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    This report discusses the proceedings and recommendations of the 2012 UDOT Research Peer Exchange. The 2012 UDOT Research Peer Exchange took place in October of 2012. Representatives from eight different state DOTs, as well as representatives from four federal agencies, gave presentations on the implementation of research in his or her organization. Participants also attended the UDOT Annual Conference where they presented a condensed version of their state or agency’s implementation of research and were able to see the inner workings of the Utah Department of Transportation. On day three, participants provided feedback for UDOT on how they could improve their research program. Participants then discussed leadership, how it fostered research implementation, and vice versa. Top suggestions for involving leadership were gathered from each participant at the end of the exchange. The participants were asked to focus on four areas: Implementation, Innovation, How Leadership Affects Research, and How Research Affects Leadership.

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ACRONYMS

AASHTO..........................American Association of State Highway and Traffic Officials
ACS.........................................................Adaptive Control Software
AMS........................................................Asset Management System
CMCG.............................Construction Machine Control Guidance
CUTC...........................................Council of University Transportation Centers
DOT..........................................................Department of Transportation
FAA.......................................................Federal Aviation Administration
FHWA....................................................Federal Highway Administration
GIS........................................................Geographic Information Systems
GPS........................................................Global Positioning System
IDOT..................................................Iowa Department of Transportation
IT............................................................Information Technology
ITD........................................................Idaho Transportation Department
LSF...................................................Living Snow Fences
LTAP.............................................Local Technical Assistance Program
LTPP..................................................Long Term Pavement Performance
MAP-21.......................................Moving Ahead for Progress in the 21st Century
MDT..................................................Montana Department of Transportation
MnDOT...........................................Minnesota Department of Transportation
MUTCD...........................................Manual on Uniform Traffic Control Devices
NHTSA.................................National Highway Traffic Safety Administration
NTSB...........................................National Transportation Safety Board
ODOT................................................Oklahoma Department of Transportation
OMS.....................................................Operations Management System
PMS........................................................Pavement Management System
RAC......................................................Research Advisory Council
RAP........................................................Reclaimed Asphalt Pavement
RD&T²..................................................Research, Development, and Technology Transfer
RITA........................................Research and Innovative Technology Administration
RRC........................................................Research Review Committee
SDDOT...........................................South Dakota Department of Transportation
SHRP 2...............................................Strategic Highway Research Program 2
SPR..................................................State Planning & Research
TRB........................................................Transportation Research Board
TRID...........................................Transportation Research International Documentation
UAV........................................................Unmanned Aerial Vehicle
UDOT................................................Utah Department of Transportation
EXECUTIVE SUMMARY

This report discusses the proceedings and recommendations of the 2012 UDOT Research Peer Exchange. The 2012 UDOT Research Peer Exchange took place from October 29th to November 1st, 2012. Representatives from eight different state DOTs, as well as representatives from four federal agencies, gave presentations on the implementation of research in his or her organization. Participants also attended the UDOT Annual Conference where they presented a condensed version of their state or agency’s implementation of research and were able to see the inner workings of the Utah Department of Transportation. On day three, participants provided feedback for UDOT on how they could improve their research program. Participants then discussed leadership, how it fostered research implementation, and vice versa. Top suggestions for involving leadership were gathered from each participant at the end of the exchange. The participants were asked to focus on four areas: Implementation, Innovation, How Leadership Affects Research, and How Research Affects Leadership.

Implementation can be occur in a variety of ways, from complete or partial implementation down to the suggestion that none of the research be adopted if it is not found to be useful to the DOT. Participants agreed that research projects need a champion for implementation to be successful and that person is vital to the projects implementation. Communication and support within the DOT was found to be the most important factor for innovation. Some of the best innovation comes from the work site and if there is not communication with workers some of the best ideas can be overlooked. In addition, some of the riskiest ideas can be overlooked if management does not have the support necessary to take those risks. For implementation to occur an informed champion must be given talking points to keep the research at the forefront of the decision-makers agenda.

Research affects leadership because it is necessary to have leaders who understand the research program and are capable of analyzing the program to identify and address shortcomings. The researcher is also in a position to offer objective suggestions that will improve a research program and make it easier for research to be conducted. In addition, leaders need their researchers to provide talking points, so that the research agenda may be easily explained to
individuals who do not necessarily have a research background or may otherwise not understand the research at hand. In most DOTs, leadership is the greatest influence of research. In order to achieve the desired goals, leaders must provide a clear and concise picture of their vision. They must also be open and accommodating to their researchers and enable them to conduct cutting edge research. Participants repeatedly stressed that communication of expectations, progress, and delivery was vital to the success of a research program. Throughout the process, management needs to stay apprised of the status of the research.
1.0 INTRODUCTION

Pursuant to 23 Code of Federal Regulations 420.209 (a)(7), as a condition for approval of FHWA planning and research funds for research activities, a State is required to conduct peer exchanges every five years as required by FHWA’s Office of Research Development & Technology Transfer (RD&T²). The objective of the peer exchange program is to give State transportation agencies a means to improve the quality and effectiveness of their research management processes. A peer exchange is a practical and effective tool to foster excellence in research, development, and technology transfer program management by providing an opportunity for panelists to share best practices and management innovations with each other. Outside managers are invited to meet with the host agency to discuss and review its RD&T² management process or provide ideas in a specific focus area. Information on the host agency’s policies and procedures is shared with panel members prior to the meeting. During the peer exchange, panel members may meet with managers, staff, stakeholders, and customers to gain further insight into the host agency's program. The information gathered from the exchange is documented in a written report and presented to agency management.

1.1 Peer Exchange Panel Members

The 2012 Research exchange was composed of ten panel members. There were seven DOT’s represented from five different FHWA regions (Regions 5, 6, 7, 8, and 10) and four federal agencies/programs were represented (SHRP 2, FHWA, TRB, and USDOT). Brief biographies of the participants are provided below.

Ron Curb (Oklahoma Department of Transportation)

Mr. Ron F. Curb has worked for the Oklahoma Department of Transportation for over 29 years. He has transportation experience in bridge design, traffic engineering and transportation planning & research. He has managed the Engineering Services Branch's Research and Traffic Data Analysis sections since 2006. In Oklahoma, he is a licensed Professional Engineer and Certified Public Manager.
Jerry DiMaggio (SHRP2)

Mr. Jerry DiMaggio is currently the Implementation Coordinator of the SHRP 2 program for TRB in Washington DC. He retired from FHWA in 2008 where he served as a Principal Bridge Engineer and National Program Manager for Foundation and Geotechnical Engineering. Jerry has worked on approximately 1000 projects in all 50 states, Central and South America and several Middle Eastern countries.

Stephen Maher (Transportation Research Board)

Mr. Maher is responsible for the leadership and management of design engineering technical standing committee and task force activities; development and conduct of the design engineering portion of the TRB Annual Meeting and other national and international conferences and workshops; worldwide response to design engineering inquiries; design related journal publications, electronic circulars and webinars; and a portion of the TRB Annual Field Visit/Research Correlation Services Program with state department of transportation and other sponsor agencies, universities and institutes.

Timothy McDowell (Wyoming Department of Transportation)

Mr. McDowell has been the administer the development and production of the Statewide Transportation Improvement Program for the State of Wyoming. He is responsible for administering the Research and Development program for WYDOT. He has been employed with the Wyoming Department of Transportation for 34 years with experience in construction and maintenance prior to present position.

John Moulden (Federal Highway Administration)

Mr. Moulden trained as a research psychologist with degrees from Johns Hopkins Univ. and Penn State Univ. Prior to FHWA, he was President of the National Commission Against Drunk Driving; Special Assistant to Chairman of the National Transportation Safety Board (NTSB), President, Transportation Safety Associates (consulting co.); and research psychologist at NHTSA (USDOT).
Linda Narigon (Iowa Department of Transportation)

Ms. Narigon is a Licensed Professional Engineer in Iowa and serves as Iowa DOT’s SPR Part II Administrator and Research Implementation Engineer. Linda is a member of TRB’s Hydrology, Hydraulics, and Water Quality Committee and a majority of her career has been in Water Resources and Floodplain Modeling. Linda joined Iowa DOT’s Research Office in 2011.

Daris Ormesher (South Dakota Department of Transportation)

Mr. Ormesher has worked in the Office of Research for the South Dakota Department of Transportation since 1989. Prior to that he worked as a Geotechnical Engineer for Woodward Clyde in Omaha, Nebraska. He has a bachelors degree in Geological Engineering. His area of expertise is geotechnical engineering but has worked on a variety of projects covering topics from pavement materials to organizational health.

Ned Parrish (Idaho Department of Transportation)

Mr. Parrish has worked as the Research Program Manager at Idaho Department of Transportation since 2007. His responsibilities include management of ITD’s Research Program, coordination of efforts to identify department research needs and priorities, and development and monitoring of research contracts. Mr. Parrish also serves as the Department’s representative on local, state, and national research committees.

Nicole Peterson (Minnesota Department of Transportation)

Ms. Peterson has been with the Minnesota Department of Transportation for 14 years. She has worked primarily in their Metro District in traffic, design and project management. She joined Research Services in their Central Office a year ago as the Research Management Engineer.

Sue Sillick (Montana Department of Transportation)

Ms. Sillick has been with the Montana Department of Transportation for over 18 years and is currently the Research Programs Manager at the Montana Department of Transportation. Her responsibilities include managing the research, development, and technology transfer programs of MDT. Prior to this position, Sue was a project manager in the research programs.
Kevin Womack (RITA)
Dr. Womack has been the Associate Administrator for Research, Development, and Technology, previously he was a Professor of Civil Engineering and Director of the Utah Transportation Center at Utah State University. Dr. Womack received his Bachelor of Science degree (1980) and Ph.D. degree (1989, civil engineering) from Oregon State University, with a Masters degree in civil engineering from the University of Pennsylvania (1985). He was elected a Fellow in the American Society of Civil Engineers in April of 2010. Dr. Womack is a registered professional engineer in the State of Oregon.

1.2 Other Peer Exchange Participants
Kevin Heaslip (Utah State University)
Dr. Heaslip is an Assistant Professor at Utah State University and the Associate Director of the Utah Transportation Center (UTC). His research areas include resiliency, alternative fuel sources, safety and automation. Dr. Heaslip served as a facilitator to the 2012 Research Peer Exchange.

Cameron Kergaye (Utah Department of Transportation)
Dr. Kergaye has been with UDOT for over twenty years and has worked in many different disciplines including design, construction and materials. He has also worked on I-15 reconstruction and in engineering services and project management. He began his position of Director of Research in the fall of 2010.

Kevin Nichol (Utah Department of Transportation)
Mr. Nichol is a Research Project Manager for UDOT. His previous experience has included planning, local government engineering, and stormwater management. He is also an advisory member of the UDOT Standards Committee.

Becky Winstead (Utah State University)
Ms. Winstead is the Utah State University TIMELab coordinator and Staff Assistant for Utah LTAP. Ms. Winstead served as a facilitator for the 2012 Research Peer Exchange.
Representatives from the states of Oklahoma, Wyoming, Iowa, South Dakota, Idaho, Minnesota, Montana, and Utah were present along with federal representatives from the Strategic Highway Research Program 2 (SHRP 2), the Transportation Research Board (TRB), the Federal Highway Administration (FHWA), and the Research and Innovation Technology Administration (RITA) from the United States Department of Transportation. The focus of the exchange was “Research Implementation and Leadership Engagement.”

On day one of the exchange, each participant gave a 20-minute presentation on how research was implemented in his or her organization and the role that leadership played in that implementation. On day two, participants attended the Utah Department of Transportation Annual Conference where they presented shortened versions of their presentations to transportation professionals from around the state of Utah. Participants were also invited to look around the conference so that they would have a greater understanding of how UDOT functions and become familiar with the research that is being done in Utah. On day three, participants engaged in a wrap up of the exchange. They addressed the following questions:

- “How does research support your leadership?”
- “How does your leadership support research?”
- “What are your top suggestions for involving your leadership?”

### 2.0 FOCUS

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<tr>
<th>Name</th>
<th>Affiliation</th>
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<tr>
<td>Ron Curb</td>
<td>Oklahoma Department of Transportation</td>
<td>Engineering Manager II - Research</td>
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<td>Jerry DiMaggio</td>
<td>SHRP2 Program/TRB</td>
<td>SHRP2 Implementation Engineer</td>
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<td>Kevin Heaslip*</td>
<td>Utah State University</td>
<td>Assistant Professor</td>
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<td>Cameron Kergeray</td>
<td>Utah Department of Transportation</td>
<td>Research Manager</td>
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<td>Stephen Maher</td>
<td>Transportation Research Board</td>
<td>Senior Program Officer</td>
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<td>Tim McDowell</td>
<td>Wyoming Department of Transportation</td>
<td>State Programming Engineer</td>
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<td>Becky Winstead*</td>
<td>Utah State University</td>
<td>Staff Assistant 3</td>
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<tr>
<td>Kevin Womack</td>
<td>USDOT/RITA</td>
<td>Associate Administrator for Research &amp; Development</td>
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* indicates facilitator

Table 1- 2012 UDOT Peer Exchange Attendees
3.0 PROCESS

The Utah Department of Transportation (UDOT) held a Research Peer Exchange on October 29-31, 2012 in Salt Lake City, Utah. To prepare for the exchange, the team received a package of information including the following:

- Travel information
- A tentative meeting agenda (Appendix A)
- A contact list of participants (Appendix B)

3.1 Presentations

As part of the exchange, participants were asked to give twenty minute presentations about their programs innovations and implementations. Following each presentation was a brief discussion of the research program. This allowed participants the ability to highlight innovations and implementations that have been successful within their respective organizations. This gave the panel members different perspectives on how to be successful in their research programs.

3.2 UDOT Annual Conference

On day 2, the participants were given the opportunity to present an abridged version of their presentations at the UDOT Annual Conference. This gave transportation professionals from different areas the ability to see what is being done nationwide in the area of transportation research. For the panel members, it gave them the ability to receive feedback from all levels of personnel that may be impacted by implementation of their research. This was a unique forum for communication between the research team and the field worker.

3.3 Deliverables & Debriefing

Day 3 allowed wrapped up the exchange by regrouping the panel to offer an observations and suggestions for the UDOT research team. They were asked a series of questions by the facilitators that provoked conversation about what was learned at the exchange and how the Peer Exchange process aided in furthering research innovation & implementation.
4.0 FINDINGS

4.1 Best Practices Observed From Presentations

The presentations of all participants in the 2012 UDOT Research Peer Exchange are summarized in the following section. They are listed alphabetically by the presenter’s last name. The complete presentations are in Appendix C.

4.1.1 “Integration of Implementable Research in Oklahoma” Ron Curb (Oklahoma DOT)

An overview of the implementation options in Oklahoma was presented followed by a discussion of focus topics for the implementation of research.

Implementation Options

- There are instances where change is not justified
- Feedback can be considered implementation
- New engineering guidelines were created
- Technology transfer can be considered implementation

The Long Term Pavement Performance (LTPP)

- Used in the development of useful software tools, manuals and guidance documents.
- Been in operation for over 25 years, millions of measurements on pavement

Implementable Research

- New product evaluation program
- Transportation pooled fund studies
- University Research - Collaboration with eight different universities
- AASHTO technology implementation group

Integration Focus Topics

- Road Pavement Profilometry (Timeline integration)
- Purchased equipment for profilometry and calibrated the equipment
- Followed FHWA incentive program and shared results
- Hosted a Webinar on the topic 10/23/12
- In the process of establishing a certification procedure

- Pavement Design (Collaborative)
  - Pavement design guide in need of updating/ overhaul
  - Built test track in 2000 and continue to test experimental pavement cycling

- Scour Stop (Independent)
  - A transition mat to replace hard armor
  - Placed in ditches and river banks to slow or stop erosion

- Quick New Product Implementation
  - MIT Scan T2 (Measures thickness without coring)
  - Pipe Underdrain Inspection Service (On Demand, DVD recording)

- Continuous Implementation
  - Herbicide research & roadside vegetation management

4.1.2 “Implementing SHRP 2 Products: Secrets to Success” Jerry DiMaggio (SHRP2)

SHRP2 is a special-purpose research program that follows a non-traditional approach to meet customer-oriented goals. Currently, 27 states participate in the program, which engages in 100+ research projects, produces 65+ useable products, and are partners for prioritizing implementation. SHRP2 focuses on four areas: safety, renewal, reliability, and capacity. An overview of their three year plan was provided and is summarized below.
Development of a Three-Year Plan

- Includes safety, product development, product implementation, marketing, IT support, and program management.
- Find target audience & barriers to implementation
- User support, training, marketing of the program
- Conducting implementation workshops & strategy sessions
- Implementation of an evaluation process

4.1.3 “TIME Lab Research: Assessment of Sign Retroreflectivity Compliance for Development of a Management Plan” Kevin Heaslip (USU)

The Transportation Infrastructure Management and Engineering Laboratory (TIME Lab) specializes in transportation operations, intelligent transportation systems, transportation maintenance & asset management, alternative fuels, and automation & electrification. The lab is part of the Utah Transportation Center which is a member of the Mountain Plains Consortium Regional UTC and has received $4.9M in funding since 2008. An overview of research on retroreflectivity was provided.

