

Research Newsletter

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A MESSAGE FROM THE RESEARCH DIRECTOR

By: Cameron Kergaye, PhD, PMP, PE

We begin the new year with a new employee in the Research Division. Jason Richins returns from working in Washington, D.C. as AASHTO's Engineering Management Fellow. With his new experiences working with the US DOT, the National Academies and other transportation organizations, I look forward to his involvement in our research program.

We also begin the year with one of the largest gatherings of transportation and research professionals in the US – the Transportation Research Board annual meeting in Washington, D.C. This meeting will be attended by a number of UDOT engineers and other professionals, each of whom is responsible to bring back innovations to Utah. Last year's attendees from UDOT returned with over 30 innovations to implement, such as: advertising projects at a 3-D level, using rubber weed mats under cable barrier, engaging local governments in the Zero Fatalities goal, calibrating Lidar point cloud intensity and sign reflectivity, and bridge planning based on a risk-based decision support model.

Many TRB annual meeting presentations will again focus on SHRP2, which is a sequel to the first Strategic Highway Research Program. After several years in development, this national transportation research program is delivering beneficial products in terms of renewal, capacity, reliability and

safety improvements. In 2013, in the first round of the SHRP2 Implementation Assistance Program, UDOT was selected to receive a lead adopter incentive to implement the product known as L01/06 - Organizing for Reliability Tools. On January 17, 2014, the application process for the third round of SHRP2 implementation assistance will begin, with five new research products ready for implementation by transportation agencies.

TRB recently sent out the initial NCHRP ballots for selecting FY15 research. UDOT will help in ranking 100 new problem statements, seven of which were developed in cooperation with UDOT professionals and local university researchers.

Finally, UDOT's Research Division is planning to host a Research Workshop (UTRAC) this spring. This is where we discuss and rank solicited problem statements as we seek improvements to Utah's transportation system. More details on the workshop date and subject areas, along with problem statement forms, will be available at the end of January.



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Completed and Active Research Available at: www.udot.utah.gov/go/research

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Opportunities: TIG Focus Technologies and SHRP 2 Implementation Assistance

Nominations for AASHTO TIG Focus Technologies are due January 15

AASHTO is soliciting nominations for 2014 Technology Implementation Group (TIG) Focus Technologies. Nominations are due to the [TIG website](#) by January 15. UDOT staff should check with their Region Director or Group Leader before submitting nominations. Nomination instructions and information on recently selected Focus Technologies are available on the TIG website.

This is an opportunity for UDOT, along with other state DOTs and FHWA, to nominate our proven innovations for potential sharing and implementation in other states. The AASHTO TIG annually selects two to four Focus Technologies and one to three Additionally Selected Technologies from nomination submittals. They award selected nominees with national recognition and the resources to lead other agencies in adopting the innovations.



In the 2013 TIG cycle, two of UDOT's nominations were selected as [Lead States Team Focus Technologies](#): Traffic Signal Automated Performance Measures, and UPlan Part II.

Round Three of SHRP 2 Implementation Assistance Opens for Applications on January 17

Another exciting round of implementation is about to begin for the second Strategic Highway Research Program (SHRP 2). In the third round of the SHRP 2 Implementation Assistance Program, FHWA and AASHTO will provide various funding levels to selected state DOTs to implement the following five products or "solutions":

- Identifying and Managing Utility Conflicts (R15B)
- Pavement Renewal Solutions (R23)
- Precast Concrete Pavement (R05)
- Freight Demand Modeling and Data Improvement (C20)
- GeoTechTools (R02)

Applications for implementation assistance for these products will be accepted on the [FHWA SHRP 2 website](#) beginning on January 17 and ending on February 14. Information on the SHRP 2 products and implementation activities is also available on the FHWA SHRP 2 website. UDOT staff should check with their Region Director or Group Leader before submitting applications.

In the first round of the Implementation Assistance Program, UDOT was selected to receive a lead adopter incentive to implement the product known as L01/06 - Organizing for Reliability Tools, intended to improve travel-time reliability through innovative operations and management.

For more information, contact David Stevens of UDOT's Research Division at davidstevens@utah.gov.

