rate	0.50
More than 15 percent below the specified rate	May be accepted at 0.40 percent or required to be repainted.

#	027650010	Traffic Striping Paint	Meter	In place

Payment:
A. The Department will not pay for removal of unauthorized, smeared, or damaged markings.
B. Price reduction for paint application rate:

Rate	Pay Factor
At the specified rate	1.0
1-10 percent below the specified rate	0.75
11-15 percent below the specified rate	0.50
More than 15 percent below the specified rate	May be accepted at 0.40 percent or required to be repainted

#	027650020	Pavement Message Paint	Each	In place

Measurement - Painted Pavement Messages:
A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.

Payment:
A. The Department will not pay for removal of unauthorized, smeared, or damaged markings.
B. Price reduction for paint application rate:

Rate	Pay Factor
At the specified rate	1.0
1-10 percent below the specified rate	0.75
11-15 percent below the specified rate	0.50
More than 15 percent below the specified rate	May be accepted at 0.40 percent or required to be repainted.

#	027650025	Pavement Marking Paint (Stop Bars, Cross Walks - 300 mm)	Meter	In place

By the meter of 300 mm wide line painted, per Standard Drawing 745-44.

#	027650030	Remove Pavement Markings	Meter

Measurement for removing pavement markings:
Measure per meter each line removed.

#	027650040	Remove Pavement Markings	Each

Measurement for removing pavement markers:
1. Measure each letter or single arrow as one pavement message.
2. Measure two-headed arrows as two pavement messages.

#	027650050	Pavement Marking Paint	Liter	In place

Payment:
A. The Department will not pay for removal of unauthorized, smeared, or damaged markings.
B. Price reduction for paint application rate:

Rate	Pay Factor
At the specified rate	1.0
1-10 percent below the specified rate	0.75
11-15 percent below the specified rate	0.50
More than 15 percent below the specified rate	May be accepted at 0.40 percent or required to be repainted

#	027650060	Pavement Marking Paint	Meter	In place

Payment:
A. The Department will not pay for removal of unauthorized, smeared, or damaged markings.
B. Price reduction for paint application rate:

Rate	Pay Factor
At the specified rate	1.0
1-10 percent below the specified rate	0.75
11-15 percent below the specified rate	0.50
More than 15 percent below the specified rate	May be accepted at 0.40 percent or required to be repainted

#	027650070	Pavement Marking Paint (Stop bars, crosswalks 300 mm)	Meter	In place

By the meter of 300 mm wide line painted, per Standard Drawing 745-44.

Section 02768: Pavement Marking Materials (Warranty Specification)

#	027680005	100 mm Pavement Marking Tape - White	Meter

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680010	200 mm Pavement Marking Tape - White	Meter

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680015	100 mm Pavement Marking Tape - Yellow	Meter

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680020	200 mm Pavement Marking Tape - Yellow	Meter

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680025	Pavement Message (Tape)	Each

Measurement - Painted Pavement Messages:
A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.
H. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680030	100 mm Pavement Marking Epoxy - White, Type I	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680035	200 mm Pavement Marking Epoxy - White, Type I	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680040	100 mm Pavement Marking Epoxy - Yellow, Type I	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680045	200 mm Pavement Marking Epoxy - Yellow, Type I	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680050	100 mm Pavement Marking Epoxy - White, Type 2	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680055	200 mm Pavement Marking Epoxy - White, Type 2	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680060	100 mm Pavement Marking Epoxy - Yellow, Type 2	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680065	200 mm Pavement Marking Epoxy - Yellow, Type 2	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680070	Pavement Message (Epoxy), Type I	Each

Measurement - Painted Pavement Messages:

A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.
H. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680075	Pavement Message (Epoxy), Type 2	Each

Measurement - Painted Pavement Messages:

A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.
H. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680080	100 mm Pavement Marking Acrylic - White	Meter

Measurement - Painted Pavement Messages:

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680085	200 mm Pavement Marking Acrylic - White	Meter

Measurement - Painted Pavement Messages:

A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680090	100 mm Pavement Marking Acrylic - Yellow	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680095	200 mm Pavement Marking Acrylic - Yellow	Meter

Measurement - Painted Pavement Messages:
A. Do not measure the gap in the skip line.
B. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680100	Pavement Message (Acrylic)	Each

Measurement - Painted Pavement Messages:
A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.
H. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

#	027680105	Pavement Message (Preformed Thermoplastic)	Each

Measurement - Painted Pavement Messages:
A. Letter = one message.
B. Arrow = one message.
C. Multi-headed arrow = one message per arrow.
D. School crossbars = one message per 600 mm x 3 m bar.
E. Crosswalk = two message per lane and two messages per shoulder.
F. Stop Bar = one message per lane and one message per shoulder.
G. Railroad crossing markings = seven messages per lane.
   1. 'R' = one message each (two required).
   2. 'X' = two messages.
   3. Transverse Bar = one message each (two required).
   4. Stop Bar = one message.
H. Include all costs for the Manufacturer's Service Representative and other technical assistance in the contract unit price.

Section 02771: Curbs, Gutters, Driveways, Disabled Pedestrian Ramps, and Plowable End Sections

#	027710005	Concrete Gutter	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710010	Concrete Curb Type B3	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710015	Concrete Curb Type B4	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710020	Concrete Curb Type M2	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710025	Concrete Curb and Gutter Type B1	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710030	Concrete Curb and Gutter Type B2	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710035	Concrete Curb and Gutter Type M1	Meter

Measured along the roadway face. Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710040	Concrete Driveway Flared 150 mm Thick	Square Meter	In place

Include Radius and Flares.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710045	Concrete Driveway Flared 175 mm Thick	Square Meter	Each

Include Radius and Flares.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710050	Concrete Driveway Open 150 mm Thick	Square Meter	In place

Include Radius and Flares.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710055	Concrete Drive Open 175 mm Thick	Square Meter	In place

Include Radius and Flares

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710060	Disabled Pedestrian Ramp Type A	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710065	Disabled Pedestrian Ramp Type B	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710075	Disabled Pedestrian Ramp Type D	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710080	Disabled Pedestrian Ramp Type E	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:

1. DEPARTMENT may accept item at a reduced price
2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710085	Disabled Pedestrian Ramp Type G	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710090	Disabled Pedestrian Ramp Type H	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027710100	Plowable End Section	Each	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

Section 02773: Asphalt Concrete Curb

#	027730010	Asphalt Concrete Curb	Meter	Along the face

Section 02776: Concrete Sidewalk, Median Filler, and Flatwork

#	027760010	Concrete Sidewalk	Square Meter	In place

Include excavation if Roadway Excavation is not a bid item.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027760020	Concrete Median Filler	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027760030	Concrete Flatwork 100 mm Thick	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027760040	Concrete Flatwork 150 mm Thick	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027760050	Concrete Flatwork 175 mm Thick	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	027760060	Concrete Flatwork 200 mm Thick	Square Meter	In place

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

Section 02785: Chip Seal Coat

#	027850010	Chip Seal Coat, Type A	Square Meter	In place

Include in this item cover material, blotter material, flush coat and temporary pavement markings. Emulsified asphalt paid separately.