Retroreflectivity (MUTCD Minimum Standard)

- Collected data on sign type, sheeting type, orientation, etc.
- Utah has 91% compliance, Type I sheeting needs replacing (98% failure)
- Blanket replacement needed, inventory should be in OMS
- QR code for new and replacement installations that will provide sign information
- Nighttime visual inspection is effective (Engineering interns)
- USU is in the process of developing a mobile app to collect and archive sign data

4.1.4 “Assisting State DOTs Deploy Research” Stephen Maher (TRB)

Return on research investments only occur when research is put into practice. Researchers must direct how the product can best be put into practice but other agencies. However, the cost of implementation can be an additional $10M to implement
research, in addition to $10-14M previously funded to conduct the research. Practice ready papers are selected for the TRB Annual Meeting and are indexed in TRID, by March of each year. All papers on the Annual Meeting Compendium of Papers are indexed in TRID as well. A discussion on deployment and implementation strategies followed.

Deployment

- Practitioners need to be brought on board early in research
- Cost of deployment of a research can be as much as 10x the cost of research
- Marketing & Communications are imperative
- “Research Pays Off” in TRB circulations highlights research implementation
- Database of practice ready papers on TRB site that is easily searchable
- “You don’t have to do research to implement research”

Different Forms of Implementation

- Tech assistance
- Standards, specs, guides, and manuals
- Follow on research
- Training and education

4.1.5 “WyDOT Research Center” Tim McDowell (Wyoming DOT)

An overview of WyDOT Research was presented focusing on the business aspect of research. Research should be profitable and should consider uncertainties including: politics, price volatility, legalities, environmental factors, and right of way issues. These include:

- Reduction in design time
- Utilization of revenue projections in the “pipeline”
- Utilization of critical project draining approach
- Reduction in holding costs
- Effective utilization state funds
Evaluating the Department of Transportation Research Programs (A Study Conducted by the University of Wyoming)

- Objective: Evaluate methodology & make recommendations
- Push for outcome based research
- Evaluation done in 2007 resulted in 10 performance measures
  - Group projects by strategic intent and project category
  - 8 out of 10 performance measures were utilized
    1. Number of needs statements submitted
    2. Outcomes of the research projects
    3. Number of research reports completed each year
    4. Percentage of administrative costs to project funding
    5. Funds requested vs. funds available
    6. Percentage of projects completed on time and on budget
    7. Cost benefit analysis for projects and the research program
    8. Additional evaluations & analysis

WyDOT Research Program

- Funds $1M in research annually
- Research Advisory Council (RAC) meets four times per year
- Mission Statement: “To enhance the economic well-being and quality of life in Wyoming by working with public and private partners to produce a safe and efficient transportation system”
- 82% of funding is contracted research, 16% pooled fun studies, and 2% in-house
- Safety projects have the greatest funding (wildlife is it’s own category)
- 9/15 contracted research projects were solicited by WyDOT
- There are three outcome categories (knowledge, product & standards)
- Completion rate of 63/65 in 3 years. (All pooled studies went over time)
- They have decreased administrative costs from 18.6% to under 10%
- There is a post research performance evaluation to be completed
- Improving online access to research reports a priority
WyDOT Conclusions:

- Overall, quite effective and proactive
- 80% of projects from 2005-2010 were being implemented
- 100% of pooled fund and in-house projects were funded
- 85% of contracted research was funded
- 100% of contracted and pooled research projects were completed within budget (88% within timeline)
- Research projects averaged a 96% on performance evaluations in phase 1
- Research projects averaged a 83% on performance evaluations in phase 2
- For pooled fund projects, the RAC should receive a formal presentation before voting on budget/time extensions
- Performance evaluations should be implemented within WyDOT’s research program

4.1.6 “Every Day Counts Technology Initiative” John Moulden (FHWA)

The need for the Every Day Counts Technology Initiative this emphasized by an implementation time of 12 years for all 50 states to implement SuperPave technology. The mission of the initiative is “To identify and deploy readily available innovation and operational changes that will make a difference and to identify policy or operational changes required to advance system innovation in the longer term”. To accomplish this, there should be a continuous collaboration with all stakeholders. All accelerated deployment innovations were selected in collaboration with stakeholders.

Selection Criteria:

- Market ready and meets the needs of the user
- Compliments strategic goals
- High success potential and ability for widespread application
- Adequate deployment and technical support
- Can work with other technologies
- Measurable outcomes and opportunities to enhance further deployment efforts
• Meets legal/regulatory requirements
• Resource and support partners available
• There are 8 stakeholder technical panel members

**Warm Mix Asphalt**

• Allows a reduction in asphalt mixture production and placement temperatures
  - Better compaction
  - Less worker fatigue
  - Less fossil fuel consumption and reduction in CO₂
  - Longer paving season
  - Longer hauling distances
• Production temperatures reduced by 30-70°F

**Precast Bridge Elements**

• Prefabricated bridge elements and systems manufactured on-site or off-site, under controlled conditions, and brought to the job location ready to install
  - Minimizes traffic & community impact
  - Improves construction zone safety
  - Improves bridge designs constructability
  - Increases quality & lowers life-cycle costs

**Geosynthetic Reinforced Soil**

• Fast, cost-effective bridge support method using alternating layers of compacted fill and sheets of geotextile reinforcement to provide bridge support.
  - Eliminates approach slab or construction joint at the bridge-to-road interface
  - Reduced construction time (complete in 10 days)
  - 25-60 % less cost depending on standard of construction
  - Less dependent on weather conditions
  - Flexible design (easily modified for unforeseen site conditions)
  - Easier to maintain because of fewer parts
  - Built with common equipment and materials
Safety Edge

- Sloped pavement edge at a 30° angle
  - Allows drivers more controlled re-entry back onto the roadway after tire drop off
  - Reduces crashes due to edge drop-off and uncontrolled recovery
  - Minimal cost (less than 1% on 2-lane highway)
  - Consolidated edge and reduction in edge raveling
  - Increases durability

Adaptive Traffic Control Technology

- ACS measures traffic flow and adjusts signal timing to promote smooth flow of traffic along arterial streets
  - ACS improves travel time reliability
  - Reduces congestion and creates a smooth traffic flow
  - Increases long-term viability of traffic signal operations
  - Widely deployable using existing control equipment

Round-Two Initiatives:

- Reduce project delivery time and construction time
- Innovative contracting
- Safety
- Environment
- Mobility

New website will go live at TRB Annual Meeting January 2013

4.1.7 “Transportation Research Innovation & Implementation: Promising Research” Linda Narigon (Iowa DOT)

Iowa focused their research and innovation presentation on the safety of teen drivers in the State of Iowa. By having the youngest national driving age, Iowa has placed a great deal of
importance on keeping teens safe behind the wheel. Because of this, their research has gained national recognition and been implemented by American Family Insurance - Teen Safe Driver Program.

**Iowa’s Main Focus Areas**

- Safety, Winter maintenance, Structures, and Concrete pavements
- In addition, human factors and intelligent construction are growing areas

**Iowa’s Graduated Drivers License**

- Emerged from research in the 1990’s (implemented in 1999) and evaluated several times since
- More than a 50% decrease in moving convictions involving 16-year-old drivers from its implementation through 2004.
- 36% of 14-year-old drivers involved in crashes were alone despite restrictions
- Use of video in teen driving – age vs. experience
  - 50% of participants received no feedback
  - 50% received a video of their driving that was watched with their parents
  - “Unsafe events” triggered recording of a 20 second clip (Sudden breaking, acceleration or swerving) -8 seconds before and 4 seconds after trigger event
  - Parents received a weekly report card that described data in a narrative form
  - Crashes increase 10-fold when the teen begins driving alone and then decreases at a moderate rate over several years
  - More young passengers lead to more crashes
  - Most serious crashes occur before midnight
  - User acceptance is critical for success
- Three groups monitored (90 participants total)
  - 14.5-15.5 year olds
  - 16 year olds who never held a school license
  - 16 year olds who have had a school license for at least 4 months
- Timeline
  - 4 weeks of no feedback (Baseline pre-intervention)
- 16 weeks of feedback
- 4 weeks of no feedback (Baseline post-intervention)

- Conclusions
  - Dramatic change in driver behavior was noted with the feedback
  - Age made no significant difference in the number of events
  - A distraction was present for 23% of events

Go-Team Project
- Evaluation of the context and detail of fatal teen crashes
- The “Go-Team” was assembled with experts in driver behavior, Iowa crash data, traffic engineering, and logistics
- Purpose of the Go-Team was to examine crashes as quickly as possible and gather as much information as possible to examine causation.
- Collision had to involve at least one driver under the age of 19
- 88 Fatal crashes
- Resulted in legislative changes that yielded a significant decrease in fatalities

4.1.8 “Successful UDOT Research Projects” Kevin Nichol (Utah DOT)

UDOT gave an overview of projects that have been successful for UDOT’s research program. The purpose was to give participants the ability to see Utah’s research accomplishments.

- UAV Technology
  - Goal: Improve high-resolution imagery along highway corridors
  - Hand launched/autonomous
  - Low cost, but requires FAA approval

- Native Fish Passage
  - Goal: Improve upstream passage through culverts of non-salmonid native fishes in an economical fashion
• In lab testing discovered that small fish do best with a natural substrate that scales to size of fish and field tests corroborated lab results

Construction Machine Control Guidance
• Goal: Develop procedures to use CMC
• Developed guidelines
• Refined implementation
• Recommend inspector training
• Outlined survey control needs

Wildlife Crossing Structures
• Goals: Identify ideal culverts for wildlife
• Found ideal size and shape to encourage use of culverts

Benefits of Research
• 46 deliverables
• $4.81M spent, estimated $80.8M cost benefit (17:1)
• Highest cost benefit was on large projects & safety

4.1.9 “SDDOT Research Implementation Process” Daris Ormesher (South Dakota DOT)

The focus of the South Dakota presentation was an overview of the research process from inception to implementation. It showed the checks and balances practiced by South Dakota and how the different roles influenced research innovation and implementation.

Research Roles
• Research review board
  - Secretary of Transportation, SDDOT Region and Division Directors, Federal Highway Administration Representative, County Representatives, and the South Dakota Board of Regents
Roles within the Process
- Office of Research (manage & perform research)
- Technical Panels (monitor & evaluate research)
- Universities & Consultants (suggest & perform research)

Research Process
- Conception, Definition, Execution, Implementation, Tracking, and Evaluation

Everything is reported back to the research review board during the research process.

Implementation Process
- Plan approval
- Research summary, objectives & outcomes and products defined
- Target audience is identified
- Implementation approach is outlined
- Implementation roles & responsibilities are defined
- A schedule is set
- Resources are listed with an estimated cost and the source of funding
- The tasks are monitored by their progress & percent completion
- Impact areas are evaluated

4.1.10 “Study of ITD’s Maintenance and Pavement Management Needs” Ned Parrish (Idaho Transportation Dept.)

Idaho’s research program recently funded a review if IDT’s Maintenance and Pavement Management systems. The process of evaluating the old system, reporting the findings and implementing the new system was documented in this presentation.

- Project was funded in 2007 with a budget of $75,000
- Interviewed 40+ staff about management practices
- Researched best practices from other states
• Maintenance management is top priority.
  - Should be accessible to all staff
  - Linkage to PMS, AMS & GIS
  - Easy of use a priority
  - Maintenance management costs: $2.7M one time cost and $300,000 annual maintenance

Current Pavement Management System

• Meets some needs but system lacks tools and accessibility
• District 6 pilot projects helps, but not for statewide use
• Pavement management costs: $950,000 one time cost, $50,000 annual license
• Research addressed the lack of maintenance management system decommissioned in 2005
• Limits of current pavement management system
• Research had high level champions and was supported by staff
• Competitive bid process made for high quality contractors for research and development
• Research provided the information needed to overhaul the current system
  - Limitations of current system
  - Best practices from other states
  - Agency needs
  - Cost estimate

• Documentation of audit recommendations
  - Research results were presented to the Idaho Transportation Board
  - DMV fees increased to cover the cost
  - Executive order to implement the system
  - Implementation took about two years, completed under budget
  - Personnel structure was integral to the success of the project
  - Communication with users in each district to understand user needs
  - “Super user” assigned to each district
  - Continuing research for improvement of systems
4.1.11 “Stewards of Transformative Change: How Minnesota Facilitates Progressive Research and Implements Innovative Ideas” Nicole Peterson (Minnesota DOT)

The focus area of this presentation was successful research and implementation of Minnesota’s research program. This not only focused on specific projects that were completely successful, but also projects that encountered difficulties along the way and how they were overcome.

MnDOT Overview

- State highway maintenance
- Operations, design and construction
- Multimodal system support and development
- Financial aid for local roads
- Funding $10.8M per year
  - 30% State research program
  - 27% Local roads research board
  - 29% FHWA
  - 3% Cooperative program for transportation research & studies
  - 10% Other

Largest amount is spent on administration followed by materials & construction then traffic & safety

Research Management

- Identify and track needs, Develop & fund projects, Execution, and Implementation

Evaluating the Cost & Benefits of Living Snow Fences (LSF)

- Average of 8 fatalities/ year because of hazardous road conditions
- 40% of hazardous locations contracted would save $1.3M/year
- MnDOT pays farmers to leave a standing row of corn as a snow fence
- LSF improves road conditions and lowers maintenance costs
MnDOT experienced difficulties contracting farmers
MnDOT determined that the payment was not sufficient
MnDOT contracted for a LSF calculator that located the most problematic sites and optimized the payments
Solutions for the LSF project
  - Payment- more flexibility in payment and a better valuation of the land, maintenance, and inconvenience of the LSF
  - Prioritization- Target high incidence landowners with a bonus incentive
  - Promotion- Educational materials to farmers, door to door visits, incentives and training
Next actions
  - Modifications based on recommendations
  - Snowplows equipped with GPS to show where LSF are needed
  - Research best plant species for LSF

Impacts of Playground Warning Signs on Vehicle Speed
Residents request the signs for local playgrounds
Agencies want to install minimum number of signs
The objective was to evaluate the efficacy of the signs on vehicle speed
Findings of the Playground warning sign research
  - Signs did not affect average vehicle speed
  - Vehicle speed correlated to playground traffic & activity
Resulted in a handbook outlining preferred sign placement for engineers
Gave government officials the knowledge to address citizen requests

Standard Sumps and the SAFL Baffle as Economical Solutions for Stormwater Treatment
Goals:
  - Minimize the sediment and effects of storm water run-off and comply with state and federal environmental regulations
  - Evaluation of current sumps and sumps with a SAFL baffle to increase sediment retaining efficacy
What was learned:
- The baffle was effective in increasing sediment capture and minimizing washout
- Shallow sumps still had a high washout rate, but increasing the diameter can mitigate it
- Resulted in 50+ SAFL Baffle installations.
- Average equipped sump reduced sediment removal to \(\frac{1}{4}\) its previous cost
- Licensed the SAFL Baffle to Upstream Technologies
- Barr Engineering has developed software for sizing manholes and SAFL Baffles
- Shows the benefits of collaborations for optimizing commercialization

4.1.12 “Implementation of Research Results at MDT” Sue Sillick (Montana DOT)

Management involvement and support, an enthusiastic champion, personnel involvement, coordination and collaboration, implementation consideration, product development, and the tools and funding required for implementation are the things necessary for any project to be successfully implemented within a research program. The projects overviewed in this presentation had all of these characteristics.