Evaluating the Feasibility of Incorporating Mobility-based Work Zone Traffic Control Performance Measures in Highway Construction Project Specifications

Construction zones can greatly affect the traffic flow on roadways, especially when lane closures are required. Traditionally, UDOT has used traffic management specifications that only allow lane closures and road work to be done during predetermined hours or specifications that require a certain number of lanes to be open at all times. In recent years, implementing mobility-based performance specification has been a topic of interest for many state transportation agencies (STAs). However a National Cooperative Highway Research Program (NCHRP) domestic scan tour of best practices in work zone assessment, data collection, and performance evaluations found that no STA has implemented mobility-based performance specifications for highway construction projects due mainly to the difficulty in obtaining real-time performance data in work zone throughout the duration of the construction (1).

Mobility-based work-zone traffic flow maintenance requires continuous monitoring of mobility-based performance data and a mechanism to send alerts to the contractors when the mobility data does not meet the standards set by the specifications. UDOT recently tested mobility-based performance specifications at an urban arterial work zone and studied issues related to implementation of mobility-based performance specifications. Parallel to this experiment, UDOT funded a study to develop guidelines for implementing mobility-based performance specifications to manage traffic flow in work zones. Dynamically collecting mobility-based data such as travel time and speed is now feasible using technologies such as Bluetooth and microwave sensors.



The core benefit of using mobility-based performance specifications is that they can give the contractor more flexibility in construction work scheduling while maintaining an acceptable level of traffic flow. If the level of traffic flow is not maintained, then the contractor is assessed a financial penalty. The penalty is determined by the amount of time where the flow is not maintained at a predetermined condition. To dis-

cuss issues and develop guidelines, a task force consisting of UDOT representatives, several representatives from the construction industry, and researchers from Brigham Young University was formed as part of the study.

Some of the issues were difficult for the task force members to agree on, and a decision-making theory called the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) was used to assist the task force members to find best approaches to deal with some of the difficult issues associated with the implementation of mobility-based performance specifications in highway construction contracts. TOPSIS was developed in 1981 by Hwang and Yoon (2). It was proposed as a means to select the best alternatives with a finite set of criteria. The analysis structure of TOPSIS was best fit for the task of developing guidelines for some of the topics which were difficult to come to consensus with traditional task force meeting environment.

Through three task force meetings and use of the TOPSIS analysis, a set of twelve guidelines were eventually developed, including guidelines about where mobility-based performance specifications should be used and which mobility data should be used. Nine guidelines were determined based on the discussion in the task force meetings. Remaining three guidelines resulted from the TOPSIS analysis and subsequent discussions; they were related to risk management, penalty-tier calculations and incentives. These guidelines are the starting point for implementing mobility-based work zone traffic control specifications in highway construction specifications and at the same time they should be reviewed as appropriate in the future as UDOT accumulates experience in using these types of specifications.

For more information, contact Professor Mitsuru Saito of BYU at msaito@byu.edu; or Kevin Nichol in the UDOT Research Division at knichol@utah.gov. Click [here](#) and [here](#) for the related UDOT Research reports.

References

1. Bourne, J. S., Eng, C., Ullman, G. L., Gomez, D., Zimmerman, B., Scriba, T. A., Lipps, R., Markow, D. L., Matthew, K. C., Holstein, D. L., and Stargell, R. (2010). *NCHRP Best Practices In Work Zone Assessment, Data Collection, and Performance Evaluation Scan Team Report 08-04*. Transportation Research Board of the National Academies, Washington, D.C.
2. Hwang, C. and Yoon, K. (1981). *Multiple Attribute Decision-making Methods and Applications A State-of-the-Art Survey*. Berlin: Springer-Verlag

A Look at UDOT's Asset Opportunities

How can UDOT realize additional revenue and cost efficiency using its existing non-monetary assets? As UDOT looks for ways to improve services to the public using limited funding, this question has been discussed among Department leaders while respecting the value and hard work of UDOT staff.

In September 2013 UDOT contracted with the firm KPMG LLP (KPMG) to conduct a Phase I Asset Opportunities study with the following objectives:

- At a high level, identify and analyze revenue and cost efficiency opportunities with UDOT's non-monetary assets.
- Review and assess the opportunities for UDOT to leverage existing assets that may be undervalued or underutilized.
- Identify domestic and international leading practices for revenue and cost opportunities and evaluate these for enhancing UDOT's business practices.
- As a result of the study, UDOT would be more prepared to use key asset opportunities to raise new or incremental revenue and/or offset the costs of operating and maintaining the facilities and services currently provided by the Department.