#	027850020	Chip Seal Coat, Type B	Square Meter	In place

Include in this item cover material, blotter material, flush coat and temporary pavement markings. Emulsified asphalt paid separately.

#	027850030	Chip Seal Coat, Type C	Square Meter	In place

Include in this item cover material, blotter material, flush coat and temporary pavement markings. Emulsified asphalt paid separately.

#	027850040	Emulsified Asphalt RS-2	Megagram	In place

#	027850045	Emulsified Asphalt CRS-2A	Megagram	In place

#	027850050	Emulsified Asphalt CRS-2B	Megagram	In place

#	027850055	Emulsified Asphalt CRS-2P	Megagram	In place

#	027850060	Emulsified Asphalt LMCRS-2	Megagram	In place

#	027850065	Emulsified Asphalt HFRS-2P	Megagram	In place

#	**027850070**	**Emulsified Asphalt HFMS-2**	**Megagram**	**In place**

#	**027850075**	**Emulsified Asphalt HFMS-2P**	**Megagram**	**In place**

Section 02786: Plant Mix Seal Coat (Open-graded)

#	027860010	Plant Mix Seal Coat	Megagram	In place

Measurement:

A. Plant Mix Seal Coat Mix: Include aggregates and all additives including hydrated lime. Provide additional measurements for Asphalt Binder.

B. Asphalt Binder: When producing products for more than the subject project, measure and calculate the payment for the Asphalt Cement from the daily extraction tests. Otherwise use delivered invoices less waste.

C. Hydrated Lime: Refer to Section 02746. Hydrated Lime will be required with no separate bid item.

D. Adjust the weighed units by the following formula to obtain the final pay units for all Plant Mix Seal Coat produced in Weber, Davis, Salt Lake, or Utah counties.

1. Pay Megagrams $= \left(\frac{2.50 \text{ X } W}{Ga}\right)$
2. W = Weighed megagrams of plant mix seal coat.
3. Ga = Average specific gravity of the mix (running average of five tests, Rice Method. AASHTO T 209.

Pay Adjustments:

A. The DEPARTMENT will reject the lot if the percent within limits for any individual measurement is less than 60 percent.

B. If the lot is rejected, the CONTRACTOR may submit an engineering analysis requesting that the pavement remain in place.

1. Include in the analysis: Data and engineering principles that indicate why the pavement should remain in place.
2. The ENGINEER, Region Materials Engineer, and Region Construction Engineer will review the analysis for acceptance, denial, or revision.
3. If the request is denied, remove the rejected material from the project within 72 hours and replace it with an acceptable material.
4. If rotomilling is required, agree on removal time period.
5. DEPARTMENT will deduct $15.00 per megagram if a rejected lot is allowed to remain in place.

Bonus or Deduction for Gradation:

A. Based on assessed HMA quantities in Table 02786-1. Base adjustments on Percent Within Limits computation using Tables 02786-2, 02786-3 and 02786-4.

Surface Smoothness Pay Adjustments:

A. Department will not pay a bonus for any pavement in a day's production in which there is grinding in over six locations or the area ground exceeds 90 square meters per traffic lane. Required hand placement area will not be included in the ground area calculations.

B. Department will pay a bonus for any mainline pavement sections of 0.2 km with a Profile Index less than the required mm per km if the above criteria are not exceeded. Refer to Standard Specifications, Section 02786, Part 3.

C. Department will compute bonuses paid as follows:

1. 0.005 X [Required mm per km) - (Profile Index)] = Incentive per square meter (including shoulder areas) to a $0.90 maximum
2. The Profile Index to be used for shoulders will be the same as the adjacent lane.

Table 02786-1 Upper and Lower Limit Determination	
Parameter	UL and LL
9.5 mm sieve	Target Value ± 5.0 percent
4.75 mm sieve	Target Value ± 5.0 percent
2.36 mm sieve	Target Value ± 5.0 percent
0.075 mm sieve	Target Value ± 2.0 percent

Table 02786-2 Pay Adjustments	
Gradation	
PT Based on min. Four Samples	**Bonus or Deduction (Dollars/megagram)**
>99	0.91
96-99	0.74
92-95	0.41
88-91	0.07
84-87	-0.26
80-83	-0.60
76-79	-0.93
72-75	-1.27
68-71	-1.60
64-67	-1.93
60-63	-2.27
<60	Reject