Overview of MDT Research
- Federal funding of $2.3M in 2013
- $1.2M in earmarked funding & $786,000 in pooled funding studies
- Research is directed by MDT executive management
- Focuses on the customer and funds applied and implementable research
- Continuous process & program improvement

Research Projects Program
- Solves problems, objective reporting, improves efficacy and efficiency
- Research review committee (RRC)
  - Determines priority
  - Approves funding
  - Reviews progress and implementation recommendations
• Technical panel
  - One assigned to each research project
  - Oversees the project from inception to implementation
  - Determines research needs & products necessary for implementation
  - Develops scope
  - Determines research venue
  - Reviews projects & makes implementation recommendations

• Implementation
  - Always deliberated throughout the project
  - Management involvement
  - Need a champion
  - Always consider implementation in every stage of the project
  - Eliminate barriers
  - Provide the tools and funding necessary for implementation

Montana Rest Area Design
• Usage evaluated (water & effluent flow, pedestrian & vehicle traffic)
• 10 Guidelines developed
• Overhauled 6 rest areas to make them more efficient
• Designed one new rest area using guidelines
• Reasons for success
  - Management involvement
  - Coordination and collaboration
  - Implementation considered from the beginning
  - Developed products for implementation
  - Tools and funding provided for implementation

Portable Concrete Barriers
• Problem identified by construction crews, chief engineer requested the research
• Combined inventory with research for improvements
Ride Specification Review

- Compare MDT with state of the practice
- Developed the test method, manual, ride specifications, implementation activities, and a final report
- Changed ride specifications and pay adjustments
- Trained personnel

Temporary Erosion and Sediment Control

- State of the practice, user survey and organizational structure review
- Completed two manuals, fact sheets and detail drawings
- Implemented a training program
- Generated two reports
- Conducted a two year implementation review
  - Added staff and a rate schedule committee
  - Revised the construction manual
  - Continued use of training

Experimental Projects Program

- In house research
- Annual meeting
  - Discusses design, construction, maintenance
  - Communicates information on experimental projects
  - Gives feedback
- Performance measures
  - Number of topic statements, Number of projects, Expenditures by subject area
  - On time, budget, scope
  - Cost sharing and partnerships
  - Overhead costs
  - Exit surveys
  - Number of publications
  - Implementation
4.1.13 Kevin Womack (RITA)

Dr. Womack focused his discussion on the need for research to be marketed and communicated effectively. Without effective communication of the research payoffs there is a concern that the agencies in control of funding will make budget cuts that will negatively impact research innovation and implementation. Documentation of research benefits is imperative to its survival.

- RITA coordinates modes.
- Questions are brought to RITA in regards to research.
  - “What’s the value on research?”
  - “What’s the return on investment?”
  - Gave typical answers “Hard to gauge”
  - Need to be concerned that this question keeps getting asked
- Research is a first cut in budgets (MAP21 is helpful)
- Had staff put together a briefing book for Washington of 150 success stories
- Implementation and value of research at RAC meeting
- Without implementation, value cannot be calculated
- Research HUB (Database of all federally funded research projects, outcomes & implementation)
- SHRP2 has an implementation component to the program.
- Researcher should work with DOT to implement the research and document it’s benefits.
- Have higher expectations of researchers to help to implement.
- If not implemented, have an explanation (no funding etc.)
- Funding is at risk if there is no measurable value
- UTC’s are filling out forms for DOT (Implementation forms)
4.2 Impressions of UDOT and Evaluation of the Exchange

4.2.1 Question: “What are your suggestions for UDOT's research, annual conference or anything other aspects?”

The main suggestion by participants for the UDOT annual conference was to label conference sessions in such a way that attendees are interested in the product (highlight research topics not research itself). A good way to market research to the people that need to see it is to make sure that the conference is putting forward their research in a way that allows people to see the value. Having a research member involved in the planning will allow them to give a venue to show these advantages as opposed to being a footnote at the conference.

Additionally there were suggestions for the UDOT website. The website should be broadened so that it is easily understood that UDOT is not the only entity conducting research. Highlighting the contracted agencies carrying out the research will allow a greater understanding of how research is conducted for UDOT. Additionally, new research innovations should be highlighted on the front page of the website so that the payoff of the research investment is seen immediately.

Other suggestions included that innovation needs to be trained. It is often thought that it will happen automatically and that is not a realistic way of thinking. There are ways to encourage innovative behaviors. One such way is to have an award offered yearly for innovative thinking and leadership. This is not something that has to be limited to UDOT employees, but should extend to private companies and universities.

Having the correct people involved can make a large difference. If you have people involved that are a part of the selection process, it can help to prioritize your research. Also, utilizing various committees such as RAC or AASHTO will allow you to promote your projects to people who have an interest in the area.
Another aspect to be considered is what kind of need there is for the research. Targeting a national audience lends itself to a greater likelihood of funding. If you focus on regional needs, you significantly narrow your audience.

It has been suggested that the term marketing is not appropriate for what researcher need to do to champion their work. Jerry DiMaggio (SHRP 2) suggested that “Outreach and Communication” might be a better route to take. This allows researchers to change their tone from one of boasting, to more of an informative perspective. This can be done in a newsletter or on the website. The newsletter should be targeted to audiences that would be interested so that there is not an overload of information. Targeting will allow the information to reach the people necessary and make it more likely that the research will get a champion.

To gain recognition, there were several suggestions for UDOT. One was to brand their research. One way to do this is to make sure that all presentations are given in the same format. Also, plan to have someone to market and obtain “visuels” of research being done. Having various photo or video shoots throughout the project will ensure that people are able to see and grasp the work that is being done.

The last suggestion for UDOT was that they have greater communication between their engineers and learn how to communicate what is being done as well as communicate what needs to be done. It is imperative to be able to relate the needs of the engineers and workers to the consumer. That will also include the ability to equip management with several talking points that they can easily remember and use in unexpected circumstances. It is helpful to be able to successfully champion a project when you run into someone in an unexpected place.

There was also praise from the 2012 Exchange participants in regards to UDOT’s research program.

- “UDOT does have a culture of innovation and sees itself as a leader in moving transportation forward” –Ned Parrish (ITD)
- “UDOT has a reputation for innovation nationally.” –Jerry DiMaggio (SHRP 2)
• “This is purely a function of who is leading UDOT right now” – Kevin Womack (RITA)
   (In regards to John Njord and Carlos Braceras)

4.2.2 Question: “How does research support your leadership?”

The overwhelming theme when participants were presented with this question was communication. There were examples of visiting the regions to understand their needs and even talking to the workers on site, offering them an environment where they would feel comfortable giving voice to their ideas. There was also the implementation of a research review board. Many DOT’s met with their boards on a quarterly, monthly or as needed basis. Ormesher (SD DOT) referred to the Research Review Board as “Problem-Solvers”. They are called in whenever a problem in encountered, whether it is project related, personnel, or even upper management related.

Another form of communication that was offered was the publication of a newsletter. This is something that conveys what is being done in research. It was recommended to do targeted circulation so that the subscribers don’t begin to ignore the emails. Maher mentioned that in Virginia, they go as far as to have the governor issue a press release about the research being conducted.

Awards were also given in two different states honoring research innovation, giving recognition and inspiring people to come to the research division with innovative ideas. These were given annually and to entities not necessarily within the DOT. In Wyoming, their LTAP has the “Show Me” award, presented to anyone who finds a better way of doing something.

Another underlying current, was to offer assistance whenever possible. Reducing red tape to allow a project to move forward is essential. Also making sure that you say yes as often as possible. With this it may need to be altered to a “Yes. But...” but offering a yes is appreciated by the people you work with. It allows them to see you as someone who is enabling their success instead of putting up barriers.
4.2.3 Question: “What would be the one thing from senior leadership that you would like to see?”

Senior leadership can provide strategic direction to the DOT research department in order to match research goals with the goals of the greater organization. Nearly every DOT representative in the room echoed this sentiment. Also, they need support to take chances in their research. There was the feeling of an inability to take risks and therefore “play it safe”, leading to less innovation.

It was also mentioned that there seemed to be a lack of regional champions. Because of this, there are regional needs that are not being addressed by the DOT. Perhaps the staff presenting an urgency of the research needed and its payoff upon completion could also help.

4.2.4 Question: “How does research support your leadership?”

When it comes to research supporting leadership, research funding is a large contributor. DiMaggio (SHRP 2) pointed out that UDOT has not participated in the SHRP 2 implementation program. Parrish mentioned that he has been struggling with getting information about the SHRP 2 program. At this time, Sillick (MDT) mentioned that in her attempts to get research funding from SHRP 2, she has been denied because of the geographical size of Montana. Narigon mentioned the turnover of RAC members and thought this might be a reason for the problems with information dissemination. Concluding remarks showed that there need to be more efforts in linking leadership of the DOT to the research programs.

4.2.5 Question: “What type of relationships do you have with your UTC’s?”

This discussion came about in regards to research funding. In addition to SHRP 2, the UTC program is a good opportunity for research funding for state DOTs. There seems to be a good working relationship between the DOT’s and their respective UTC’s. As the program has developed after the most recent round of awards, the disagreements have been able to be worked out and they are working well for the DOT’s. The one complaint across the board in working
with a UTC has been the writing of final reports. The way the university system is set up, there is no credit given to a university researcher for a report at the end of a research study. As a result of this, the reports being turned in are subpar and often need to be rewritten. The University system is unlikely to change its requirements, and so the task falls to the DOT to get an acceptable report. McDowell (WyDOT) suggested that the report should be written into the budget from the beginning. Narigon (IDOT) stated that they put a technical writer into the budget of every project to teach technical writing skills. She also suggested that perhaps a few states could pool funds to hire on a fulltime technical writer.

Writing seems to be the largest problem when working with universities. There is no incentive from the university who is ultimately responsible for the researchers employment. It seems that many university researchers are delegating writing to graduate students who have English as a second language. Native English speakers, however, seem to write just as poorly. It is a problem that will need to be continually addressed.

4.2.6 Question: “What are your top suggestions for involving your leadership”

The most recommended topic seemed again to fall on communication. Communication was broken down into subcategories such as researcher engagement, getting to know all new management in a timely fashion, and monthly meetings between researchers, project managers, and the review boards. It was suggested that serving on a national board (NCHRP, FHWA) would help with the communication between the DOT and funding agencies.

Documentation is also vital to the success of leadership. Being able to have a successful report that others can emulate can be very beneficial. Maher (TRB) also suggested the publishing of an annual accountability report that will show the benefits of the research being conducted. This stresses the importance of being able to market what your successes in research are and how they have benefitted the consumer.
APPENDIX A: MEETING AGENDA

Research Implementation & Leadership Engagement
2012 UDOT Research Peer Exchange

Sunday, Oct. 28
(Arrival to Salt Lake City/Little America Hotel)
6:00 - 9:00 PM Group Dinner at Stoneground Restaurant (Optional)
   ~249 East 400 South, 2nd Floor

Monday, Oct. 29
(Little America Hotel - Uintah Room)
7:00 - 8:00 AM Breakfast Provided in the Uintah Conference Room
8:00 - 8:30 AM Welcome & Introductions - Cameron Kergaye
8:30 - 9:00 AM Overview of the Peer Exchange - Cameron Kergaye
9:00 - 10:00 AM Presentations ~ 30 Minutes/Participant
   ~ Examples of DOT research that have led to implementation
10:00 - 10:15 AM Break
10:15 - 11:45 PM Presentations ~ 30 Minutes/Participant
11:45 - 1:00 PM Lunch at the Grand America Hotel
1:00 - 3:00 PM Presentations ~ 30 Minutes/Participant
   ~ Examples of DOT research that have led to implementation
3:00 - 3:15 PM Break
3:15 - 5:00 PM Discuss Criteria for Selecting Implementable Research
   ~ What are the indicators of implementable research?
   ~ How do you measure implementation or adoption?
   ~ How is implementation encouraged or proscribed?
6:00 - 9:00 PM Dinner at Rodizio Grill
   ~ Trolley Square, 600 South 700 East, 2nd Floor
Tuesday, Oct. 30
(UDOT Annual Conference, South Towne Expo Center, Sandy, UT)

7:00 – 7:30 AM  Shuttle to Conference Center
7:30 – 8:00 AM  Breakfast Provided at the Conference Center
8:00 – 12:00 PM Peer Exchange Presentations – 10 Minutes/Participant
   ~8:00 - 9:30 Moulden, Maher & DiMaggio (35)
   ~10:00 - 10:50 Sillick, Parrish, Narigon, & Curb (44)
   ~11:00 - 11:50 Ormesher, McDowell, Taylor, & Nichols (53)
12:00 – 1:00 PM  Lunch Provided at the Conference
1:00 – 5:00 PM  Breakout Sessions (See Information Provided)
   ~Participants may attend up to three sessions.
5:30 – 7:30 PM  Dinner Banquet at Conference
7:30 – 8:00 PM  Shuttle Returns to Hotel

Wednesday, Oct. 31
(Little America Hotel – Uintah Room)

7:30 – 8:30 AM  Breakfast Provided in the Uintah Conference Room
8:30 – 9:00 AM  Discussion & Impressions of the UDOT Annual Conference
9:00 – 10:30 AM Engaging Your Leadership in Research
   ~How does research support your leadership?
   ~How does your leadership support research?
   ~Top suggestions for involving your leadership.
10:30 – 10:45 AM Break
10:45 – 12:00 PM Lessons Learned from the Peer Exchange
12:00 – 12:30 PM  Summary Remarks
12:30 – 1:30 PM  Boxed Lunch Provided
1:30 – 4:30 PM  Tour of UDOT’s CFI, DDI & TOC (Optional)
7:00 – 10:00 PM Utah Jazz vs. Dallas Mavericks Basketball Game (Optional)
# APPENDIX B: CONTACT LIST OF PARTICIPANTS

## 2012 UDOT Research Peer Exchange Attendees

<table>
<thead>
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APPENDIX C: PRESENTATIONS
IMPLEMENTATION

- Implementation should be the primary consideration throughout all stages and from all sources of transportation research and development.
OVERVIEW

- OPTIONS FOR IMPLEMENTATION
- BACKGROUND OF LTPP DATA
- SOURCES OF IMPLEMENTABLE RESEARCH
- INTEGRATION FOCUS TOPICS
- IMPLEMENTATION EXAMPLES
- SUMMARY

OPTIONS FOR IMPLEMENTATION

- no justification for change
- feedback for continuing research
- data for collaborative research
- new or revised test method
- equipment calibration procedure and subsequent QMS
- parameter testing for QA/QC
- construction control directive
- engineering design directive or guidance
- new / revised specification / standard drawing
- special provision / construction plan note
- technology transfer for equipment / material / software
- procedures training per organizational level
LTPP DATA

- Long Term Pavement Performance Program
- began operations in 1987 under the 5-year SHRP administered by the NRC of the NAS
- ProVal software
- Datasets aid in MEPDG inputs
- FWD Maintenance Manual

http://www.fhwa.dot.gov/publications/publicroads/10septoct/03.cfm

SOURCES OF IMPLEMENTABLE RESEARCH

- Evaluation of New Technologies
- Transportation Pooled Fund Studies
- University Transportation Research Contracts
- Products from AASHTO’s Technology Implementation Group
Evaluation of New Technologies

- Profilographs and Inertial Profilers
- Scour-Stop Product
- MIT Scan T2 Equipment
- Pipe Under-drain Inspection Equipment

Transportation Pooled Fund Studies

- Inertial Profiler Baseline
- Characteristics of Drainage Layers for MEPDG
- NCAT Asphalt Pavement Test Track
University Transportation Research Contracts

- Local Calibration Data MEPDG ~ Flexible & Rigid Pavements
- ODOT FFY 2012 SP&R Item Number 2235 "Distress Modeling for DARWin-ME"
- University of Oklahoma on the I-35 instrumentation research project.
- NCAT Instrumentation on I-35
- Herbicide Research Program & Roadside Vegetation Management
Products From AASHTO’s Technology Implementation Group

- AASHTOWare FOR MEPDG
- DARWin ME
- Initial JCP models from LTPP Data

INTEGRATION FOCUS TOPICS

- Road Pavement Profilometry (TIMELINE)
- Pavement Design (COLLABORATIVE)
- Erosion Mitigation (INDEPENDENT)
Road Pavement Profilometry (TIMELINE INTEGRATION)

- Early history of road smoothness testing and equipment
- Local profilograph and profiler cart purchase
- Local Validation of Profilograph & Profiler Equipment Calibration and Specification Compliance
- Equipment transferred to field office
- Quality Improvement Task Force Recommendation of Zero Blanking Band
- Incentive/disincentive process recommended by FHWA
- Pavement And Bridge Deck Smoothness Special Provision
- Shared the results with the industry

Current participation in TPF-5(063) Improving the Quality of Pavement Profiler Measurement

A webinar meeting was held on Tuesday October 23rd to finish the review of the AASHTO standards on what is needed for high speed inertial profilers and review the ProVAL future enhancements for prioritization.