Initially the KPMG team met with UDOT Central Group Leaders to identify a long list of relevant asset opportunities, along with some with which other states and municipalities have had success. Then an asset scan workshop was conducted using phone interviews with several UDOT Central Divisions and some Region personnel. In this step KPMG collected data about UDOT's current operations and policies to use in the study. We appreciate everyone's time and effort in providing KPMG with the requested information.

UDOT practices regarding non-monetary assets were compared with national and international leading practices for 22 assets from three major asset groups:

1. Alternative Revenue Sources. Two of the cost savings and revenue opportunities in this group are commercialization of non-interstate rest are-

as and sponsorship of Incident Management Team (IMT) vehicles.

2. Core DOT Operations. One example cost savings opportunity is highway operations and maintenance concessions, where a private company under a qualified management contract would operate and maintain part of the roadway network or a certain corridor.
3. Real Estate. An example cost savings and revenue opportunity in this group is allowing more cell towers to be placed on UDOT right-of-way or other real property.



While finding that UDOT is already successful in some asset opportunities, the KPMG team screened several opportunities and recommended that UDOT move forward with at least 11 priority assets that could potentially each meet a target revenue or cost savings threshold of \$500,000. Further study will be conducted in Phase II of the research once UDOT leaders have identified which asset opportunities would be most worthwhile pursuing.

A summary of the study results is available in the [Phase I final report](#) on the Research Division website. The report also includes several market examples of successful asset opportunity initiatives in other countries, states, and municipalities. For more information, contact David Stevens in the Research Division at davidstevens@utah.gov.

Hot Spot Identification and Analysis Methodology

To aid the UDOT Traffic & Safety Division in meeting their goal of advancing the safety of roadway sections throughout the state, the Department of Civil and Environmental Engineering at BYU has worked with the Statistics Department in developing analysis tools for safety. The most recent of these tools has been the development of a hierarchical Bayesian Poisson Mixture Model to analyze traffic safety on UDOT roadways statewide and to integrate the results in a GIS framework. The purpose of the tool is to identify safety hot spots across the state. To best meet the safety needs; however, there was a need to develop a framework for highway safety mitigation that would aid in selecting countermeasures and prioritizing safety needs at the hot spot locations.

This research sets out to enhance the framework for highway safety mitigation outlined in the Highway Safety Manual and developed for Utah in previous research conducted by BYU. The specific goal of this research was to enhance the framework by developing a methodology for accomplishing the steps of network screening, diagnosis, and countermeasure selection. This methodology is titled [“Hot Spot Identification and Analysis.”](#)

The hot spot identification and analysis methodology consists of the seven steps outlined in Figure 1. The methodology is to help in the identification of hot spots with safety concerns so that they can be analyzed and countermeasures can be identified to mitigate the safety issues.

The research was accomplished through a research process wherein data were collected on crashes across the state, hot spots were identified, and the hot spot identification and analysis methodology was applied. In addition, specific examples of how the methodology is to function were provided with specific examples from Utah’s state roadway network. By using the methodology, a systematic approach can be taken to identify safety issues on the roadway network and to se-

lect feasible countermeasures to mitigate the problem.

The next steps in this research are to develop a methodology on how to accomplish the final two steps of the framework for highway safety mitigation, specifically economic appraisal and project prioritization. In addition the hot spot identification and analysis methodology should continually be implemented on Utah’s roadway network.

For more information contact Professor Grant G. Schultz (gschultz@byu.edu) at BYU or W. Scott Jones of UDOT’s Traffic and Safety Division at wsjones@utah.gov.