Table 02786-3 Quality Index Values for Estimating Percent Within Limits										
PU/PL	**n=3**	**n=4**	**n=5**	**n=6**	**n=7**	**n=8**	**n=10**	**n=12**	**n=15**	**n=20**
100	1.16	1.50	1.75	1.91	2.06	2.15	2.29	2.35	2.47	2.56
99	1.16	1.47	1.68	1.79	1.89	1.95	2.04	2.09	2.14	2.19
98	1.15	1.44	1.61	1.70	1.77	1.80	1.86	1.89	1.93	1.97
97	1.15	1.41	1.55	1.62	1.67	1.69	1.74	1.77	1.80	1.82
96	1.15	1.38	1.49	1.55	1.59	1.61	1.64	1.66	1.69	1.70
95	1.14	1.35	1.45	1.49	1.52	1.54	1.56	1.57	1.59	1.61
94	1.13	1.32	1.40	1.44	1.46	1.47	1.49	1.50	1.51	1.53
93	1.12	1.29	1.36	1.38	1.40	1.41	1.43	1.43	1.44	1.46
92	1.11	1.26	1.31	1.33	1.35	1.36	1.37	1.37	1.38	1.39
91	1.10	1.23	1.27	1.29	1.30	1.31	1.32	1.32	1.32	1.33
90	1.09	1.20	1.23	1.24	1.25	1.25	1.26	1.26	1.27	1.27
89	1.08	1.17	1.20	1.21	1.21	1.21	1.21	1.21	1.22	1.22
88	1.07	1.14	1.16	1.17	1.17	1.17	1.17	1.17	1.17	1.17
87	1.06	1.11	1.12.	1.12	1.12	1.13	1.13	1.13	1.13	1.13
86	1.05	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08	1.08
85	1.03	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04
84	1.02	1.02	1.02	1.01	1.01	1.01	1.00	1.00	1.00	1.00
83	1.00	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.96	0.96
82	0.98	0.96	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.92
81	0.96	0.93	0.92	0.91	0.90	0.90	0.89	0.89	0.89	0.88
80	0.94	0.90	0.88	0.87	0.86	0.86	0.85	0.85	0.85	0.85
79	0.92	0.87	0.85	0.84	0.83	0.83	0.82	0.82	0.82	0.81
78	0.89	0.84	0.82	0.81	0.80	0.79	0.79	0.78	0.78	0.78
77	0.87	0.81	0.79	.0.78	0.77	0.76	0.76	0.75	0.75	0.75
76	0.84	0.78	0.76	0.75	0.74	0.73	0.72	0.72	0.72	0.72
75	0.82	0.75	0.73	0.72	0.71	0.70	0.69	0.69	0.69	0.68
74	0.79	0.72	0.70	0.68	0.67	0.67	0.66	0.66	0.66	0.65
73	0.77	0.69	0.67	0.65	0.64	0.64	0.62	0.62	0.62	0.62
72	0.74	0.66	0.64	0.62	0.61	0.61	0.60	0.59	0.59	0.59
71	0.71	0.63	0.60	0.59	0.58	0.58	0.57	0.56	0.56	0.56
70	0.68	0.60	0.58	0.56	0.55	0.55	0.54	0.54	0.54	0.53
69	0.65	0.57	0.55	0.54	0.53	0.52	0.51	0.51	0.51	0.50
68	0.62	0.54	0.52	0.51	0.50	0.50	0.48	0.48	0.48	0.48
67	0.59	0.51	0.49	0.48	0.47	0.47	0.46	0.45	0.45	0.45
66	0.56	0.48	0.46	0.45	0.44	0.44	0.43	0.42	0.42	0.42
65	0.53	0.45	0.43	0.42	0.41	0.41	0.40	0.40	0.40	0.39
64	0.49	0.42	0.40	0.39	0.38	0.38	0.37	0.37	0.37	0.37
63	0.46	0.39	0.37	0.36	0.35	0.35	0.35	0.34	0.34	0.34
62	0.43	0.36	0.34	0.33	0.33	0.33	0.32	0.31	0.31	0.31
61	0.39	0.33	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28
60	0.36	0.30	0.28	0.27	0.26	0.26	0.25	0.25	0.25	0.25
#60	#0.35	#0.29	#0.27	#0.26	#0.25	#0.25	#0.24	#0.24	#0.24	#0.24

Enter table in the appropriate sample size column and round down to the nearest value.

Table 02786-4 Definitions, Abbreviations, and Formulas for Acceptance	
Term	**Explanation**
Target Value (TV)	The target values for gradation and asphalt cement content are given in the CONTRACTOR's mix design. The target value for density is 93.5% of maximum (Rice) density.
Average (AVE)	The sum of the lot's test results for a measured characteristic divided by the number of test results; the arithmetic mean.
Standard Deviation (s)	The square root of the value formed by summing the squared difference between the individual test results of a measured characteristic and AVE, divided by the number of test results minus one. This statement does not limit the methods of calculations of s; other methods that obtain the same value may be used.
Upper Limit (UL)	The value above the TV of each measured characteristic that defines the upper limit of acceptable production. (Table 2)
Lower Limit (LL)	The value below the TV of each measured characteristic that defines the lower limit of acceptable production (Table 2)
Upper Quality Index (QU)	QU = (UL - AVE)/s
Lower Quality Index (QL)	QL = (AVE - LL)/s
Percentage of Lot Within UL (PU)	Determined by entering Table 3 with QU.
Percentage of Lot Within LL (PL)	Determined by entering Table 3 with QL.
Total Percentage of Lot (PL) Within UL and LL (PT)	PT = (PU + PL) - 100
Pay Adjustment (PF)	Determined by entering Table 1 with PT or PL.

All values for AVE, s, QU, and QL will be calculated to two decimal place accuracy which will be carried through all further calculations. Rounding to lower accuracy is not allowed.

Table 02786 - 6 National Highway System and Truck Routes - Category 1		
Interstate Routes	**Beginning**	**Ending**
1-15	Arizona State Line	Idaho State Line
1-70	Jct I-70 - Cove Fort	Colorado State Line
1-80	Nevada State Line	Wyoming State Line
1-84	Idaho State Line	Jct I-80 - Coalville
1-215	Jct I-80 - Parleys Canyon	Jct I -15 - North Salt Lake
US Routes		
US-6	Nevada State Line	Jct US-50 - Delta
US-6	Jct I-15 - Spanish Fork	Jct I-70 - Green River
US -40	Jct I-80 - Park City	Colorado State Line
US-50	Jct US-6 - Delta	Jct I-15 - Holden
US -89	Arizona State Line	Jct I-70 - Sevier
US -89	Jct I-70 - Salina	Jct SR-28 - Gunnison
US-89	Jct US-6 - Spanish Fork	Jct SR-73 - Lehi
US-89	Jct I-15 - Draper, Exit 295	Jct SR-269 - 5th and 6th South
US-89	Jct I-15 - Farmington	Jct I-80 - Uintah
US-89	Jct I-84 - Uintah	Jct SR-134 - North Ogden
US-89	Jct US-91 - Logan	Idaho State Line
US-91	Jct I-15 - Brigham City	Jct US-89 - Logan
US-189	Jct I-15 - South Provo	Jct US-40 - Heber City
US-191	Arizona State Line	Jct I-70 - Thompson
US-666	Jct US-191 - Monticello	Colorado State Line