- May establish a certification procedure and QA/QC guidelines for road smoothness
- Possible future longitudinal profiling capabilities using PaveVision3D technology
Pavement Design (COLLABORATIVE)

- Need for improved pavement design guide: new or rehabilitated, HMA or PCC
- LTPP data
- The 1993 AASHTO Guide for the Design of Pavement Structures
- AASHTO Joint Task Force on Pavements sponsored NCHRP 1-37A which resulted in a mechanistic-empirical pavement design guide and accompanying software.
- DARWinME software
Pavement Design (COLLABORATIVE)

- TPF-5(229) Characteristics of Drainage Layer Properties for MEPDG
- 2000, 2003, 2006, 2009 NCAT Pavement Test Track cycles, 10,000,000 ESALs per cycle
- TPF-5(267) Accelerated Performance Testing on the 2012 NCAT Pavement Test Track (beginning) continued>

Pavement Design (COLLABORATIVE)

- ODOT SPR Item 2200 Instrumented Pavement Construction on I-35, Purcell, Oklahoma
- ODOT SPR Item 2208 Development and Implementation of MEPDG for Rigid Pavements
- ODOT SPR Item 2209 Development of a Flexible Pavement Database for Local Calibration of MEPDG
- ODOT SPR Item 2235 Distress Modeling for DARWin ME, Phase 1
EXAMPLE OF INDEPENDENT INTEGRATION

- Scour Stop product


SCOUR-STOP

- ½" Polymer (Recycled)
- 4,000 pounds Tensile Strength
- Deep Anchoring
SCOUR-STOP

- IMPLEMENTATION:
  SERVING AS WASHITA RIVER BANK PROTECTION
EXAMPLE OF QUICK NEW PRODUCT IMPLEMENTATION

- MIT Scan T2 Equipment
NDT THICKNESS MEASUREMENTS FOR PORTLAND CONCRETE PAVEMENTS

- MIT SCAN T2 Equipment
- Sole Source Distributor
- Target Pricing, Selection and Calibration
- Construction Projects (AC, PCC, No CRCP)
- Significant Reduction in the Number of Corings Required

MIT-SCAN-T2
Measuring Device to Accurately and Non-Destructively Determine the Thickness of Asphalt Concrete or Concrete Pavements During Construction

NDT THICKNESS MEASUREMENTS FOR PORTLAND CONCRETE PAVEMENTS

- IMPLEMENTATION:
- ODOT COMMITTEE IN PROCESS OF DETERMINING EQUIPMENT QUANTITY NEEDED STATEWIDE AND FREQUENCY OF CORINGS FOR QA/QC & DEVELOPING SPECIFICATIONS FOR NON-DESTRUCTIVE THICKNESS MEASUREMENT OF AC & PCC PAVEMENT
PIPE UNDERDRAIN INSPECTION SERVICE

- Special Service Equipment
- On Demand
- Size Limitation = 18” minimum diameter
- 1000’ long power/fiber optic cable
- DVD recording

Rover, camera & spool
Remote control & recording equipment

Specially Designed Trailer
PIPE UNDERDRAIN INSPECTION SERVICE

- IMPLEMENTATION:
  ESTABLISHED A STATEWIDE SERVICE TO INVESTIGATE PIPE UNDERDRAINS

EXAMPLE OF A NEVER ENDING IMPLEMENTATION

- Herbicide Research Program & Roadside Vegetation Management
Research Vegetation Management (RVM) Training & Consultation / Herbicide Research program

- Pesticide Applicator Certification
- Equipment Calibration Workshops
- Approved Herbicide & Adjuvant List (AHAL)

- Refinement of RVM Practices
- New & Generic Herbicide Formulations
- Tank Mix Compatibilities (Adjuvants/Herbicides)

**IMPLEMENTATION:**
RESULTS INCORPORATED ANNUALLY INTO NEW VEGETATION SPECIFICATIONS
SUMMARY OF INTEGRATIONS

**TICKLELINE** National Inertial Profiler Developments with Local Validation of Profilograph & Profiler Equipment Calibration and Specification Compliance

**COLLABORATIVE** MEPDG Software with National & Local Data Inputs for Pavement Design

SUMMARY OF IMPLEMENTATIONS

**QUICK** Nondestructive Testing Equipment for Measurement of Pavement Thickness

**SERVICE** Established Service to Inspect Underdrain Pipes

**NEVER ENDING** Herbicide Research & Roadside Vegetation Management
THANK YOU!

Ron F. Curb, P.E., CPM
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Engineering Services Branch
email: rcurb@dot.org
phone: 405-522-3795
Planning & Research Division
Oklahoma Dept. of Transportation
200 Northeast 21st Street, Rm. 3-A4
Oklahoma City, Oklahoma 73105-3204
Implementing SHRP 2 Products: "Secrets to Success"
Utah Dot Peer Exchange: October, 2012
Jerry A. DiMaggio, SHRP 2 Implementation Coordinator

Agenda

• A Brief history of SHRP 2
• Summary of the Success Secrets
• Implementation Continuum
• Definition of Success
• Know the Audience and Stakeholders: Assumptions
• Joint AASHTO/FHWA 3-Year Plan
• Budget and Next Steps
• Summary
• Role of special-purpose research programs: focused, large-scale program of limited duration
• Success stories of first SHRP: Superpave, winter maintenance, high performance steel and concrete
• SHRP 2 proposed 2001; NCHRP with matching funds from FHWA develop detailed research plans
• SAFETEA-LU authorized the program
• $218 million, 9 years, ends 3/31/15

• Needs identified by State DOT and industry leaders—driven by customer-oriented goals:
  – Make highways safer: revolutionary change
  – Fix highways: address epidemic of aging infrastructure
  – Reduce congestion: increase physical and operational capacity
• Success requires non-traditional approach:
  – Multiple disciplines
  – Collaboration with non-DOT stakeholders
  – Portfolio: from new knowledge to practical tools to allow existing innovations to be more widely used
Four Focus Areas

- **Safety:** fielding the largest-ever naturalistic driving study to reduce crashes and save lives through understanding driver behavior
- **Renewal:** making rapid, innovative construction possible for "ordinary" projects
- **Reliability:** Providing management and technical tools to reduce congestion through operations
- **Capacity:** Systematizing collaborative decision making to achieve better, faster project decisions

Status of Research Program: The Numbers

- 106 contracts to date, 37 complete, 10-12 new contracts by end of 2012
- Nearly all of the $218 million is committed
- More than 500 expert committee members
- More than 300 research contractors
- 49 reports published or in production/review
- 30+ web tools, databases, software apps
- 24+ pilots conducted with state DOTs
Development requires close collaboration with users and stakeholders to ensure that innovations work in real-world situations.

Summary of the Implementation Secrets

- What's missing in our traditional technology deployment approaches? Develop and follow detailed Strategic and Tactical Plans!
- Implementation Continuum: Define products and additional developmental activities. Many products are new processes/procedures.
- Define Success: have realistic expectations, locate champions and lead users, don't understand estimate IT complexities.
- Know the Audience and Stakeholders: Assumptions.
- Joint AASHTO/FHWA 3-Year Plan
- Budget and Next Steps
- Summary
Research  Development  Implementation

**Research (2007 - 2013)**
- 100+ research projects
- Administered by TRB

**Development (Now through 2015)**
- Conversion of research results into 65+ products that are usable by implementing agencies
- Pilot testing and refinement of products

**Implementation (2012 - forward)**
- Partner agencies prioritize products for implementation
- State DOTs and other agencies integrate products into current transportation practices
Development Activities

- TRB is underway with development activities to convert research results into usable products through:
- Activities include development of:
  - Guidebooks
  - Training programs
  - Model specifications and/or standards
  - Web tools
  - Webinars and workshops
  - Pilot tests of products (new technologies, IT and processes)

Define What Is Implementation?

1. Implementation is the routine use of a SHRP2 product
2. Carried out by State DOTs and other implementing agencies
3. Focus on high-priority products for national adoption, with lesser efforts on other products
Definition of Success

- 5-6 States/agencies adopt as standard practice
- Additional states/agencies follow the lead
- AASHTO and FHWA provide continuing support
- Private sector buy-in
- Positive impact on practice
- Cost-effective use of products

Key Assumptions

- Product
  - Ready
- Audience
  - Ready
- DOTs have capacity to utilize
- AASHTO and FHWA have resources
- High priorities have broad appeal
- Related product grouped
- 3-year plan financially constrained
- Support for other products
- Revisit plan annually

Cost-effective
• A 3-year plan was jointly agreed to by AASHTO and FHWA based on the following considerations:
  – AASHTO and FHWA priorities
  – Year each priority product is ready
  – Logical bundling of products
  – 6-7 products per year
  – Fiscally constrained to $81 million
  – Planning level cost estimates
  – Set asides for additional and cross cutting items

Set Asides Included in Plan

  – Safety Implementation
  – Additional Product Development/Future Priorities
  – Other Product Implementation
  – Marketing & Communications
  – IT Support
  – FHWA, AASHTO, TRB Program Management
Product Level Implementation Plans

- Implementation goals and objectives
- Target audiences
- Barriers to implementation
- Implementation strategies and tactics
- Change management issues
- Roles and responsibilities for FHWA, AASHTO and others
- Governance structure (e.g. advisory committee)
- Hosting of web tools; IT requirements
- Updating of content
- User support
- Training
- Marketing/communications
- Budget
- Evaluation

Next Steps

- Implementation Advisory Committee makes recommendation to FHWA and AASHTO
- Strategic implementation plans developed for bundles of products:
  - TCAPP
  - Reliability technical tools
  - Long life pavements
- Implementation plan workshops and strategy sessions to develop product-level implementation plans and to deploy products
- Implement a demonstration project program
- Develop and execute an evaluation process for the implementation program (near term/long term)
**Next Steps**

- FHWA to develop contracts and identify roles of:
  - Headquarters program offices,
  - Resource centers and
  - Divisions

- AASHTO to identify resources for implementation and roles of:
  - AASHTO committees,
  - Technology Implementation Group
  - AASHTO staff

- TRB to develop plan for remaining development and support activities

- FHWA, AASHTO and TRB to jointly develop:
  - IT Plan
  - Marketing and Communications Plan
  - Evaluation Plan

**Deployment**

- Routine use of products by lead states and other agencies

- Interest generated among other states and implementing agencies in use of products

- Adoption of standards, specifications, manuals by AASHTO

- Evaluation of impact on practice and benefits and value of use of SHRP2 products
THANK YOU!
Jerry A. DiMaggio, SHRP 2 Implementation Coordinator
Email: jdimaggio@nas.edu
Direct: (202) 334-2109
TIMELab RESEARCH:
ASSESSMENT OF SIGN RETROREFLECTIVITY
COMPLIANCE FOR DEVELOPMENT OF A
MANAGEMENT PLAN

UDOT Research Peer Exchange

Kevin Heaslip, Ph.D, P.E.

October 30, 2012

TIMELab at USU

Transportation Infrastructure Management and Engineering Laboratory  http://timelab.usu.edu

Member of the Mountain Plains Consortium Regional UTC

A collaboration of UDOT and USU

Specializes in:
- Transportation Operations
- Intelligent Transportation Systems
- Transportation Maintenance and Asset Management
- Alternative Fuels for Transportation
- Transportation Automation & Electrification
Funding Profile

$4.9 Million in funding since 2008

Funding Sources
- UDOT
- WSDOT
- USDOT/FHWA
- AASHTO
- Department of Energy
- Forest Service

Research and Workforce Development
Mission

Retroreflectivity and Nighttime Visibility

• MUTCD minimum retroreflectivity standard
UDOT OPERATIONS AND SITE SELECTION

- Four Administrative Regions
- Regions Subdivided into Maintenance Stations
- Sampling Determined by Sign Densities

SIGN ATTRIBUTES

- Data Collected Included
  - Sign Type (MUTCD)
  - Sheeting Type
  - Retroreflectivity Measurements
  - Orientation
  - Mounting
  - Offsets
  - Installation Data
## Classifying Damage

![Signs Surveyed](image)

### Signs Surveyed

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<th>Green</th>
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[Image]
Compliance Overview

91 % Overall Compliance

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<td>0</td>
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<td>0</td>
<td>0</td>
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<td>3</td>
<td>2</td>
<td>5</td>
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</tr>
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<td>3%</td>
<td>1%</td>
<td>3%</td>
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<td></td>
</tr>
</tbody>
</table>

Type I Sheeting

[Graph showing retroreflectivity for Type I sheeting]
Type III Sheeting

Type III HIP & Type XI
Type IX

Rotational Sensitivity

802 cd/lx/m²
552 cd/lx/m²
338 cd/lx/m²
585 cd/lx/m²
387 cd/lx/m²
513 cd/lx/m²
Rotational Sensitivity

![Graph showing rotational sensitivity over different rotation angles.](image)

Damaged Sign Challenges

![Images of damaged signs.](image)
Plan Implementation

- Update traffic sign installation requirements.
- Establishment of a in-service traffic sign inventory.
- Integrate traffic sign inventory into OMS.
- Implement traffic sign management methods.
  - Blanket Replacement
  - Visual Nighttime Inspection

Sign Installation Requirements

Installation Data is imperative to efficient traffic sign management
- Only 8% of sample population had installation stickers.
- Two recommendations
  - New Installations
    - ASTM Type and date of manufacture stamped into back of sign
  - Replacements
    - Portable Dot Peen Machine
In-service Sign Inventory

Can be accomplished by mobile or manual inspector collection.
Sign attributes that should be collected:

- MUTCD Number
- Sheeting Color
- Sheeting Type
- Sheeting Area
  - Offset
- Mount Height
- Orientation
- Retroreflectivity Values
- GPS Location
- Photograph
- Installation Date

Blanket Replacement

ASTM Type I sheeting exhibited a high rate of failure.

Type I sheeting with cracking damage had a 98% failure rate.
Visual Nighttime Inspection

- Myth - Nighttime visual inspection requires that the agency follows the consistent parameters that were used in the development of the minimum retroreflectivity levels.

- Studies have shown that inspectors aging from 18-24 have accuracy in detecting failed signs.

- Hiring engineering interns would avoid overtime hours for maintenance crews.

Mobile Data Collection App

Each time an asset is addressed, information such as location, size, photograph, retroreflectivity, and etc will be input into the graphical user interface (GUI) of the application by maintenance personnel.

This information is then transferred wirelessly to UDOT controlled servers, minimizing the potential for data loss or corruption.
Technology Development

Implementation Conclusions

Opportunities
- Champion Enthusiasm
- TAC Involvement
- Maintenance Budgetary Challenges
- Influencing Policy
- Technology Dissemination

Challenges
- Champion Enthusiasm
- Staff Turnover
- Research Budgetary Challenges
Questions?
Presentation Outline

• Introductory Comments
• Research Pays Off Series
• Practical Papers Database
• Electronic Circulars
• Annual Meeting Sessions and Workshops: 2013 Theme and 2012 Examples
• Cooperative Research Program (e.g., NCHRP)
• Strategic Highway Research Program 2
• Virginia DOT Implementation Initiative
Introductory Comments

- August 29, 2012 Webinar: https://connectdot.connectsolutions.com/p65xotvzh0/
- The return on investment in research only occurs when it is put into practice
- The sooner this happen and the greater the frequency of use, the higher the return

Introductory Comments

- Research should address needs
- It is essential to recognize the need and direct the research to produce products that can be put into practice
- Researchers should begin to think about deployment and involve practitioners at an early stage in most research
Research Deployment is not Easy!

• Successful deployment can exceed the work to develop the innovation

• It is essential to have a plan to put the innovation into practice

• It takes a team to be successful
  – Technical Experts, Champions
  – Marketing and Communications Specialists
  – Practitioners

The Mechanistic-Empirical Pavement Design Guide (MEPDG) design and analysis process incorporates a hierarchical approach to design inputs for subgrade, materials, environment, traffic, and project information, which demands that the designers must be knowledgeable about pavement design inputs and pavement performance. In 2002 the Indiana Department of Transportation (Indiana DOT) initiated an aggressive and coordinated campaign to educate those individuals necessary to implement the MEPDG for state projects. Indiana DOT estimates that its efforts to implement the MEPDG will save taxpayers more than $20 million in pavement rehabilitation projects during one construction season.

Research Pays Off: Warm-Mix Asphalt Heating Up in Virginia

Warm-mix asphalt (WMA) promises potential constructability and environmental benefits. Without proof that the technology provides equivalent levels of performance, however, some transportation agencies in the United States have questioned implementation. In 2006, the Virginia Department of Transportation (VDOT) and the Virginia Center for Transportation Innovation and Research (formerly the Virginia Transportation Research Council) constructed maintenance overlays on trial sections to evaluate the laboratory and field performance of WMA materials. The objective was to determine the potential use of the materials on Virginia's roadways.

