

2016 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is March 14, 2016. Submit statements to Tom Hales at tahales@utah.gov. ***

Title: UDOT Concrete Sustainability Calculator

No. (office use): 16.01.10

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UDOT Champion (suggested): Bryan Lee and Tom Hales

Select One Subject Area

Materials/Pavements

Maintenance

Traffic Mgmt/Safety

Preconstruction

Planning

Public Transportation

1. Describe the problem to be addressed.

Concrete is the world's - and Utah's - most consumed building material. Concrete contains a significant amount of embodied energy and produces considerable amounts of pollutants through the production of its constituents, primarily cement, aggregate and admixtures. Pollution is a significant factor in northern Utah contributing to our poor air quality.

This problem statement proposes the creation of a database and calculator to account for all of the embodied energy and emissions created by the concrete products used by UDOT. In the present, this will give concrete suppliers and UDOT knowledge about their mixtures. In the future, UDOT has the option of specifying certain levels of emissions. Hopefully, this will provide the impetus to find ways of maintaining durability and strength, while minimizing environmental impact. Future research can focus on other common UDOT materials such as asphalts, steels and entire structures as well as construction practices and maintenance.

2. Explain why this research is important.

This database and calculator can be used by UDOT officials to track UDOT's impact on the local environment. UDOT will be able to identify the emissions and energy consumed within the state and outside the state. This can be used internally or leveraged as part of a marketing campaign. In the future, UDOT will be able to set emission standards on concretes, and ideally all assets, to show the public that it is concerned with emissions.

3. List the research objective(s):

1. Create a database of all UDOT approved concrete material sources and their environmental impact (e.g., embodied energy, emissions) within Utah and nationally.
2. Develop a calculator to tabulate emissions and energy for all UDOT approved concrete mixtures for internal or public use.

4. List the major tasks:

1. Establish a standardized set of criteria for calculating various emissions (CO₂, PM_{2.5}, etc) and energy use for concrete constituents
2. Create a database of emissions for all current UDOT approved concrete material sources
3. Create an easy-to-use spreadsheet-based calculator for all concrete mixture.

5. List the expected results:

1. UDOT engineers will be able to track and set priorities regarding concrete material sustainability.

6. Describe how this research will be implemented.

At the conclusion of this project, the calculator can be used on all newly UDOT approved concrete mixtures. Using this information UDOT can track and/or control concrete sustainability.

**7. Requested from UDOT: \$37,000
(or UTA for Public Transportation)**

Other/Matching Funds: \$-

Total Cost: \$37,000

8. Outline the proposed schedule, including start and major event dates.

1. Literature Review (2 month) – Provide concise document to research committee outlining findings on common calculation and accounting methods common in the sustainability field. Agree upon acceptable standardized methodology with committee.

2. Database and Calculator Construction (8 months) – Contact material suppliers to determine standard operating procedures, identify shipping distances and methods, source material, etc. Special attention will be paid to Utah-specific metrics like PM2.5. Calculator will accept inputs similar to those submitted to UDOT by concrete suppliers for ease of use.

3. Report (2 months) – The final report will contain specific information on methodology, use of the calculator and how to update the database for future suppliers and materials. Recommendations will be made on future concrete mixtures for sustainable optimization and extending the results to other materials and UDOT assets in a consistent manner.