State Routes	Beginning	Ending
SR-9 - Zions Park		
SR-10 - Castle Valley	Jct I-70 - Fremont Jct	Jct US-6 - Price
SR-12 - Bryce Canyon	Jct US-89 - Panguitch	Jct SR-63 - Bryce Canyon
SR-26 - Riverdale Road	Uct I-15 - Exit 342	Jct US-89 - Ogden
SR-28 - Levan Desert	Jct US-89 - Gunnison	Jct I-15 - South Nephi
SR-31 - Huntington	Mile Post 33	Mile Post 49
SR-36 - Tooele Access	Jct entrance - Tooele Army Depot	Jct I-80 - Tooele Interchange
SR-39 - 20th and 21st, Ogden	Jct I-15 - Exit 344	Jct SR-203 - Harrison Blvd
SR-52 - 8th North, Orem	Jct 1-15 - Orem	Jct US -189 - Olmstead Jct
SR-57 - Orangeville Bypass	Jct SR-10 - Hunter Power Plant	Entrance - Wilberg Coal Mine
SR-71 - 7th and 9th East Street, SLC	Jct SR0-209 - 90th South St.	Jct SR-186 - 4th South Street
SR-73 - Lehi Connection	Jct I-15 - South Lehi	Jct US-89 - South Lehi
SR-79 - 12th Street, Ogden	Jct I-15 - Exit 347	Jct SR-203 - Harrison Blvd.
SR-96 - Scofield Access	Mile Post 3	Mile Post 4
SR-111 - Bacchus Highway	Jct SR-48 - Bingham Highway	Jct SR-201 - 21st South Expressway
SR-134 - 2700 North	Jct I-15 - North Ogden, Exit 352	Jct US-89 - North Ogden
SR-152 - Van Winkle Expressway	Jct SR-71 - 9th East Street	Jct I-215 - East (Exit 8)
SR-154 - Bangerter Highway	Jct I-15 - Draper	Jct I-80 - Salt Lake Intl Airport
SR-171 - 33rd and 35th South, SLC	Jct SR-172 - 56th West Street	Jct I-215 - East, Exit 3
SR-172 - 56th West Street, SLC	Jct 6200 South - Kearns	Jct I-80 - International Center
SR-186 Foothill Blvd	Jct SR-71 - 7th East Street, SLC	Jct I-215 - East (Exit 1)
SR-190 - Big Cottonwood	Jct I 215 - East, Exit 7, SLC	Jct SR-210 - Little Cottonwood
SR-201 - 21st South Expressway	Jct I-80 - Lake Point	Jct I-15 - South Salt Lake
SR-203 - Harrison Blvd	Jct US-89 - South Ogden	Jct SR-39 - 12th Street
SR-209 - 90th & 94th South	Jct SR-68 - Redwood Road (SLC)	Jct SR-210 - Little Cottonwood
SR-210 - Little Cottonwood	Jct SR-190 - Big Cottonwood	Jct SR-209 - 90th and 96th South

SR-264 - Skyline Mine Road	Mile Post 12	Mile Post 15
SR-265 - University Parkway	Jct I-15 - Exit 272	Jct I-215 East, Exit 5
SR-266 - 45th & 47th South, Taylorsville	Jct I-215 - West, Exit 15	Jct I-215 - East, Exit 5
SR-269 - 5th & 6th South, Salt Lake City	Jct I-215, Exit 310	Jct SR-71 - 7th East Street

#	**027860020**	**Asphalt Cement PG 64-34**	**Megagram**

#	**027860030**	**Asphalt Cement PG 70-28**	**Megagram**

#	**027860040**	**Asphalt Cement PG 70-34**	**Megagram**

#	**027860050**	**Asphalt Cement PG 64-28**	**Megagram**

Section 02812: Pressurized Irrigation System

#	**028120010**	**Pressurized Irrigation System**	**Lump Sum**
Include all materials and workmanship to provide a complete and fully operational pressurized irrigation system.			

#	**02812002D**	**_____ mm PVC Pipe Schedule _____**	**Meter**	**In place**

Section 02821: Chain Link Fencing and Gates

#	**028210002**	**0.9 m Chain Link Fence, Type I**	**Meter**	**In place**
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	**028210004**	**1.2 m Chain Link Fence, Type I**	**Meter**	**In place**
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	**028210006**	**1.5 m Chain Link Fence, Type I**	**Meter**	**In place**
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	**028210008**	**1.8 m Chain Link Fence, Type I**	**Meter**	**In place**
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	**028210010**	**2.2 m Chain Link Fence, Type I**	**Meter**	**In place**
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210012	0.9 m Chain Link Fence, Type II	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210014	1.2 m Chain Link Fence, Type II	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210016	1.5 m Chain Link Fence, Type II	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210018	1.8 m Chain Link Fence, Type II	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210020	2.2 m Chain Link Fence, Type II	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210022	0.9 m Chain Link Fence, Type III	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210024	1.2 m Chain Link Fence, Type III	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210026	1.5 m Chain Link Fence, Type III	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210028	1.8 m Chain Link Fence, Type III	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210030	2.2 m Chain Link Fence, Type III	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210032	0.9 m Chain Link Fence, Type IV	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210034	1.2 m Chain Link Fence, Type IV	Meter	In place

A. Measured parallel to the ground along the fence including line posts, less openings.

#	028210036	1.5 m Chain Link Fence, Type IV	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210038	1.8 m Chain Link Fence, Type IV	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210040	2.2 m Chain Link Fence, Type IV	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210042	Chain Link Fence, Type I with Barb Wire Arm	Meter	In place
A. Measured parallel to the ground along the fence including line posts, less openings.				

#	028210044	Chain Link Brace Post	Each	In place

#	028210046	Chain Link Gate, H=0.9 m X W=1.2 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210048	Chain Link Gate, H=1.2 m X W=1.2 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210050	Chain Link Gate, H=1.5 m X W=1.2 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210052	Chain Link Gate, H=1.8 m X W=1.2 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210054	Chain Link Gate, H=0.9 m X W=1.8 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210056	Chain Link Gate, H=1.2 m X W=1.8 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210058	Chain Link Gate, H=1.5 m X W=1.8 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210060	Chain Link Gate, H=1.8 m X W=1.8 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210062	Chain Link Gate, H=0.9 m X W=2.4 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210064	Chain Link Gate, H=1.2 m X W=2.4 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210066	Chain Link Gate, H=1.5 m X W=2.4 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210068	Chain Link Gate, H=1.8 m X W=2.4 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210070	Chain Link Gate, H=0.9 m X W=3.0 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210072	Chain Link Gate, H=1.2 m X W=3.0 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210074	Chain Link Gate, H=1.5 m X W=3.0 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210076	Chain Link Gate, H=1.8 m X W=3.0 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210078	Chain Link Gate, H=0.9 m X W=3.6 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210080	Chain Link Gate, H=1.2 m X W=3.6 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210082	Chain Link Gate, H=1.5 m X W=3.6 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210084	Chain Link Gate, H=1.8 m X W=3.6 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210086	Chain Link Gate, H=0.9 m X W=4.3 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210088	Chain Link Gate, H=1.2 m X W=4.3 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210090	Chain Link Gate, H=1.5 m X W=4.3 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210092	Chain Link Gate, H=1.8 m X W=4.3 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210094	Chain Link Gate, H=0.9 m X W=4.9 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210096	Chain Link Gate, H=1.2 m X W=4.9 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210098	Chain Link Gate, H=1.5 m X W=4.9 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

#	028210100	Chain Link Gate, H=1.8 m X W=4.9 m	Each	In place
A. Double gates will be counted as two gates. B. Include barbed wire arms on gates.				

Section 02822: Right-of-Way Fence and Gate

#	028220005	Right-of-Way Fence, Type A (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220010	Right-of-Way Fence, Type A (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220015	Right-of-Way Fence, Type B (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220020	Right-of-Way Fence, Type B (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220025	Right-of-Way Fence, Type D (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220030	Right-of-Way Fence, Type D (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220035	Right-of-Way Fence, Type E (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220040	Right-of-Way Fence, Type E (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220045	Right-of-Way Fence, Type F (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220050	Right-of-Way Fence, Type F (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220055	Right-of-Way Fence, Type G (Wood Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220060	Right-of-Way Fence, Type G (Metal Post)	Meter	In place
Measure parallel to the ground along the fence including line posts, less openings.				