The field trials indicated that WMA can be placed at lower temperatures, using conventional HMA paving practices and procedures. After 2 years, cracking was observed along the center line of the HMA and WMA sections in one trial, although the cracking in the WMA section was much less extensive. In 2008, Virginia DOT developed special provisions allowing contractors to use WMA technologies for maintenance overlay projects. In 2009, Virginia DOT adopted a supplemental specification incorporating WMA into standard practice. The research supported Virginia DOT's use of WMA as an alternative to HMA. The construction and environmental improvements noted in this study can increase the flexibility of maintenance projects, reduce construction costs, and improve air quality.
The Vermont Department of Transportation (VTrans) initiated a research project, Performance Monitoring of Jointless Bridges, to gain a thorough understanding of how jointless bridges respond to thermal movements and to dead and live loads in a northern climate. The primary research objectives were to provide VTrans engineers with the knowledge and quantitative data to design and construct cost-effective, efficient, safe, reliable, and low-maintenance structures. The research has been conducted in three phases, beginning in 2002 and is expected to be completed in 2013. The primary benefit expected from the research is the development of design standards for a comprehensive analysis of performance data, producing designs that can maximize efficiency, as well as identify and mitigate known risks. Actions implemented as a result of research in the early phases of the project have already paid off. Ancillary benefits include refining construction details and specifications to avoid unnecessary claims related to these structures. Tangible economic benefits include reductions in maintenance and construction costs. Indirect benefits include savings from a more rapid construction schedule and fewer environmental impacts.
TRB Research in Progress


EJ Investigation of Straw Wattle Influence on Surficial Slope Protection. Transportation Research Board Annual Meeting 2012.19p

D Equipment Replacement Optimization: Part II. Dynamic Transportation Research Board Annual Meeting 2012.20p

EJ Experimental Analysis of Structural Compatibility at the Interface Between Asphalt Concrete Pavements and Orthotropic Steel Deck. Transportation Research Board Annual Meeting 2012.19p

EJ Evaluation and Spalling on Pullout Capacity of Steel MSE Retaining Structures. Transportation Research Board Annual Meeting 2012.19p

D Development and Implementation of the Simplified MGS Stiffness Design Methodology. Transportation Research Board Annual Meeting 2012.20p
Climate Change and Transportation: Summary of Key Information
July 17, 2012
TRB's Transportation Research Circular E-C164: Climate Change and Transportation: Summary of Key Information highlights the key findings of a variety of studies on the subject of climate change and its ramifications for the transportation sector conducted by the National Research Council, the principal operating agency of the National Academy of Sciences and the National Academy of Engineering.

Automated Imaging Technologies for Pavement Distress Surveys

TRB's Transportation Research Circular E-C156: Automated Imaging Technologies for Pavement Distress Surveys presents the basics of film or magnetic tape-based image acquisition and its potential for pavement distress surveys. Additional information on symbol and document image processing, image analysis, surface characterization, and comprehensive Pavement Management System requirements is included. The circular also discusses digital acquisition and its potential for high-quality image and performance data as well as for the potential for harmonic distress analysis.
Deploying Transportation Research – Doing Things Smarter, Better, Faster
Deploying Transportation Research – Doing Things Smarter, Better, Faster

• Deploy! Case Studies of Successful Technology Deployment Methods from Across the Highway Transportation Spectrum, Part 1 & 2

• Be Prepared; Work Smarter: Strategic Program Elements for Effective Research Leaders

• Innovations Worth Deploying Now: High-Value Research Results

• Practical Research + Practical Results = An Innovative Culture
Deploying Transportation Research – Doing Things Smarter, Better, Faster

- Keys to Deploying Research Results
- Deploying Transportation Research: Video Theater
- Implementing SHRP 2 Innovations: The Road from Research to Action
- Understanding the Impact of Deployment Best Practices to Reduce Petroleum, Clean the Air, and Mitigate Climate Change in the Transportation Sector

2012 TRB Annual Meeting – "Implementation"

- Best Practices and Lessons Learned Through Private Industry Partnerships with Public Agencies and Academia to Implement Research Results
- Positive Train Control: Implementation Challenges and Possible Solutions
- Implementation of NCHRP Project Results by State Departments of Transportation: AASHTO Research Advisory Committee Initiative
2012 TRB Annual Meeting – "Implementation"

- State of Play: Implementation Efforts for Vehicle-Miles-Traveled Fee
- Implementation of the AASHTO Highway Safety Manual – What is Underway?
- DARWin-ME: Initial Experience of Software Users
- FAA's Airport Geographic Information System Program: Implementation Plan and Data Submission

Facilitating Implementation Impacting Practice

NCHRP Impacts State Departments of Transportation at all Levels Across all Functions

**Applied Research Products**

- Recommended AASHTO Guides, Policies, Specifications
- Guides for practitioners
- Software products
- New or improved models/tools
- New or improved operations and services
- New or improved testing/evaluation techniques
- Fact finding (white papers)

**Panels: Available Tools**

- Include in original scope
- Request a continuation project/funds
- Use NCHRP 20-44 funds for the unexpected
- Apply various techniques, for example:
  - Workshops, webinars, demonstrations
  - Training material, pilot courses, PPT summaries
  - Interaction with AASHTO committees or programs; assistance in balloting
AASHTO Products Examples

- LRFD Bridge Design Specifications
- M-E Pavement Design Guide
- Highway Safety Manual
- Asset Management Guides (2)
- Manual for Assessing Safety Hardware (MASH)
- Roadside Design Guide (Chapters)
- Bike and Pedestrian Guides (In development)
- Green Book (Geometric design updates)

Impacts

NCHRP AT 50 YEARS
THE NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Iowa DOT’s relentless pursuit of excellence

NCHRP pays off for Caltrans

New Hampshire’s go-to source for research

Delivering value across a transportation agency

Leveraging the state research investment
Additional Activity (Proposed)

- Prepare theme summaries (state of knowledge-guidance)
- Review final implementation plans for possible funding
- Better assist those who provide advice and training based on NCHRP results
- Support state DOTs thru RAC to facilitate NCHRP implementation
An off-the-record estimate from a major U.S. firm set the cost of the implementation phase of new product development at approximately 10 times the cost of research.

- Strategic packaging and branding;
- Technical assistance;
- Standards, specifications, guidebooks, and manuals;
- Follow-on research, testing, and evaluation;
- Lead users and demonstration projects;
- Training and education; and
- Long-term stewardship.
Virginia DOT Implementation Initiative

• 2010: Independent Audit of the Virginia Transportation Research Council Completed

• Audit Recommended more Emphasis on Implementation and Use of Research Results

• Changed name to "Virginia Center for Transportation Innovation and Research"

• Approximately $10M Budgeted (additional, annually) for Research Implementation

• Represents 40 Percent of FY 2013 Budget

Virginia DOT Implementation Initiative

• Money Used to Cover Construction Delta Costs for Research Implementation

• Proposals for Funds Received from Research Director and Associate Directors

• Research Personnel work with Districts to Implement Research Results into Projects

• 2011: Recycled and Quieter Pavements Projects; 2012: Road Kill Composting Program

• Contact: James W. White, Implementation Coordinator, James.White@vdot.virginia.gov
"Research is to see what everybody else has seen, and to think what nobody else has thought."

—Albert Szent-Györgyi, Hungarian biochemist

QUESTIONS?

Thank You!
• People Spend So Much Time Just Wondering.......... 

• We Will Show You What Wonder Is!!!!

• WYDOT Research Center began focusing on performance measures in 2007.
• Focused on Wyoming Centric first, Rural Regional second.
• Applied Research with return---on---investment.
• What we do best!!
Performance-Based Management
“Maximizing Value and Cost Savings”

Programming
Minimized risks in the Project Pipeline

Project Optimization
Optimized components, scoping, timing, designs, mix, locations, groupings

Program Trade-Offs
Best cost and benefit trade-offs between programs — performance target—seEng, optimized budgets

Program Optimization
Recommended assets, treatments, project timing, maintenance operations

Asset Management Efforts
Larry Redd, P.E., larryredd@earthlink.net

Uncertainties Can Ruin Your Asset Management Plans

Best Laid Plans
- Optimized project selection
- Intended performance benefits
- Assumed revenue by year

Unplanned Outcomes
- Actual Revenue?
- Missed deliveries
- Holding Costs
- Obsolete projects
- “Hurry-up” projects
- Low performance

STIP—“Project Pipeline”

Project Programming

|------|------|------|------|------|------|------|

Unplanned Outcomes

Pipeline Uncertainties
- Scope growth and project cost
- Labor and Materials price volatility
- Environmental or ROW issues
- Unplanned political priorities
- Construction cost inflation
- Uncertain or variable revenue

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larryredd@earthlink.net

Larry Redd LLC

- 101 -
Simulation Cartoon

3Rs and 4Rs in Design
3Rs and 4Rs “On-the-Shelf”
3R4Rs Paved

3R4R Project Loading Rate
3R4R Design Completion Rate
3R4R Paving Rate

1Rs and 2Rs in Design
1Rs and 2Rs “On-the-Shelf”
1R2Rs Paved

1R2R Project Loading Rate
1R2R Design Completion Rate
1R2R Paving Rate

Larry Redd, P.E., larryredd@earthlink.net

Non---Optimum Pipeline Costs

Costs

Costs of “Being Lean”--
- Loss of Stimulus Funds, Block Grants, Special Legislative Funds
- “Hurry-up” design costs
- Non-optimum advanced const.

“Optimum” Range

Holding Costs --
- “PE 10 yr Limit List”
$Millions at risk, and
$Billions in projects may not get done
- Lost permit costs
- ROW and EA costs
- Development costs
- Obsolete projects
- Redesign costs

Amount in Inventory (“On-the-Shelf”)

Larry Redd LLC, Proprietary and Confidential
Uncertainty Factors

- Scope growth
- Political priorities
- Material price volatility
- Labor costs
- Other construction cost escalation
- Legal issues
- Environmental or regulatory issues
- Right-of-way issues

Sensitivity of Losses to Key Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Initial Value</th>
<th>Sensitivity Value</th>
<th>Reduction in Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Time for 3R4Rs</td>
<td>5 yrs</td>
<td>3 yrs</td>
<td>Up to 22% or more</td>
</tr>
<tr>
<td>Pipeline (Shelf)</td>
<td>Proportional</td>
<td>“Keep the Critical Projects Moving”</td>
<td></td>
</tr>
<tr>
<td>Draining Logic</td>
<td>based on intended Mix</td>
<td></td>
<td>Up to 16% or more</td>
</tr>
<tr>
<td>Holding Cost factor (per year)</td>
<td>5% for 3R4Rs and 2% for 1R2Rs</td>
<td>2.5% for 3R4Rs and 1% for 1R2Rs</td>
<td>20 to 30%</td>
</tr>
<tr>
<td>Hurry Up Inefficiency</td>
<td>40% inefficiency</td>
<td>20% inefficiency</td>
<td>25% or more</td>
</tr>
<tr>
<td>Use of Projected Revenue</td>
<td>No Projections used</td>
<td>Projected two years out</td>
<td>Up to 30% or much more</td>
</tr>
<tr>
<td>“Smoothness” of Funding</td>
<td>“Bumpy” or “Blocky” funding</td>
<td>Smoothed or flattened funding</td>
<td>Ideally this would eliminate losses</td>
</tr>
</tbody>
</table>

Larry Redd, P.E., larryredd@earthlink.net
Next Steps ------ Strategy Development

- Pipeline loading – project volume & mix based on projected revenue, etc.
- Pipeline Mgmt – e.g. Critical Project concept
- Holding costs – i.e. costs of delays

- Hurry—Up project costs
- Reduce project pipeline times/delays
  - Uncertainties ----- scope growth, etc.
  - Critical path of design

Quantify Benefits vs. “What If” Scenarios

Overlap Of Processes at WYDOT

District Engineers

Design

Mat’s Lab

Project Delivery
- TAM and Planning Processes
- Roles, Responsibilities
- Expectations
- Interactions & Handoffs
- WYDOT BSC and PMI

Larry Redd, P.E., larryredd@earthlink.net
Key Opportunities

• Reduce design cycle times
• Utilize revenue projections in loading the pipeline
• Utilize the “Shelby” draining approach
• Reduce Holding Costs
• Reduce Hurry Up Costs
• Smooth out “blocky funding” if possible (state funds?)
• Continue research on other uncertainty factors (scope growth, price volatility, inflation, political, legal, regulatory, etc.)

Evaluating Department of Transportation’s Research Programs: A Methodology and Case Study

University Of Wyoming
College of Engineering and Applied Sciences
April 16, 2016
Study Objectives

• Develop an Evaluation Methodology

• Demonstrate the methodology using the WYDOT Research Program as a case study

• From the WYDOT case study, make conclusions and recommendations

• Recommendations for implementing the developed methodology for any other DOT research program

Transportation Funding – SP&R

• SAFETEA---LU, 2005---2012
  — Started pushing for outcome---based research
  — Utilize performance measurements for evaluating research

• MAP21, 2012
  — Emphasizes performance based research
  — Major reductions in Earmarks
  — Performance Management mandate
SP&R Funding

Background

• **Evaluating Research Programs**
  – Process Management
  – Program Quality
  – Program Value

• **Performance Measurements**
  – Assessment of data and techniques that reflect which performance measures work
  – needs and expectations are met
Background – Phase I

• Evaluation of WYDOT’s Research Center and Research Program
  – Performed in 2007
  – Resulted in specific recommendations
  – Developed 10 Performance Measurements

First Level Analysis

  – Project Groupings
    • Strategic Intent
      – Infrastructure Upgrade, Preservation of Infrastructure, Public Affairs, Safety, Shared Knowledge, etc.

  • Project Category
    – In-House Research, Contracted Research, and Pooled Fund Studies
Performance Measurements

• 8 of the 10 Developed Performance Measurements are Used for the Stage I Methodology

  – Number of Projects and Amount of Funding per Project by Strategic Intent

  – Number of Proposals Responding to Research Program Solicitations

PM’s for Stage I Continued

  – Number of Needs Statements Submitted by the Agency’s Programs

  – Outcomes of the Research Projects

  – Number of Research Reports Completed Each Year

  – Percentage of Administrative Costs to Overall Program Funding
PM’s for Stage I Continued

– Funds Requested by the Research Community versus Funds Available

– Percentage of Projects Completed On-time and Within Budget

Stage II Methodology

– Addresses the Remaining 2 Performance Measurements using Performance Evaluations
  • Cost---benefit analysis for Individual Projects
  • Cost---benefit analysis for the Research Program

– Additional Evaluations and Analysis
WYDOT Research Program

– Funds over $1 million in research annually
– Research Advisory Committee (RAC)
  • Meets 4 times a year to approve and fund research projects
– WYDOT Mission
  • “To enhance the economic well-being and quality of life in Wyoming by working with public and private partners to produce a safe and efficient transportation system”

Breakdown by Project Category

• 3 Types of Projects
  – Contract Research
  – Pooled Fund Studies
  – In-house Research
Number of Projects and Funding by Strategic Intent

- Projects relating to Safety have more funding
- Wildlife Studies was created due to the significant amount of projects related to Wildlife

Number of Proposals Responding to Research Program Solicitations

- 9 out of 15 Contracted Research Projects were solicited by WYDOT
  - In-house Research Projects and Pooled Fund Studies were not considered for this PM
Outcomes of the Research Projects

- 3 Project Outcome Categories
  - Knowledge
  - Product
  - Standards

Number of Research Reports Completed Each Year

- Out of the 65 projects from the First Level Analysis
  - All Contracted Research Projects but 2 were completed within 3 years
  - 2 Contracted Research Projects went over their proposed timeline
  - All pooled Fund Studies went over their initial proposed timeline
Pooled Fund Extension Form

Request for Additional Funding for
Pooled Fund Studies

Project Name: 
Project Number: 
Lead State: 
WYDOT Liaison: 
Number of Participating States: 

Project History
Start Date: 
Initial Estimated Completion Date: 
Initial Funding: 
Additional Funding Already Received: 
Additional Needs: 
Additional Funding Requested: 
Additional Time Requested: 
New Estimated Completion Date: 

Benefits and Implementation for WYDOT
What products/knowledge/policies/etc. have resulted from this project?