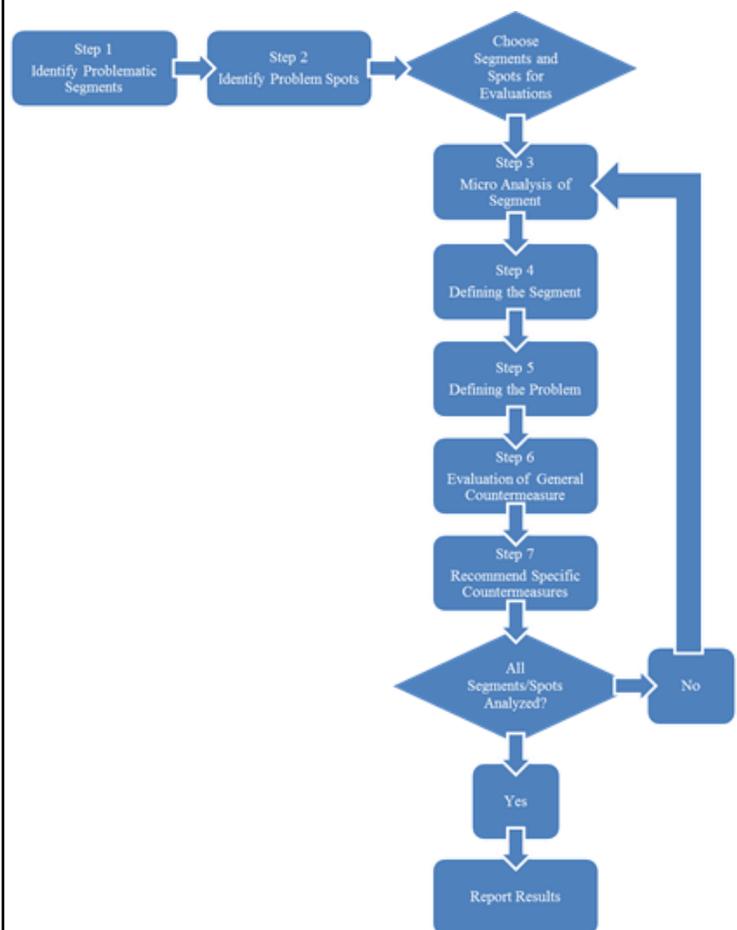


Figure 1: Hot spot identification and analysis methodology

Research Division Comings and Goings

Daniel Hsiao, P.E., formerly of UDOT's Research Division, retired in December 2013 after many years of service to the Department and to the citizens of Utah. He is most proud of his work in helping the Department implement the Accelerated Bridge Construction (ABC) technique that has become one of the flagship technologies representing UDOT's innovative engineering. During his retirement, Daniel plans to stay active professionally when he isn't either traveling or otherwise working "under the supervision of his lovely wife."

Steve Bagley, former Technical Writer for UDOT's Research Division has also moved on, having accepted a position outside of UDOT.

We appreciate the numerous contributions made by Daniel and Steve and wish them the best in their future pursuits.



Jason Richins, P.E. has joined UDOT's Research Division. Jason has been with UDOT for 12 years, most recently in the Structures Division, but just returned from Washington, DC, where he was an Engineering Management Fellow for AASHTO. In that position, Jason was the liaison for two SHRP 2 products and helped with the subcommittee meetings for Construction, Materials and Maintenance. Jason also assisted AASHTO in working with DOTs and other stakeholders to identify the impact of changes to Buy America through the MAP-21 bill and helped alleviate associated problems.

We're excited to welcome Jason to UDOT's Research team and know he will be a valuable asset to our customers and UDOT staff.



Calendar of Events

UDOT RESEARCH WORKSHOP 2014

As mentioned in the “Message From The Director,” UDOT’s Research Division is planning to host another Research Workshop (UTRAC) this spring. This is an opportunity to determine problems and solutions to Utah’s transportation system. More details on the workshop date and subject areas, along with a solicitation for problem statements, will be available at the end of January.

RESEARCH FUNDING OPPORTUNITIES (click to see the full document)

January 15, 2014 - Technology Implementation Group (TIG) Nominations DUE

February 14, 2014 - NCHRP Synthesis of Practice Topics DUE

March 1, 2014 - NCHRP Highway Innovations Deserving Exploratory Analysis (IDEA) Proposals DUE

March 2014 (TBA) - UDOT Research Problem Statements DUE

WEBINARS (click to see webinar details)

Title	Day/Date	Time	Location
Freight Demand Modeling & Data Improvement Strategic Plan (TRB SHRP 2)	Tuesday, January 21	12:00 PM – 1:30 PM	Personal computer or conference room
Reshaping Rural Highways for Livability (The Regional Scale) [NHI]	Tuesday, January 21	1:00 PM – 2:30 PM	
SHRP 2 Pavement Renewal Solutions (TRB SHRP 2)	Tuesday, February 4	12:00 PM – 1:30 PM	
Technical Considerations for Mobile LiDAR Use in Transportation Applications (TRB)	Wednesday, February 5	12:00 PM – 2:00 PM	
Accommodating Large Trucks & Oversize Loads at Roundabouts: Concerns & Some Solutions (TRB)	Friday, March 7	11:00 AM – 1:00 PM	
Leading from Any Chair in the Organization	On demand	On demand	
Temperament at Work: Understanding Yourself & Others	On demand	On demand	
Eat Well to Work Well	On demand	On demand	
The Power of Body Language	On demand	On demand	