#	028220065	Right-of-Way Gate 1.2 m	Each	In place
Double gates will be counted as two gates.				

#	028220070	Right-of-Way Gate 1.8 m	Each	In place
Double gates will be counted as two gates.				

#	028220075	Right-of-Way Gate 2.4 m	Each	In place
Double gates will be counted as two gates.				

#	028220080	Right-of-Way Gate 3.0 m	Each	In place
Double gates will be counted as two gates.				

#	**028220085**	**Right-of-Way Gate 3.7 m**	**Each**	**In place**
Double gates will be counted as two gates.				

#	**028220090**	**Right-of-Way Gate 4.3 m**	**Each**	**In place**
Double gates will be counted as two gates.				

#	**028220095**	**Right-of-Way Deer Gate**	**Each**	**In place**
Double gates will be counted as two gates.				

#	**028220100**	**Swing Gate**	**Each**	**In place**
Double gates will be counted as two gates.				

#	**028220105**	**Right-of-Way Brace Post**	**Each**	**In place**
Brace Posts include end, gate, corner or braced line posts				

Section 02825: Cattle Guard

#	**028250010**	**Precast Concrete Cattle Guard**	**Each**	**In place**

Section 02841: Traffic Barriers

#	**028410010**	**Beam Guardrail**	**Meter**	**In place**

#	**028410020**	**Double Beam Guardrail**	**Meter**	**In place**

#	**028410030**	**Guardrail Transition Elements**	**Each**	**In place**

#	**028410040**	**Precast Concrete Barrier**	**Meter**	**In place**

#	**028410050**	**Precast Concrete Barrier (Half Section)**	**Meter**	**In place**

#	**028410060**	**Traffic Control Cable**	**Meter**	**In place**

#	**028410070**	**Barrier Reflector**	**Each**	**In place**

#	028410080	Cast-in-Place Constant Slope Barrier	Meter	In place

Section 02842: Delineators

#	028420010	Delineator Type I	Each	In place
#	028420020	Delineator Type II	Each	In place
#	028420030	Delineator - Culvert Marker	Each	In place
#	028420040	Delineator - Maintenance Marker	Each	In place
#	028420050	Delineator - Freeway Turn Around	Each	In place

Section 02843: Attenuation/End Section

#	028430005	Attenuator Type A	Each	In place
#	028430010	Attenuator Type B	Each	In place
#	028430015	Attenuator Type C	Each	In place
#	028430020	Attenuator Type D	Each	In place
#	028430025	Attenuator Type E	Each	In place
#	028430030	End Section Type F	Each	In place
#	028430035	End Section Type G	Each	In place
#	028430040	End Section Type H	Each	In place
#	028430045	Marker Post and Mounting Hardware	Each	Each
#	028430050	Object Marker Sheeting or Marker Plate Hardware	Each	Each

Section 02861: Precast Retaining/Noise Walls

#	028610005	Precast Noise Wall 1.00 m	Meter	In place
#	028610010	Precast Noise Wall 1.25 m	Meter	In place
#	028610015	Precast Noise Wall 1.50 m	Meter	In place
#	028610020	Precast Noise Wall 1.75 m	Meter	In place
#	028610025	Precast Noise Wall 2.00 m	Meter	In place
#	028610030	Precast Noise Wall 2.25 m	Meter	In place
#	028610035	Precast Noise Wall 2.50 m	Meter	In place
#	028610040	Precast Noise Wall 2.75 m	Meter	In place
#	028610045	Precast Noise Wall 3.00 m	Meter	In place
#	028610050	Precast Noise Wall 3.25 m	Meter	In place
#	028610055	Precast Noise Wall 3.50 m	Meter	In place
#	028610060	Precast Noise Wall 3.75 m	Meter	In place
#	028610065	Precast Noise Wall 4.00 m	Meter	In place
#	028610070	Precast Noise Wall 4.25 m	Meter	In place
#	028610075	Precast Noise Wall 4.50 m	Meter	In place
#	028610080	Precast Noise Wall 4.75 m	Meter	In place
#	028610085	Precast Noise Wall 5.00 m	Meter	In place
#	028610090	Precast Retaining/Noise Wall 2.25 m	Meter	In place

#	028610095	Precast Retaining/Noise Wall 3.25 m	Meter	In place
#	028610100	Precast Retaining/Noise Wall 3.50 m	Meter	In place
#	028610105	Precast Retaining/Noise Wall 3.75 m	Meter	In place
#	028610110	Precast Retaining/Noise Wall 4.00 m	Meter	In place
#	028610115	Precast Retaining/Noise Wall 4.25 m	Meter	In place
#	028610120	Precast Retaining/Noise Wall 4.50 m	Meter	In place
#	028610125	Precast Retaining/Noise Wall 4.75 m	Meter	In place
#	028610130	Precast Retaining/Noise Wall 5.00 m	Meter	In place
#	028610135	Precast Retaining/Noise Wall 5.25 m	Meter	In place
#	028610140	Precast Retaining/Noise Wall 5.50 m	Meter	In place
#	028610145	Precast Retaining/Noise Wall 5.75 m	Meter	In place

Section 02891: Traffic Signs

#	028910005	Remove Sign		Each
#	028910010	Relocate Sign	Each	In place
Includes removal and disposal of existing concrete sign base.				
#	028910020	Auxiliary Sign, Type A-1	Square Meter	In place
#	028910022	Sign, Type A-1	Square Meter	In place
#	028910025	Sign Type A-1 305 mm X 457 mm	Each	In place
#	028910030	Sign Type A-1 508 mm X 381 mm	Each	In place

#	028910035	Sign Type A-1 610 mm	Each	In place
#	028910040	Sign Type A-1 610 mm X 305 mm	Each	In place
#	028910045	Sign Type A-1 610 mm X 610 mm	Each	In place
#	028910050	Sign Type A-1 610 mm X 762 mm	Each	In place
#	028910055	Sign Type A-1 762 mm X 610 mm	Each	In place
#	028910060	Sign Type A-1 762 mm X 762 mm	Each	In place
#	028910065	Sign Type A-1 910 mm X 910 mm	Each	In place
#	028910070	Sign Type A-1 1219 mm X 1219 mm	Each	In place
#	028910075	Auxiliary Sign Type A-2	Square Meter	In place
#	028910080	Sign Type A-2 305 mm X 457 mm	Each	In place
#	028910085	Sign Type A-2 508 mm X 381 mm	Each	In place
#	028910090	Sign Type A-2 610 mm	Each	In place
#	028910095	Sign Type A-2 610 mm X 305 mm	Each	In place
#	028910100	Sign Type A-2 610 mm X 610 mm	Each	In place
#	028910105	Sign Type A-2 610 mm X 762 mm	Each	In place
#	028910110	Sign Type A-2 762 mm X 610 mm	Each	In place
#	028910115	Sign Type A-2 762 mm X 762 mm	Each	In place
#	028910120	Sign Type A-2 910 mm X 910 mm	Each	In place
#	028910125	Sign Type A-2 1219 mm X 1219 mm	Each	In place