Percentage of Administrative Costs to Overall Program Funding

<table>
<thead>
<tr>
<th>Year</th>
<th>Administrative Costs</th>
<th>Overall Research Budget</th>
<th>Percent Admin. Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>$16,360</td>
<td>$923,795</td>
<td>1.8%</td>
</tr>
<tr>
<td>2006</td>
<td>$69,433</td>
<td>$1,061,660</td>
<td>6.5%</td>
</tr>
<tr>
<td>2007</td>
<td>$103,993</td>
<td>$559,716</td>
<td>18.6%</td>
</tr>
<tr>
<td>2008</td>
<td>$81,877</td>
<td>$628,172</td>
<td>13.0%</td>
</tr>
<tr>
<td>2009</td>
<td>$118,183</td>
<td>$1,212,314</td>
<td>9.7%</td>
</tr>
<tr>
<td>2010</td>
<td>$118,642</td>
<td>$1,375,280</td>
<td>8.6%</td>
</tr>
<tr>
<td>2011</td>
<td>$118,642</td>
<td>$1,359,808</td>
<td>8.7%</td>
</tr>
<tr>
<td>Averages</td>
<td>$89,590</td>
<td>$1,217,249</td>
<td>9.57%</td>
</tr>
</tbody>
</table>

- 2005---2006 A different accounting system was used within WYDOT
- 2009---2011 shows the expected administrative costs, under 10%
Performance Evaluations

• Phase 1 Performance Criteria Ranking

1. Fulfillment of project objectives
2. Expected Level of Implementation
3. Internal/External Technology Transfer
4. Quality of Research Reports
5. Completed on Time
6. Completed within Budget
7. Researcher Feedback Form

Performance Evaluations

• Phase 2 Performance Criteria Ranking

1. Actual Level of Implementation
2. Contribution to WYDOT’s Mission
3. Benefit Cost Analysis
4. Impacts to National, Regional, or Local Agencies
5. Additional Research Pursued
Phase 1 Performance Evaluation Form

Phase 2 Performance Evaluation Form
Benefits from the Performance Evaluations

• Phase 1
  – Identifies the successful and unsuccessful research projects
  – Help WYDOT identify which types of research projects are not successful

• Phase 2
  – Generates final score of a research project
  – Compiling all projects completed will allow for an overall score of the Research Program

Budgetary Categories

• 3 main budget categories were created
  – Direct Costs
    • Total Personnel Costs, Fringe Benefits, Research Travel, Report Generation, Equipment, Others
  – Technology transfer
    • Conferences/Report Presentation, Miscellaneous Travel
  – Indirect Costs
    • Project Administration, Overhead
WYDOT Research Project Budget Analysis Form

<table>
<thead>
<tr>
<th>Projected Project Costs</th>
<th>Percentage of Overall Project Budget</th>
<th>Lower Range</th>
<th>Upper Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Costs</td>
<td>$63,206</td>
<td>83%</td>
<td>81%</td>
</tr>
<tr>
<td>Total Personnel Costs</td>
<td>$84,108</td>
<td>45%</td>
<td>44%</td>
</tr>
<tr>
<td>Principal Investigator</td>
<td>$15,708</td>
<td>20%</td>
<td>12%</td>
</tr>
<tr>
<td>Other Personnel</td>
<td>$18,900</td>
<td>25%</td>
<td>23%</td>
</tr>
<tr>
<td>Fringe Benefits</td>
<td>$6,083</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>Research Travel</td>
<td>0%</td>
<td>*</td>
<td>2%</td>
</tr>
<tr>
<td>Report Generation</td>
<td>0%</td>
<td>*</td>
<td>2%</td>
</tr>
<tr>
<td>Equipment</td>
<td>$16,800</td>
<td>22%</td>
<td>3%</td>
</tr>
<tr>
<td>Others</td>
<td>$6,215</td>
<td>8%</td>
<td>2%</td>
</tr>
<tr>
<td>Technology Transfer</td>
<td>$2,000</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Conferences</td>
<td>$1,000</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Miscellaneous Travel</td>
<td>$1,000</td>
<td>2%</td>
<td>1%</td>
</tr>
<tr>
<td>Indirect Costs</td>
<td>$11,138</td>
<td>19%</td>
<td>12%</td>
</tr>
<tr>
<td>Project Administration</td>
<td>$2,210</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Overhead</td>
<td>8,868</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>Total Project Cost</td>
<td>$76,344</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WYDOT Research Program Website Analysis

- Compared the WYDOT Research Program Website to other DOT Research Websites for content and overall structure
  - Comparisons were made between the following DOTs:
    - Colorado
    - Idaho
    - Montana
    - South Dakota
    - Utah
    - Minnesota
Improving Access to Past Research Reports

- Currently WYDOT has a few Research Reports on their website
- Allow research reports to be accessed from search engines

Creating a Mission Statement
Social Networking

WYDOT Case Study Conclusions

• The WYDOT Research Center is an effective and productive program

• Sponsors a variety of projects that fulfill WYDOT’s Mission

• Flexible and proactive when addressing current research needs
WYDOT Case Study Conclusions

• Over 80% of projects approved and completed from 2005---2010 had some level of implementation

• 60 percent of research projects were initiated by WYDOT employees

• 8 WYDOT Programs and 2 WYDOT Districts sponsored research projects between 2005 and 2010

WYDOT Case Study Conclusions

• Less than 10 percent of the overall research budget is used for administrative costs

• 100% of proposed pooled fund studies, 100% of the proposed in---house research projects, and 85% of proposed contracted research projects were approved and funded by the RAC were funded during the analysis period
WYDOT Case Study Conclusions

• 100% of contracted and in-house research projects are completed within budget and 88% are completed within their proposed timeline

• The performance evaluations completed on the research projects yielded high overall performance scores

WYDOT Case Study Conclusions

• The research projects averaged a score of 96% for the phase 1 performance evaluation

• The research projects averaged a score of 83% for the phase 2 performance evaluation

• Pooled fund studies are effective research options for WYDOT but they should be more closely evaluated
WYDOT Case Study Recommendations

- WYDOT should continue funding research projects that advance the overall goals of their mission statement
- The RAC should receive formal presentations about pooled fund studies before voting on budgetary and timeline extensions
- The performance evaluations should be implemented within the WYDOT Research Program

WYDOT Case Study Recommendations

- The developed standardized budget should be used to evaluate proposed research project’s budgets
- WYDOT Research Program should revamp its website for greater technology transfer opportunities
WHY?

- How long does it take to deploy innovation in the transportation industry?
  - Change a business practice
  - Replace a design system
  - Replace a construction process...

EVERY DAY COUNTS MISSION

- To identify and deploy readily available innovation and operational changes that will make a difference.
- To identify policy or operational changes required to advance system innovation in the longer term.
TECHNOLOGIES & INNOVATIONS

- Continuous collaboration with stakeholders
  - develop innovations and technologies;
  - solve problems;
  - bring innovation to market.
- Many sources for ideas (Federal R&D, other countries, states, universities, entrepreneurs, etc.).

A COLLABORATIVE TECHNOLOGY SELECTION PROCESS

- EDC Innovations & technologies selected collaboratively with FHWA and key stakeholders input.
- Technologies scored by an objective panel
- R&T Leadership team selected 5 technology innovations for accelerated deployment. (EDC-I)
EDC TECHNOLOGY SELECTION CRITERIA

- Market ready
- Meets user needs
- Complements National/DOT/FHWA strategic goals
- Has “high payoff” & success potential
- Shows potential for widespread application and use
- Has adequate deployment & technical support resources available
- Can be packaged with other technologies to multiply benefits
- Has measurable outcomes
- Meets legal & regulatory requirements
- Resource & Support partners available
- Provides opportunities to enhance future deployment efforts

STAKEHOLDER TECHNICAL PANEL MEMBERS

- AASHTO  Dave Huft (SD), Keith Platte (AASHTO)
- NACE  Tony Giancola
- ARTBA  John Kulka (HRI, Inc.), Rich Juliano
- AGC  Donald Weaver (Weaver-Bailey Construction), Brian Deery (AGC)
### EDC-I TECHNOLOGY SELECTION MATRIX

#### EVERY DAY COUNTS (EDC) – TECHNOLOGY SELECTION MATRIX (DRAFT!!!)

**CRITERIA**

1. Does it Meet Customer Needs?
2. Market Ready?
3. Roadmap & Outcome Plans Ready?
5. High Payoff/Success Potential?
6. Result in Widespread Application & Use?
7. Adequate Deployment, Implementation & Technical Support Available?
8. Can Be Packaged with Other Technology?
9. Outcomes Measurable?
10. Resource & Support Partners Available?
11. Meets all Legal/Regulatory/Political Requirements?

#### TECHNOLOGY

1. "Green" Paving Technologies:
   - Increased use of recycled materials – concrete & asphalt
2. Accelerated Bridge Construction:
   - Increased use of Precast Bridge Elements (PFBES); Geosynthetic Bridge Abutments; Augmented Cast-in-Place (ACP) & Continuous Right Auger (CFA) Foundations; EPS Geofoam
3. Bridge Inspection Technology (BIN):
   - Expanded training on innovative NDE technologies & methodology
4. ACS Lite:
   - Expanded use adaptive traffic signal control technology

### WHAT ARE THE INNOVATIONS? EDC-I

- Warm Mix Asphalt
- Precast Bridge Elements
- Geosynthetic Reinforced Soil
- Safety Edge
- Adaptive Traffic Control Technology
TECHNOLOGY & INNOVATION

Warm Mix Asphalt

Allows a reduction in asphalt mixture production & placement temperatures

Benefits:
- Provides better compaction
- Reduce worker fatigue
- Reduces fossil fuel consumption
- Reduces CO₂e & other emissions
- Longer paving season
- Allows for longer hauling distances
- Benefits with High RAP

WARM MIX ASPHALT

- Various technologies are used, which allows the plant mix to be produced and compacted at lower temperatures...

  Typical production temperature reduction 30 to 75°F

WMA Technologies:
- Foaming Processes
- Wax-like Additives
- Chemical Additives
- Hybrids
**Prefabricated Bridge Elements & Systems**

Prefabricated bridge elements and systems manufactured on-site or off-site, under controlled conditions, and brought to the job location ready to install.

Benefits:
- Minimizes traffic & community impact
- Improves construction zone safety
- Improves bridge designs constructability
- Increases quality & lowers life-cycle costs

**Geosynthetic Reinforced Soil**

Fast, cost-effective bridge support method using alternating layers of compacted fill and sheets of geotextile reinforcement to provide bridge support.

Benefits:
- Eliminates approach slab or construction joint at the bridge-to-road interface
- Reduced construction time (complete in 10 days)
- 25 - 60 % less cost depending on standard of construction
- Less dependent on weather conditions
- Flexible design – easily modified for unforeseen site conditions
- Easier to maintain because of fewer parts
- Built with common equipment and materials
TECHNOLOGY & INNOVATION

Safety Edge

Sloped pavement edge at a 30° angle which allows drivers a more controlled re-entry back onto the roadway after tire drop-off, if shoulder re-creates a drop-off

Benefits:
- Reduces crashes due to edge drop-off and uncontrolled recovery
- Minimal cost (less than 1% on 2-lane highway)
- Consolidated edge reduces edge raveling, increases durability

Adaptive Traffic Control Technology

ACS measures traffic flow and adjusts signal timing to promote smooth flow of traffic along arterial streets

Benefits:
- ACS improves travel time reliability, reduces congestion, smoothes traffic flow
- Increases long-term viability of traffic signal operations
- Widely deployable & uses existing control equipment
Round II Initiatives Categories

- Reducing Project Delivery Time
- Reducing Construction Time
- Innovative Contracting
- Safety
- Environment
- Mobility

Reducing Project Delivery Time

Programmatic Agreements
- Locally Administered Projects
  - Certification / Qualification Program for IFAs
  - Innovative Procurement for Engineering Services
  - Innovation Partnering

Geospatial Data Collaboration
Reducing Construction Time

- Advanced Modeling for Construction Means and Methods

Accelerated Bridge Construction
- Geosynthetic Reinforced Soil (GRS)
- Prefabricated Bridge Elements & Systems
- Slide-in Bridge Construction

Intelligent Compaction

Innovative Contracting

- Construction Manager / General Contractor
- Alternative Technical Concepts
- Design Build
Spring 2013 Delivery

21st Century Solutions

- Five new initiatives
- Focused on Safety, Environment & Mobility
- Virtual Summits
  - Delivery in February & March
  - Digital technology to participant's desktops
- EDC Exchange for Local & Tribal Agencies
State Transportation Innovation Councils (STICs)

STICs will have an important deployment role
✓ Boost implementation success
✓ Provides a state partnership in innovation
✓ Offers opportunities for national collaboration

FHWA preparing a number of strategies to support efforts in the States

MEASURING IMPLEMENTATION

• Process Measures
• Outcome Measures
• Impact Measures
Safety Edge<sub>SM</sub>

**Goal 1:** By December 2011, 40 State DOTs will have used the Safety Edge<sub>SM</sub> on projects

**Goal 2:** By December 2011, 15 State DOTs and all Federal Lands Divisions have adopted Safety Edge<sub>SM</sub> specifications.

**Goal 3:** By December 2012, 40 State DOTs will have adopted as a standard for paving projects

---

GeosyntheUc Reinforced Soil

**Goal 1:** By June 2012, 20 states have adopted the GRS IBS specifications and special provisions within their standard bridge documents.

**Goal 2:** By December 2012, a total of 30 NHS bridges in 20 states have been designed and/or constructed using GRS

**Goal 3:** By December 2012, 75 Off-NHS bridges have been designed and/or constructed using GRS
Pre-fabricated Bridge Elements & Systems

Goal 1: By December 2012, to accelerate bridge construction, 100 cumulative bridges have been designed and/or constructed rapidly using PBES.

Goal 2: By December 2012, 25 percent of single- or multi-span replacement bridges authorized using Federal-aid have at least one major prefabricated bridge element that shortens onsite construction time relative to conventional construction.

Adaptive Signal Control Technology

Goal 1: By December 2012, ASCT tools will be used by 40 agencies to guide programming and/or implementation of adaptive signal control.
Warm Mix Asphalt

**Goal 1:** By December 2011, 40 State DOTs and all Federal Lands Divisions will have a specification &/or contractual language that allows WMA on Federal-aid or Federal Lands projects.

**Goal 2:** By December 2012, at least 30 State DOTs will have achieved set targets for WMA usage.

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Innovation Deployment Planning

- **Tier I: EDC**
  - EDC competitive program for accelerated implementation of innovations that are truly ready to become the state-of-the-art practice.

- **Tier II: Corporate Technology Deployment**
  - Competitive process for the selection of non-selected or near-market ready innovations for pilot, showcase, and/or demonstration that will feed future Tier I selections. Candidates will come from non-selected Tier I innovations and a solicitation of FHWA program offices.

- **Tier III: Core Program Area Technology Deployment**
  - Program office determines priority innovations for further development, showcase, demonstration and/or deployment. May feed Tier I or Tier II. Funds to be distributed proportionately to the major program areas.
Thank You!
The Big 4

- Safety
- Winter Maintenance
- Structures
- Concrete Pavements

Growing areas

- Human Factors
- Intelligent Construction
Research in the 1990’s led to recommendations for Iowa’s driver licensing of teens. This resulted in Iowa’s Graduated Driver Licensing (GDL). Changes included time limits and hours of instruction required to obtain an intermediate license. The change took effect in 1999. Several studies have followed this change to evaluate its significance.

“Graduated Driver License, Iowa’s Experience Since the Law’s Inception”
The late Scott R. Falb, Iowa DOT Office of Driver Services, Nov. 2005

Year GDL took effect. Not all novice drivers were part of the GDL this year.

DOT Crash Reporting Form Changed
2007 Study by CTRE

The impact of the school permit, which allows teenage drivers to drive alone to school, school events, or work, was also examined. The percentage of school license holders per licensed driver was relatively constant for 14-year-olds and 16-year-olds from the before to after period, but increased for 15-year-olds.

The percentage of 15-year-old school license holders in December 1997 was 22.7%, compared to 30.0% in December 2003.
2007 Study by CTRE

A large number of 14-year-olds involved in crashes still drove alone (36%), despite GDL restrictions.

The relative nighttime involvement decreased sharply for 14-year-olds after implementation of GDL for the nighttime period from midnight to 6 AM, indicating that GDL driving time restrictions may have been successful in reducing the nighttime accident risk...however, increased for the 10 PM to midnight time period.

Use of Video in Teen Driving - Age vs. Experience

Funded through:
• TPF-5(207), IA (lead), KS, MO.
• NHTSA
• CDC

Work conducted at the University of Iowa Policy Center, http://ppc.uiowa.edu/
Use of Video in Teen Driving - Age vs. Experience

Research includes

- Evaluation of driving characteristics
- Evaluating impacts of feedback (from researcher to driver and parents)

This research examined the use of event-triggered video feedback to reduce unsafe driving by teens in urban and rural settings.

“Unsafe events” triggered the video system to begin recording a 20-second video and audio clip.

Triggered events included situations where a driver exceeded a lateral or longitudinal physical limit, such as when abrupt accelerations, braking or erratic steering occurred.

Parents received a weekly report card of their teen’s driving data that described each event in narrative form.
Teen crashes

- Number 1 cause of death and injury among our 14-19 year-olds
  - Young drivers and passengers
  - Occupants of other vehicles
  - Non-motorists – pedestrians, bicyclists

Crash causes

1. Inexperience in vehicle control skills
2. Poor ability to anticipate & identify hazards
3. Sensitivity to peer influence and willingness to take risks
4. Impulsive
5. Poor understanding of driving abilities relative to demands
   - Texting and cell phone conversations compound
Compelling teen driving research

- Crash risk increases about 10-fold when teens begin driving unsupervised and decreases at a moderate rate over first several years.
- More young passengers → more crashes.
- Most severe crashes occur before midnight.
- Enhanced Graduated Driver Licensing (GDL) showing positive results:
  - More supervised driving
  - Passenger restrictions
  - Nighttime driving limitations

Event-triggered video as an intervention tool

- Purpose is to extend parent mentoring, not monitoring:
  - Goal is to enhance learning for long term.
- Video provides the driver and parent the context of safety-relevant events.
- Looking for teachable moments...
  - The good, the bad, and the “you almost died”.
- User acceptance is critical for success.
Event-triggered video recorders

- Two cameras
- 3-axis accelerometer
- Video/audio buffer
- GPS location and speed
- Triggers and saves video clips when g-force exceeds threshold (~ .5 g)
- Records 8 sec before/4 sec after trigger
- Cellular download

Current evaluation: age and experience

- Three different groups of participants
  - School license holders (14.5 – 15.5 years old)
  - Inexperienced intermediate license (16 years old) – never held a school license
  - Experienced intermediate license (16 years old) – had a school license for at least 4 months
- Half the participants in each group assigned to control condition
- Total study: 90 participants
**Timeline**

- ETVR installed prior to independent driving under applicable license
- First 4 weeks were no-feedback baseline for all (pre-intervention)
- 16 weeks of feedback
  - Flashing light on ETVR (immediate feedback)
  - Weekly report and CD of video (delayed feedback)
- Four weeks of baseline (post-intervention)

**March 2012 analysis**

- Data completed for 79/90 participants
- 240,257 miles
- Primary dependent measure is number of safety-relevant events per 1000 miles
  - Event frequency
- Negative binomial regression
  - Log of mileage as offset variable
  - Repeated measures
Subjects as of March 10, 2012

<table>
<thead>
<tr>
<th></th>
<th>Completed (n=79)</th>
<th>In Process (n=11)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intervention</td>
<td>Control</td>
<td></td>
</tr>
<tr>
<td>School Group (School License)</td>
<td>12</td>
<td>11</td>
<td>32</td>
</tr>
<tr>
<td>Inexperienced Intermediate Group</td>
<td>13</td>
<td>13</td>
<td>28</td>
</tr>
<tr>
<td>(Intermediate License without prior</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>School License)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced Intermediate Group</td>
<td>15</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>(School License before Intermediate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>License)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>40</td>
<td>39</td>
<td>90</td>
</tr>
</tbody>
</table>

Data collection complete Summer 2012

Use of Video in Teen Driving - Age vs. Experience

Preliminary results

Drivers' Actions

- Improper turns & curves
- Abrupt braking
- Abrupt acceleration

Baseline 1 Weeks 1-8
Baseline 2 Weeks 33-40
Baseline 3 Weeks 25-32
Baseline 4 Weeks 17-24
Baseline 5 Weeks 9-16
Baseline 6 Weeks 1-8
### Effectiveness of Intervention March 2012

<table>
<thead>
<tr>
<th>License group</th>
<th>Intervention condition</th>
<th>Event rate</th>
<th>Lower 95% CL</th>
<th>Upper 95% CL</th>
<th>$\chi^2$ value for diff</th>
<th>$P &gt; \chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>School</td>
<td>Control</td>
<td>40.8</td>
<td>23.8</td>
<td>70.1</td>
<td>4.85</td>
<td>0.0275</td>
</tr>
<tr>
<td>School</td>
<td>Intervention</td>
<td>12.9</td>
<td>5.4</td>
<td>30.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inexperienced</td>
<td>Control</td>
<td>40.0</td>
<td>18.7</td>
<td>85.8</td>
<td>5.93</td>
<td>0.0149</td>
</tr>
<tr>
<td>Inexperienced</td>
<td>Intervention</td>
<td>12.3</td>
<td>6.9</td>
<td>21.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced</td>
<td></td>
<td>20.6</td>
<td>12.8</td>
<td>33.1</td>
<td>12.15</td>
<td>0.0005</td>
</tr>
<tr>
<td>Experienced</td>
<td>Intervention</td>
<td>6.0</td>
<td>3.6</td>
<td>10.0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
After the intervention March 2012

- School license group saw an increase of about 11 events/1000 miles after intervention ended ($X^2 = 5.13, p = 0.0235$)
- No increase after the intervention ended for both inexperienced and experienced 16-year-olds in the feedback condition.

No effect of age

[Graph showing safety-relevant events per 1000 miles for different segments and groups.]
Effect of experience March 2012

Safety-relevant events per 1000 miles

Segment

- Inexper ctrl
- Inexper intv
- Exper ctrl
- Exper intv

Distraction was present for 1118 events (23%)

Distraction events
March 2012

Distraction was present for 1118 events (23%)

- Cognitive: 27%
- Device: 10%
- Passenger: 30%
- External: 3%
- Inattentio: 15%
- n Dining: 3%
- Grooming: 3%
- In-vehicle: 2%
Results for 78 drivers suggest:

- Feedback significantly decreases event frequency relative to control for all driver groups
- School permit drivers saw a rebound in event rates after intervention ended
- Effect of experience
  - Inexperienced drivers tend to have more events in the initial baseline period
  - In the control condition, event rates are higher for inexperienced drivers after about 3 months of driving
  - In the feedback condition, inexperienced drivers tend to have more events

Data collection was completed on August 31, 2012 and all systems have been removed.

### Summary

Data collection was completed on August 31, 2012 and all systems have been removed.

<table>
<thead>
<tr>
<th>As of June 30, 2012</th>
<th>Completed (n=90)</th>
<th>In-Process (n=0)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedback</td>
<td>Control</td>
<td>Feedback</td>
</tr>
<tr>
<td>School Group (School License)</td>
<td>16</td>
<td>16</td>
<td>0</td>
</tr>
<tr>
<td>Inexperienced Intermediate Group (Intermediate License)</td>
<td>14</td>
<td>14</td>
<td>0</td>
</tr>
<tr>
<td>Experienced Intermediate Group (School License before Intermediate License)</td>
<td>15</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>45</td>
<td>45</td>
<td>0</td>
</tr>
</tbody>
</table>

Work being completed:
- Data coding of final events,
- Quality assurance of data,
- Data analysis,
- Report writing

[Image of text Continued]
40 to 50 teenage fatalities each year in Iowa from vehicular crashes.

While all states keep and analyze crash records, the amount of detail from each state varies. Specific crash-related factors may not reveal themselves in the overall state-based crash statistics.

Research includes

- Short case studies were developed for each fatal teen crash in Iowa.
- At the core of the investigations was the "Go-Team."
- This team consisted of experts in driver behavior and performance, Iowa crash data, traffic engineering, and logistics.
- The purpose of the Go-Team was simple and effective: begin the investigation of a crash with as much data as possibly available within a short timeframe, assembled from a team of experts proficient in examining the complex nature of a car crash.
Go Team project

- Driver of at least one of the vehicles involved under the age of 19 (did not include chain-reaction crashes).

- 88 Fatal crashes evaluated. Four of these included more than one teen driver. 29 full ejections and 8 partial ejections.

Go Team project

Number of drivers ages 14-19 involved in fatal crashes in Iowa

Number of drivers ages 16-18 involved in fatal crashes in Iowa

[Graph showing data]

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Fatal crashes involving teen drivers

Fatalities from crashes involving teen drivers

ABC Implementation

Iowa DOT new Policy
Technical Transfer/Training/Workshop
First Slide-In project scheduled for next spring.
Successful UDOT Research Projects

2012 UDOT Research Peer Exchange
2012 UDOT Annual Conference

Kevin P. Nichol, PE, MPA
Successful Projects

- Evaluation of UAV Technology
- Culvert Elements for Native Utah Fish Passage
- Construction Machine Control Guidance
- Wildlife Crossing Structures
- Measuring Benefits of Research
- Accelerated Bridge Construction
UAV Technology

Goal: Improve high-resolution imagery along highway corridors

- Monitor wetlands and invasive plant species
- Track construction projects
- Locate structures for inventories
UAV Technology

- Left Bay
  - GPS Receiver
  - Servo
  - Propeller
  - Elevons
  - Winglet

- Right Bay
  - RC Receiver
  - Servo
  - Winglet

- Main Bay
  - Modem & Retriever
  - Batteries
  - RGB Camera
  - Gumstix
  - NIR Camera
  - IMU

- Left Bay
- Right Bay
- Autopilot
UAV Technology
Native Fish Passage

Goal: Improve upstream passage through culverts of non-salmonid native fishes in an economical fashion.
Native Fish Passage – Phase I

Control

Substrate

Cylinders
Native Fish Passage – Phase I
Native Fish Passage – Phase II
Construction Machine Control Guidance
Developed guidance for design and construction
Refined an implementation process
Recommended project inspector training
Outlined survey control needs for design
Wildlife Crossing Structures

Goals:

* Identify preferred culvert and bridge designs for passing mule deer, elk, and wildlife
* Maintain wildlife connectivity and avoid vehicle collisions
Wildlife Crossing Structures

Elk at I-70 "Long Box Culvert" MP 6
Benefits of Research

Estimated benefits of research at UDOT:

- Estimated B/C ratio
- Feedback on process/direction

Reviewed research projects from 2006 to 2008:

- Evaluated and classified 41 projects
- Interviewed key champions to quantify implementation
- Compiled and calculated B/C ratio
- Determined greatest payback per classification
Benefits of Research

46 deliverables benefit-cost (17:1)
* 46 deliverables were produced
* $4.81 million cost of projects
* $80.8 million of estimated benefit
* Highest benefits achieved by studies on big ticket items:
  * Highways, bridges, traffic control, and right-of-way
  * Safety studies also show significant returns
* Portion of Research Division resources dedicated to implementation
Accelerated Bridge Construction

http://www.youtube.com/watch?feature=player_detailpage&v=gInuHGcjf24
SDDOT Research Implementation Process

Daris Ormesher
South Dakota DOT

SDDOT Implementation Process

- Research Process
- Implementation Process
- Implementation Example
Research Review Board

n Secretary of Transportation
n Division Directors
  – Planning and Engineering
  – Operations
  – Finance
n SDDOT Region
n Federal Highway
n County
n South Dakota Board of Regents

SDDOT Research Roles

n **Research Review Board:** set priorities, approve funding, decide implementation
n **Office of Research:** manage and perform research; chair technical panels; administer research program; maintain research library; coordinate LTAP; coordinate with other state and national research programs
n **Technical Panels:** define, monitor and evaluate research; recommend implementation
n **Universities & Consultants:** suggest & perform research
Research Process Phases

- Conception: Identify improvement opportunity
- Definition: Confirm need, define scope
- Execution: Perform research
- Implementation: Put research into practice
- Tracking: Monitor implementation progress
- Evaluation: Estimate value of research projects & program

Research Conception

- Suggester
- Suggestion
- Office of Research
- Research Review Board
- Research Opportunities Meeting
- Office of Research
- Technical Panel & Project Manager
Research Definition

Research Execution
SDDOT Research Process
David Hu4, Research Program Manager

Implementation

Tracking & Evaluation

Implementation Actions

Secretary's Directives, Implementation Plan

SDDOT Office of Research

Implementation Report

Implementation Valuation

Research Review Board
Projects Implemented

- Well Defined Projects
- Upper Management Support
- Materials Related
- DOT Only Projects

SD2008-08 Implementation Plan
SD2008-08 Implementation Plan

n Version History
n Implementation Plan Approval

1 Version History

<table>
<thead>
<tr>
<th>Version #</th>
<th>By</th>
<th>Revision Date</th>
<th>Approved By</th>
<th>Approval Date</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>SD2008-08</td>
<td>07/06/2011</td>
<td>SDOT Research Review</td>
<td></td>
<td>Original Version</td>
</tr>
</tbody>
</table>

n Research Summary
– Research Summary
– Research Objectives and Outcomes
  < Assess FHWA LRFD Specifications
  < Recommend Refinements
– Research Products
  < Executive Summary
  < Final Report
  < Load Test Database
  < Implementation Plan
## Implementation Plan

### Target Audience

<table>
<thead>
<tr>
<th>Organization</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDDOT Foundations Section</td>
<td>The Foundations Section will have to establish a load testing plan, incorporate load testing provisions in construction plan sets, and revise procedures for deep foundation design.</td>
</tr>
<tr>
<td>SDDOT Bridge Design Program</td>
<td>Bridge Design will need to incorporate revised resistance factors into substructure design procedures to reflect revised procedures for deep foundation design.</td>
</tr>
<tr>
<td>SDDOT Local Transportation Programs</td>
<td>Local Transportation Programs must be informed of modifications to construction plans, pile driving, and load testing procedures, review relevant construction.</td>
</tr>
</tbody>
</table>

## Implementation Approach

### Implementation Recommendation

- **Implemented Recommendation (Approved by RRB 11/04/2010)**
  - The Foundation Section and the Bridge Office should update current procedures for serviceability design
  - The Foundation Section will formally analyze
### Implementation Roles and Responsibilities

<table>
<thead>
<tr>
<th>Task or Milestone Name</th>
<th>Responsible Office(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze serviceability limit state</td>
<td>Foundations Section, Bridge Design</td>
</tr>
<tr>
<td>Analyze lateral pile performance</td>
<td>Foundations Section, Bridge Design</td>
</tr>
<tr>
<td>Analyze pile grouping effects</td>
<td>Foundations Section, Bridge Design</td>
</tr>
<tr>
<td>Use Grade 50 in Lateral Load</td>
<td>Bridge Design</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task or Milestone Name</th>
<th>Responsible Office(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identify supplemental funding sources</td>
<td>SD Division, Federal Highway Administration</td>
</tr>
<tr>
<td>Develop load test specifications</td>
<td>Foundations Section, Research Consultant</td>
</tr>
<tr>
<td>Select load test projects</td>
<td>Foundations Section</td>
</tr>
<tr>
<td>Perform load tests</td>
<td>Construction Contractors, Research Consultant</td>
</tr>
</tbody>
</table>

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### Implementation Schedule

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze serviceability limit state</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze lateral pile performance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Analyze pile grouping effects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Grade 50 in Lateral Load Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Grade 50 in Vertical Load Analysis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employ undisturbed sampling</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establish research project</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Identify supplemental funding sources</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Develop load test specifications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Select load test projects</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perform load tests</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recalibrate resistance factors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate pile capacity formulas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluate GRLWEAP driveability model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refine GRLWEAP driveability model</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Needed Resources

<table>
<thead>
<tr>
<th>Resource</th>
<th>Estimated Cost</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load testing services by contractors; 3 projects per year average for 5 years, $150,000 per project</td>
<td>$2,250,000</td>
<td>Federally-sponsored; Special funding to support pile load testing from FHWA</td>
</tr>
</tbody>
</table>
## Needed Resources

| SDDOT staff & me for engineering and research management | $175,000 | Project funding; State Planning & Research funds from SDDOT Office of Research |

## Evaluation

<table>
<thead>
<tr>
<th>Task or Milestone Name</th>
<th>Progress</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze serviceability limit state</td>
<td>This action is planned July, 2011.</td>
<td>0%</td>
</tr>
<tr>
<td>Analyze lateral pile performance</td>
<td>This action is planned July, 2011.</td>
<td>0%</td>
</tr>
<tr>
<td>Analyze pile grouping effects</td>
<td>This action is planned July, 2011.</td>
<td>0%</td>
</tr>
<tr>
<td>Use Grade 50 in Lateral Load Analysis</td>
<td>This action is planned July, 2011.</td>
<td>0%</td>
</tr>
</tbody>
</table>
## Evaluation (continued)

<table>
<thead>
<tr>
<th>Establish research project</th>
</tr>
</thead>
<tbody>
<tr>
<td>The SD2008-08 technical panel has developed a Research Project Statement entitled <em>Technical Support for SDDOT’s Pile Load Testing Program</em> for presentation to SDDOT’s Research</td>
</tr>
<tr>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Develop load test specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Foundations Section is working with Dr. Allen Jones and Dr. Lance Roberts to develop an initial Special Provision for load testing.</td>
</tr>
<tr>
<td>60%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Three projects—SD 65 over the Grand River in Corson County,</th>
</tr>
</thead>
</table>

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## Evaluation (continued)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Progress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform load tests</td>
<td>0%</td>
</tr>
<tr>
<td>Recalibrate resistance factors</td>
<td>0%</td>
</tr>
<tr>
<td>Evaluate pile capacity formulas</td>
<td>0%</td>
</tr>
<tr>
<td>Evaluate GRLWEAP driveability model</td>
<td>0%</td>
</tr>
<tr>
<td>Refine GRLWEAP</td>
<td>25%</td>
</tr>
</tbody>
</table>

## Criteria for Evaluation Effect on Practice

<table>
<thead>
<tr>
<th>Impact Area</th>
<th>Potential Impact</th>
<th>Method of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>Savings in pile length, number, and cost due to more efficient foundation designs</td>
<td>Estimated savings in pile cost compared to current designs.</td>
</tr>
<tr>
<td>Product &amp; Service</td>
<td>Improved reliability in foundations</td>
<td>Subjective evaluation, as quantitative</td>
</tr>
</tbody>
</table>
### Criteria for Evaluation Effect on Practice

<table>
<thead>
<tr>
<th>Impact Area</th>
<th>Potential Impact</th>
<th>Method of Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td>Enhanced public safety deriving from improved foundation reliability</td>
<td>Subjective evaluation, as quantitative estimates are not practical</td>
</tr>
<tr>
<td></td>
<td>Reduced material</td>
<td>Subjective evaluation, as quantitative estimates are not practical</td>
</tr>
</tbody>
</table>

### Key Terms

- ENR Formula
- Grade 50 Steel
- GRLWEAP
- LRFD
- Pile Load Test
- PDA
Questions?