#	028910130	Auxiliary Sign Type P-1	Square Meter	In place
#	028910132	Sign Type P-1	Square Meter	In place
#	028910135	Sign Type P-1 305 mm X 457 mm	Each	In place
#	028910140	Sign Type P-1 508 mm X 381 mm	Each	In place
#	028910145	Sign Type P-1 610 mm	Each	In place
#	028910150	Sign Type P-1 610 mm X 305 mm	Each	In place
#	028910155	Sign Type P-1 610 mm X 610 mm	Each	In place
#	028910160	Sign Type P-1 610 mm X 762 mm	Each	In place
#	028910165	Sign Type P-1 762 mm X 610 mm	Each	In place
#	028910170	Sign Type P-1 762 mm X 762 mm	Each	In place
#	028910175	Sign Type P-1 910 mm X 910 mm	Each	In place
#	028910180	Sign Type P-1 1219 mm X 1219 mm	Each	In place
#	028910185	Auxiliary Sign Type P-2	Square Meter	In place
#	028910190	Sign Type P-2 305 mm X 457 mm	Each	In place
#	028910195	Sign Type P-2 508 mm X 381 mm	Each	In place
#	028910200	Sign Type P-2 610 mm	Each	In place
#	028910205	Sign Type P-2 610 mm X 305 mm	Each	In place
#	028910210	Sign Type P-2 610 mm X 610 mm	Each	In place
#	028910215	Sign Type P-2 610 mm X 762 mm	Each	In place

#	028910220	Sign Type P-2 762 mm X 610 mm	Each	In place

#	028910225	Sign Type P-2 762 mm X 762 mm	Each	In place

#	028910230	Sign Type P-2 910 mm X 910 mm	Each	In place

#	028910235	Sign Type P-2 1219 mm X 1219 mm	Each	In place

#	028910240	Panel Overlay	Square Meter	In place

#	028910245	Panel Replacement	Square Meter	In place

#	028910250	Overhead Sign Structure	Each

#	028910255	Sign Foundation	Each

#	028910260	Temporary Sign Covering	Each

Section 02892: Traffic Signal

#	02892001D	Traffic Signal System _____	Lump sum
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	02892002D	Traffic Signal System _____	Lump sum
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	02892003D	Traffic Signal System _____	Lump sum
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	02892004D	Traffic Signal System _____	Lump sum
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	02892005D	Traffic Signal System _____	Lump sum
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	**02892006D**	**Traffic Signal System _____**	**Lump sum**
Includes all materials and workmanship to provide a complete and fully operational signal system.			

#	**028920015**	**Signal Power Source**	**Each**
Includes meter base, safety switch, rigid steel conduit, wire, weatherhead and conduit standoffs.			

#	**028920020**	**Installation of State Furnished Material**	**Lump sum**

#	**028920025**	**Installation of State Furnished Mast Arm Mounted Sign**	**Each**

#	**028920030**	**Traffic Counting Loop Detector**	**Each**	**In place**

#	**02892040D**	**_____ PVC Conduit Schedule _____**	**Meter**	**In place**

Section 02896: Boundary Survey

#	**028960010**	**Boundary Survey and Survey Plat**	**Lump sum**

#	**028960020**	**Right-of-Way Markers**	**Each**	**In place**

Section 02911: Mulch

#	**029110010**	**Cellulose Fiber Mulch**	**Hectare**

#	**029110020**	**Straw Mulch**	**Hectare**
If the moisture content in straw mulch exceeds 18 percent, apply additional straw to compensate for the difference.			

Section 02912: Topsoil

#	**029120010**	**Contractor Furnished Topsoil**	**Square meter**	**In place**

#	**029120020**	**Contractor Furnished Topsoil**	**Megagram**

#	**029120030**	**Strip and Stockpile Topsoil**	**Cubic meter**	**In stockpile**

#	**029120040**	**Spread Stockpiled Topsoil**	**Square meter**	**In place**

Section 02922: Seed, Turf Seed, and Turf Sod

#	029220010	Drill Seed	Hectare	In place

#	029220020	Turf Seed	100 - Square Meter	In place

#	029220030	Broadcast Seed	Hectare	In place

#	029220040	Broadcast Seed	100 - Square Meter	In place

#	029220050	Broadcast Turf Seed	100 - Square Meter	In place

#	029220060	Turf Sod	Square Meter	In place

Section 02931: Pole Planting/Willow Cuttings

#	029310010	Pole Planting	Each	In place

#	029310020	Willow Plantings	Each	In place

Section 02932: Trees, Shrubs, and Groundcovers

#	029320010	Plant - Tubeling	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	029320030	Plant - No. 1 Container	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	029320050	Plant - No. 5 Container	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	02932006D	Plant - No _____ Container	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	029320070	Plant - 32 mm Caliper	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	02932008D	Plant - _____ mm Caliper	Each	In place
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	**029320090**	**Plant - 38 mm Caliper**	**Each**	**In place**
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	**029320110**	**Plant - 1.2 m**	**Each**	**In place**
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	**029320130**	**Plant 1.5 m**	**Each**	**In place**
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

#	**02932014D**	**Plant - _____ m**	**Each**	**In place**
Missing or unacceptable plant material at the final plant inspection will not be paid for.				

Section 02936: Vegetation Establishment Period

#	**029360010**	**Establishment Period**	**Lump Sum**

Section 02938: Tree Pruning

#	**029380010**	**Tree Pruning**	**Each**

Section 02961: Rotomilling

#	**029610010**	**Rotomilling**	**Square Meter**

#	**029610020**	**Rotomilling - 25 mm**	**Square Meter**

#	**029610025**	**Rotomilling - 40 mm**	**Square Meter**

#	**029610030**	**Rotomilling - 50 mm**	**Square Meter**

#	**029610040**	**Rotomilling - 75 mm**	**Square Meter**

#	**029610050**	**Rotomilling - 100 mm**	**Square Meter**

#	**029610060**	**Rotomilling - 125 mm**	**Square Meter**

#	**029610070**	**Rotomilling - 150 mm**	**Square Meter**

Section 02962: In-Place Cold Recycled Asphaltic Base

#	029620010	In-Place Cold Recycled Asphaltic Base	Square Meter	In place
Payment includes milling of existing pavement to required depth and width, mixing the millings with emulsified asphalt, quick lime and water, if required, relaying, and compacting.				

Section 02963: Profile Rotomilling

#	029630010	Profile Rotomilling	Square Meter	In place
Depth will be strictly followed according to plan profile. Engineer will check the depth according to the specification.				

Section 02966: Recycled Surface

#	029660010	Recycled Surface	Square Meter	In place
Of surface area covered.				

#	029660020	Rejuvinating Agent	Megagram

Section 02967: Surface Repaving

#	029670010	Surface Repaving	Square Meter
A. Do not measure 50 mm overlap. B. DEPARTMENT will pay the cost of furnishing and delivering Hot Mix Asphalt under its own bid item. Placing and compacting Hot Mix Asphalt is included in Surface Repaving.			

#	029670020	Rejuvinating Agent	Megagram

Section 03211: Reinforcing Steel and Welded Wire

#	032110010	Reinforcing Steel - Coated	Kilogram

Measurement: Per plan quantity.
1. Do not include the mass of the coating or the specified test bars as computed weight.
2. DEPARTMENT will not make allowances for extra reinforcing steel required to provide lap splices that are requested by the CONTRACTOR.
3. DEPARTMENT will not make allowances for clips, chairs, wire, or other materials used for fastening reinforcement in place.
4. When using soft metric bar sizes, DEPARTMENT will not allow adjustment in mass for the substitution.
5. Adjustments to plan quantity by the kilogram.

Payment: DEPARTMENT will not pay for costs incurred by substituting U. S. Customary reinforcing bars for the specified metric bars.

#	032110020	Reinforcing Steel	Kilogram

Measurement: Per plan quantity.
1. Do not include the mass of the coating or the specified test bars as computed weight.
2. DEPARTMENT will not make allowances for extra reinforcing steel required to provide lap splices that are requested by the CONTRACTOR.
3. DEPARTMENT will not make allowances for clips, chairs, wire, or other materials used for fastening reinforcement in place.
4. When using soft metric bar sizes, DEPARTMENT will not allow adjustment in mass for the substitution.
5. Adjustments to plan quantity by the kilogram.

Payment: DEPARTMENT will not pay for costs incurred by substituting U. S. Customary reinforcing bars for the specified metric bars.

Section 03310: Structural Concrete

#	033100010	Structural Concrete (Est. Qty _____M^3)	Lump

Measurement:

A. When the Contract provides a lump sum bid, the quantities shown on the plans are estimated quantities only, and are not to be used as exact quantities.

B. When the contract provides measurement per cubic meter, measure quantities by the dimensions shown.

C. Use the prismoidal formula when the method of average end areas is not sufficiently accurate.

D. Do not measure concrete required to fill over breakage of excavation for footings, walls, or slabs.

E. DEPARTMENT will not deduct for volume occupied by pipes (other than culverts), reinforcing steel, piles, metal grillage, anchors, conduits, or weep holes.

Payment

A. DEPARTMENT will pay for reinforcing steel for structures separately, unless otherwise noted.

B. DEPARTMENT will pay separately for concrete placed in individual structures containing less than 6.5 m^3 at the bid price per cubic meter for Concrete, Small Structure.

C. DEPARTMENT will make no separate payment for excavation for structures.

D. DEPARTMENT will adjust prices as follows when the Contract provides for concrete structures as a lump sum:

1. If the ENGINEER increases or decreases the quantity of concrete:
   - Unit price will be determined by dividing the contract lump sum price of that item by the estimated quantity of concrete as shown on the plans.
   - The contract lump sum price will be adjusted by an amount equal to the product of the change in quantity and computed unit price.
2. If the estimated quantity of concrete as shown is in error by more than 10 percent:
   - The contract lump sum price will be increased or decreased by an amount equal to the product of the unit price determined in accordance with the previous line of this paragraph and the difference between the corrected quantity and the estimated quantity.

E. Concrete Slope Protection: If preparation of the existing subgrade requires excavation or backfilling in excess of the 90 mm average depth beyond the slope at bid time, DEPARTMENT will pay per Section 01282.

Price Adjustments for Strength

A. When concrete is below specified strength:

1. DEPARTMENT may accept item at a reduced price
2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	033100020	Concrete - Small Structure	Cubic Meter

Measurement:

A. When the contract provides measurement per cubic meter, measure quantities by the dimensions shown.
B. Use the prismoidal formula when the method of average end areas is not sufficiently accurate.
C. Do not measure concrete required to fill over breakage of excavation for footings, walls, or slabs.
D. DEPARTMENT will not deduct for volume occupied by pipes (other than culverts), reinforcing steel, piles, metal grillage, anchors, conduits, or weep holes.

Payment:

A. DEPARTMENT will pay for reinforcing steel for structures separately, unless otherwise noted.
B. DEPARTMENT will pay separately for concrete placed in individual structures containing less than 6.5 m^3 at the bid price per cubic meter for Concrete, Small Structure.
C. DEPARTMENT will make no separate payment for excavation for structures.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. DEPARTMENT will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

#	033100030	Concrete Slope Protection	Square Meter

Payment

A. DEPARTMENT will pay for reinforcing steel for structures separately, unless otherwise noted.
B. DEPARTMENT will make no separate payment for excavation for structures.
C. Concrete Slope Protection: If preparation of the existing subgrade requires excavation or backfilling in excess of the 90 mm average depth beyond the slope at bid time, DEPARTMENT will pay per Section 01282.

Price Adjustments for Strength

A. When concrete is below specified strength:
   1. DEPARTMENT may accept item at a reduced price
   2. The pay factor will be applied to the portion of the item which is represented by the strength tests that fall below specified strength.
   3. Department will calculate the pay factor as follows:

kPa below specified strength:	Pay Factor:
1 - 700	0.98
701 - 1400	0.94
1401 - 2100	0.88
2101 - 2800	0.80
More than 2800	0.50 or engineer may reject

Section 03311: Joint Closure

#	**033110010**	**Joint Closure**	**Square Meter**

Section 03392: Penetrating Concrete Sealer

#	**033920010**	**Penetrating Concrete Sealer**	**Square Meter**	**Of surface covered**

Section 03412: Prestressed Concrete

#	**03412001D**	**Prestressed Concrete Member _____ m _____ mm Type _____ (Specialty Item)**	**Each**

DEPARTMENT will accept and pay as follows:

1. Girders may be accepted at a reduced price when the average compressive strength is at least 94 percent of the specified strength.
2. Price reduction factor is as follows:

$$\text{Price Reduction Factor} = 100 - 0.30 \left(\frac{f'c - AVG}{0.06 f'c} \right)^2$$

Where: $f'c$ = specified 28-day compressive strength in kPa.
AVG = average compressive strength of 3 cylinder breaks in kPa.

3. DEPARTMENT will calculate the amount paid by multiplying the contract unit price for the prestressed concrete member by the price reduction factor.

Section 03575: Flowable Fill

#	**035750010**	**Flowable Fill**	**Cubic Meter**	**In place**

Section 03605: Approach Slab Jacking

#	**036050010**	**Approach Slab Jacking**	**Cubic Meter**

Section 03921: Parapet Surface Repair and Sealing

#	**039210010**	**Parapet Surface Repair**	**Meter**

Additional compensation is not allowed for removing and repairing failed concrete patches.

#	**039210020**	**Parapet Sealing**	**Meter**

Section 03923: Column Sealing

#	039230010	Column Sealing	Each

Section 03924: Structural Concrete Repair

#	039240010	Column Repair	Each
#	039240020	Pedestal Repair	Each
#	039240030	Bent Cap Repair	Each
#	039240040	Pier Cap Repair	Each
#	039240050	Diaphram Repair	Each
#	039240060	Wingwall Repair	Each
#	039240070	Abutment Backwall Repair	Each
#	039240080	Beam End Repair	Each

Section 03932: Concrete Slope Protection Repair

#	039320010	Concrete Slope Protection Repair	Square Meter

Section 03933: Parapet Rehabilitation

#	039330010	Parapet Modification	Meter
#	039330020	Parapet End Modification	Each

Section 03934: Pothole Patching

#	039340010	Pothole Patching	Square Meter

Estimated plan quantities are based on preliminary field review for bidding purposes only.
Repair the actual quantities determined by the Engineer.
Pothole patching may be reduced, deleted, or increased over the bid quantities from the contract. If any of these situations occur, the price of the actual quantity will be paid for at the contract unit price.
Department will not allow additional compensation for repairing blow throughs, or for removing and repairing failed patches.

Section 05120: Structural Steel

#	051200010	Structural Steel (Est. Qty_____) (Specialty Item)	Lump Sum

A. The quantities of structural steel shown on the plans are estimated quantities. The DEPARTMENT will not consider variations from these quantities as cause for claims.
B. Adjustments:
   1. The DEPARTMENT will adjust price in an amount equal to the product of the change in quantity times unit price if increases or decreases in quantities result from design revision.
   2. The DEPARTMENT will determine the unit price by dividing the contract lump sum by the estimated quantity of structural steel shown on the plans.

#	051200020	Structural Steel	Kilogram

Section 05831: Expansion Joint Modification

#	058310010	Expansion Joint Modification	Meter

Section 05832: Expansion Joint

#	058320010	Expansion Joint	Meter

Measured from out-to-out of deck along the skew of the individual joints.

Section 07105: Waterproofing Membrane

#	071050010	Waterproofing Membrane	Square Meter

Section 07921: Sealing Existing Concrete Slope Protection Joints

#	079210010	Sealing Existing Concrete Slope Protection Joints	Meter

Section 07922: Relief Joint Crack Sealing

#	**079220010**	**Relief Joint Crack Sealing**	**Meter**

Section 09991: Cleaning and Repainting Structural Steel

#	**099910010**	**Cleaning and Repainting Structural Steel**	**Lump Sum**

Section 09992: Cleaning and Overcoating Structural Steel

#	**099920010**	**Cleaning and Overcoating Structural Steel**	**Lump sum**

Section 13552: Ramp Meter Signals and Signing

#	**135520010**	**Ramp Meter Signals and Signing System**	**Lump sum**
Includes all materials and workmanship to provide a complete and fully operational ramp metering system.			

Section 13553: ATMS Conduit

#	**135530010**	**ATMS Conduit**	**Meter**

Section 13554: Polymer Concrete Junction Box

#	**135540010**	**Polymer Concrete Junction Box**	**Each**	**Each**

Section 13555: ATMS Cabinet

#	**135550010**	**ATMS Cabinet**	**Each**	**Each**

Section 13556: Closed Circuit Television (CCTV) Assembly

#	**135560010**	**Closed Circuit Television (CCTV) Assembly System**	**Lump**	**Lump Sum**
Includes all materials and workmanship to provide a fully operational Closed Circuit Television (CCTV) Assembly System.				

Section 13557: Variable Message Sign

#	**135570010**	**Variable Message Sign System**	**Lump**	**Lump Sum**
Includes all materials and workmanship to provide a fully operational Variable Message Sign System.				

Section 13591: Traffic Monitoring Detector Loop

#	**135910010**	**Traffic Monitoring Detector Loop**	**Each**	**Each**

Section 13592: Roadway Weather Information

#	**135920010**	**Roadway Weather Information System**	**Lump**	**Lump Sum**
Includes all materials and workmanship to provide a fully operational Roadway Weather Information System.				

Section 13593: Weigh In Motion

#	**135930010**	**Weigh In Motion System**	**Lump**	**Lump Sum**
Includes all materials and workmanship to provide a fully operational Weigh In Motion System.				

Section 13594: Fiber Optic Communication

#	**135940010**	**Fiber Optic Communication System**	**Lump**	**Lump Sum**
Includes all materials and workmanship to provide a fully operational Fiber Optic Communication System.				

Section 16135: Electrical Junction Boxes

#	**161350010**	**Plastic Type I Junction Box**	**Each**	**In place**
#	**161350020**	**Plastic Type I Double Junction Box**	**Each**	**In place**
#	**161350030**	**Plastic Type II Junction Box**	**Each**	**In place**
#	**161350040**	**Plastic Type II Double Junction Box**	**Each**	**In place**
#	**161350050**	**Plastic Junction Box Extension Type I**	**Each**	**In place**
#	**161350060**	**Plastic Junction Box Extension Type II**	**Each**	**In place**
#	**161350070**	**Steel Junction Box**	**Each**	**In place**
#	**161350080**	**Maintenance Marker**	**Each**	**In place**

Section 16525: Highway Lighting

#	**16525001D**	**Highway Lighting System _____**	**Lump Sum**
Includes all materials and workmanship to provide a complete and fully operational highway lighting system.			

#	**16525002D**	**Highway Lighting System _____**	**Lump Sum**
Includes all materials and workmanship to provide a complete and fully operational highway lighting system.			

#	**16525003D**	**Highway Lighting System _____**	**Lump Sum**
Includes all materials and workmanship to provide a complete and fully operational highway lighting system.			

#	**16525004D**	**Highway Lighting System _____**	**Lump Sum**
Includes all materials and workmanship to provide a complete and fully operational highway lighting system.			

#	**165250015**	**Lighting Power Source**	**Each**

Section 16526: Electrical Work Bridges

#	**165260010**	**Electrical Work Bridges**	**Lump sum**