Daris Ormesher
SD Department of Transportation
700 East Broadway Avenue
Pierre, SD 57501-2586
605.773.3358
Daris.Ormesher@state.sd.us
Study of ITD’s Maintenance and Pavement Management Needs

Ned Parrish, Research Program Manager
Idaho Transportation Department

Presentation Outline

• Provide overview of the project
• Describe key factors to project success
• Present overview of implementation efforts
• Discuss factors that led to implementation success
• Summarize actions following implementation
• Questions
Project Background

- Project requested by Chief Engineer and Transportation Planning Administrator
- ITD Research Advisory Council selected project for funding in the fall of 2007
- Broad-based steering committee established that included staff from:
  - Highways, Planning, and Administration
  - Each district
- Project budget = $75,000

Research Conducted

- Reviewed ITD systems and practices for needs, gaps, and enhancements
  - Maintenance management
  - Pavement management
  - Financial management (AMS)
  - Geographic information systems
- Interviewed 40+ headquarters and district staff
- Gathered information about management systems and best practices in other states
Maintenance Management Findings

- Acquiring an MMS system is a top priority
- System must provide:
  ▫ Basic cost accounting and budgeting information
  ▫ Ability to analyze productivity rates and assess level of service for performance measurement
  ▫ Condition information and maintenance history for system assets/features
- System should be accessible to HQ and district staff and provide information at state, district, and shed levels
- Linkages needed to PMS, AMS, GIS, and other systems
- Ease of reporting and geographical display important

Estimated Costs for Maintenance Management System

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statewide software license and implementation</td>
<td>$1,500,000</td>
</tr>
<tr>
<td>Financial management system interface development</td>
<td>$500,000</td>
</tr>
<tr>
<td>Hardware (8 - 10 GPS units per district)</td>
<td>$300,000</td>
</tr>
<tr>
<td>User interface customization</td>
<td>$250,000</td>
</tr>
<tr>
<td>Training (train the trainer)</td>
<td>$150,000</td>
</tr>
<tr>
<td><strong>Total One-time Costs</strong></td>
<td><strong>$2,700,000</strong></td>
</tr>
<tr>
<td>Annual maintenance (~ 20% of license fee)</td>
<td>$300,000</td>
</tr>
</tbody>
</table>
Pavement Management Findings

• Current 20-year old system meets some department needs:
  ◦ Assesses need based on annual pavement condition surveys for submittal to Legislature
  ◦ Identifies deficient pavements using “worst-first” strategy

• System weaknesses:
  ◦ Lacks analysis tools needed to examine preservation treatment strategies
  ◦ System is centralized, requiring districts to request information from HQ

• District 6 pilot project has given the district some additional capabilities, but not intended to be a statewide system

Estimated Cost for New Basic Pavement Management System

<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software</td>
<td>$700,000</td>
</tr>
<tr>
<td>Customization and training</td>
<td>$250,000</td>
</tr>
<tr>
<td><strong>Total One-time Costs</strong></td>
<td><strong>$950,000</strong></td>
</tr>
<tr>
<td>Annual licenses</td>
<td>$50,000</td>
</tr>
</tbody>
</table>
Success Factor: The Research Addressed Key Problem Area

• No Maintenance Management System
  ▫ MMS was over 20 years old
  ▫ Decommissioned since July 2005 following acquisition of new financial system

• Limited Pavement Management System
  ▫ PMS was of similar age
  ▫ Available only to technical experts at HQ
  ▫ System would not connect to MMS or other related systems

Success Factor: Significant Support for the Study

• Project had high-level sponsors/champions
  ▫ Chief Engineer
  ▫ Planning Division Administrator

• Study supported by staff in HQ and districts
  ▫ Interest in better tools for analyzing pavement management options
  ▫ Desire for system to manage maintenance function
    ▪ Scheduling work
    ▪ Evaluating level of service
    ▪ Budget planning
Success Factor: Contractor Quality

- Selected contractor for the project through competitive RFP process
- The contractor selected, AP Tech, had substantial expertise
  - Experience working with a number of state DOTs
  - Knowledgeable of best management practices
  - Familiar with available commercial-off-the-shelf systems
- Contractor prevented from bidding on system development/implementation to help ensure objectivity

Success Factor: The Research Provided the Needed Information

- Documented limitations/weaknesses of existing systems
- Described agency needs and clearly articulated systems benefits
- Summarized best practices from other states
- Provided estimates for costs of systems acquisition and ongoing operations
- Included information about ROI from similar systems in other states
Success Factor: Study
Informed Audit
Recommendations

- **American Society of Civil Engineers (ASCE) Review**
  - Recommended acquisition of a new maintenance management system

- **Office of Performance Evaluations (OPE) Audit**
  - Recommended change from “worst-first” to “preservation-first” focus
  - Found ITD lacks necessary management systems for cost-effective highway program
  - Recommended Legislature appropriate $6 million for new MMS and PMS systems, integrated with AMS and GIS

Report Impact

- Research results presented to ID Transportation Board
- Information from the study discussed in ID Legislature
  - Joint Legislative Oversight Committee
  - House and Senate Transportation Committee
- Legislation passed increasing DMV fees with a portion of the initial revenues dedicated to systems acquisition and implementation
- Governor issued executive order directing ITD to implement new systems
Implementation Overview

- Project team established (3/09)
- Used research report in developing RFP (8/09)
- Agile Assets selected and contract signed (12/09)
- System goes live (12/10)
- Staff training provided (Spring/11)

- Project completed under budget

Success Factor: Team Structure

- The research sponsors continued to champion the project in the implementation phase
- ITD designated business leaders for each system
- Project Manager with experience in IT system implementation
- Vendor technical experts provided on site support
- Roles and expectations were clearly articulated
Success Factor: User Involvement

• Project team interviewed customers in HQ and districts to better understand systems needs.
• Communications continued throughout the process
  ▫ Weekly meetings of core team
  ▫ Monthly project status reports widely distributed
• Super users identified for each system in each district
• Super users and regular users involved in system testing and refinement

Subsequent Developments

• Similar review done of ITD’s aging LRS
  ▫ Funding received for a new system
  ▫ The system is currently under development
• ITD has continued to develop its asset management capabilities
  ▫ Added equipment management and fleet management modules
  ▫ Established Transportation Systems Section
• Currently developing tool similar to UDOT’s UPLAN
Questions?

For additional information:

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How Minnesota facilitates progressive research and implements innovative ideas

Utah DOT Peer Exchange and Research Conference
October 2012
By Nicole Peterson
MnDOT Research Management Engineer

Overview of MnDOT Program
MnDOT’s Core Business:
State highway maintenance, operations, design and construction; multimodal system support and development; and financial aid for local roads

http://www.dot.state.mn.us/strategicplan/

FY2012 Research Funds by Funding Source

- FHWA State Planning and Research (29%) $3,190,840
- State Research Program (30%) $3,284,000
- Local Road Research Board (27%) $2,902,378
- Cooperative Program for Transportation Research and Studies (3%) $363,000
- Other (10%) $1,117,087
- Total $10,857,305
FY2012 Research Funds by Topic Area

- 28% Administrative
- 26% Materials & Construction
- 16% Traffic & Safety
- 9% Policy & Planning
- 8% Bridge & Structures
- 6% Maintenance Operations & Security
- 4% Multimodal
- 2% Environmental

MnDOT Research Management

- Identifying and Tracking Needs
  - Internal and external collaboration
  - Our database and other tools
- Developing and Funding Projects
  - MnDOT Transportation Research and Innovation Group (TRIG)
  - Local Road Research Board
  - Other funding programs
- Project Execution
  - Technical Advisory Panel and project management roles
- Implementation
  - Facilitating growth
  - Marketing and outreach efforts
  - Tracking next steps
What Was the Need?

- Minnesota Division of Emergency Management estimated 142 fatalities caused by hazardous driving conditions associated with blowing & drifting snow between 1984 & 2002 (Average of 8 fatalities/year)

- By contracting 40 percent of sites with snow problems to the Living Snow Fences program, MnDOT could save $1.3 million per year. LSFs improve driver visibility and road surface conditions, and have the potential to reduce accidents, snow removal costs and removal equipment emissions.
MNDOT is paying farmers to leave standing corn as a snow fence in problem areas on state highways.

This Honeysuckle single row protects MN–Hwy 30.
Segments of roads with LSFs (right) have better driver visibility and road surface conditions than those without (left), leading to lower road maintenance costs and fewer accidents. LSFs can also benefit the atmosphere by storing carbon dioxide and reducing emissions from snow removal operations.

Evaluating the Costs and Benefits of Living Snow Fences

» Inducing landowners to participate in the LSF program has been difficult, and as of 2011 MnDOT had only used 12 percent of its LSF budget, obtaining contracts for just 2.3 percent of problem sites.

» The current level of payments offered to landowners may not be a sufficient incentive to establish and maintain LSFs, and research was needed to determine a payment structure that will increase adoption rates while remaining cost-effective.
What Was Our Goal?

The goal of this project was to develop a calculator for estimating optimal LSF program payments to landowners by identifying costs, benefits and obstacles to implementing the program.

MnDOT developed a calculator for estimating optimal LSF program payments to landowners by identifying costs, benefits and obstacles to implementing the program.

http://www.dot.state.mn.us/environment/livingsnowfence/cost-benefit.html

"Of about 3,800 possible LSF sites in Minnesota, not all have the same traffic, crash rates and snow problems. The tool developed in this project will allow personnel to prioritize LSF funding to target the most critical sites."

—Dan Gullickson
Living Snow Fence Program Coordinator
MnDOT Office of Environmental Stewardship

What Did We Learn?

Based on agency and landowner feedback, researchers recommend improving the LSF program in the following ways:

- Payments
- Prioritization
- Promotion
Evaluating the Costs and Benefits of Living Snow Fences

What’s Next?

» Modifications to our LSF program based on recommendations

» Researchers suggest that once MnDOT snowplows are fully equipped with GPS, resulting data should be used to quantify sand and salt applications to determine where snow fences are needed most and what impact they are having.

» Further research is also needed on the effectiveness of various plant species for use as LSFs

Evaluating the Costs and Benefits of Living Snow Fences

In the context of a research program...

» Highlights the spectrum of implementation and the need to understanding obstacles to implementing
What Was the Need?

- Residents often request these warning signs from their local governments to make their neighborhood streets safer
- Agencies aim to install only the most necessary road signs

What Was Our Goal?

This project’s objective was to evaluate the impact of playground warning signs on vehicle speeds at three locations in Bloomington, Minnesota. Since the state and federal editions of the Manual on Uniform Traffic Control Devices currently leave the placement of these signs to engineering judgment, the study results would help local engineers determine whether the benefits of the signs justify the costs.
Impacts of Playground Warning Signs on Vehicle Speeds

What Did We Learn?

» Installing playground warning signs did not have a large effect on average vehicle speeds at any of the three sites.

» However, researchers found that vehicle speeds were strongly related to levels of playground activity and parked cars.

» The impact of playground warning signs on vehicle speeds appeared to be site-specific. Researchers noted that some of the variability in the vehicle speed impacts is likely due to the differences in site characteristics and suggested that it may also be affected by subjective differences in how the field personnel categorized on-street parking levels for the study.
Impacts of Playground Warning Signs on Vehicle Speeds

What’s Next?

» Use this research


Impacts of Playground Warning Signs on Vehicle Speeds

In the context of a research program...

» Equipping practitioners at all levels of government with information to make better decisions in response to citizen requests.
Standard Sums and the SAFL Baffle as Economical Solutions for Stormwater Treatment

What Was the Need?

» Minimize the effects of stormwater runoff on regional surface waters and groundwater
» Effectively remove sediments using significantly cheaper standard sumps, which are cylindrical tanks that are already a common feature of stormwater infrastructure
» Comply with federal and state environmental regulations

What Was Our Goal?

The goal of this project was to evaluate the effectiveness of standard sumps for stormwater management, including sumps retrofitted with the SAFL Baffle, a device designed to increase the effectiveness of sumps for removing and retaining sediments from stormwater runoff.
Tests of the SAFL Baffle showed that it dissipated the energy of water entering the sump.

Improving sediment capture by 10 percent to 15 percent and decreasing washout by a factor of 16, to nearly zero at high flow rates.

Shallow sumps with baffles clogged by debris had significant washout, but this can be mitigated by increasing baffle hole diameters.

Washout was also high in sumps with outlet pipes angled at 90 degrees to inlet pipes, but could be decreased by installing the baffle at an angle of 90 to 120 degrees to the inlet pipe.

Additionally, researchers developed recommendations for using the SAFL Baffle in sumps receiving water from both inlet pipes and grates.

Typical baffles are impermeable, leading to a circulation of water that washes sediment out of sumps. The SAFL Baffle developed by the St. Anthony Falls Laboratory is porous, distributing the jet flowing from the inlet pipe more evenly across the sump, reducing its maximum velocity and so virtually eliminating washout.
Standard Sumps and the SAFL Baffle as Economical Solutions for Stormwater Treatment

What’s Next?

» Continue to share the results

» Upstream Technologies manufacturing the SAFL Baffle (www.RevolutionaryBaffle.com)

» Software has been developed by Barr Engineering for sizing sump manholes and SAFL Baffles, as well as many of the hydrodynamic separators (https://www.barr.com/WhatsNew/SHSAM/SHSAMapp.asp)

In the context of a research program...

» Demonstrates the need to work collaboratively through the development process to optimize the commercialization potential of products.
For More Information about MnDOT’s Research Services

http://www.dot.state.mn.us/research/index.html

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Also, take a look at our MnDOT Library resources:
http://www.dot.state.mn.us/library/
IMPLEMENTATION OF RESEARCH RESULTS AT MDT

Sue Sillick
Montana Department of Transportation
October 2012

Organizational Structure
MDT Organization

RESEARCH PROGRAMS

MDT Organization

RESEARCH PROGRAMS
Research Staff

Research Programs Manager
Sue Sillick

Research Projects Manager
Kris Christensen

Experimental Projects Manager
Craig Abernathy

Librarian
Katy Callon

RESEARCH PROGRAMS

Funding

SPR
2013 Federal Funding $1.8 M; $2.3 M Total (est.)
Planning – Project by Project

Earmark Funding
FHWA and other USDOT Administrations
Amount Varies on an Annual Basis
Currently ~ $1.2 M

Pooled---Fund Studies
TPF---5(251); $636,000; MT $150,000
Guiding Principles

Target MDT Needs
  Department---Wide, Multi/Inter---Modal Focus
  Answer Questions/Solve Problems
Direction Set by MDT’s Executive Management
Strong Focus on Customer
Focus on Applied, Implementable Research
Define “Research” and “Implementation” Broadly

RESEARCH PROGRAMS

Guiding Principles

Focus on Business Case, Implementation, and Technology Transfer
Involve Stakeholders (Internal and External) to Facilitate Implementation
Provide Necessary Resources
Continuous Process and Program Improvement

RESEARCH PROGRAMS
Research Programs

Research Projects
Experimental Projects
Technology Transfer

Research Projects Program

Purpose
Research projects provide solutions to MDT’s problems and improve efficiency and effectiveness of operational activities.

Benefits
Solves Problems – Answers Questions
Objective Reporting of Results
Improves Operations Efficiency and Effectiveness


Research Projects Program

Research Review Committee (RRC)
Director, Deputy Director, Division
Administrators, District Rep, FHWA, WTI,
Research Manager (12 members)
Determines MDT’s High Priority Research Needs
and which Topics Forward to Technical Panels
Approves Research Projects (SOW and Proposal/
Funding)
Reviews Progress and Implementation
Recommendations

RESEARCH PROGRAMS

Research Projects Program

Technical Panel
Critical for Success
One for each Research Project (Champion,
RPM, Stakeholders, Implementers)
Oversees Research Project from Idea through
Implementation
Determines Need for Research

RESEARCH PROGRAMS
Research Projects Program

Technical Panel
Determines Products Necessary for Implementation
Develops Scope
Determines Appropriate Venue for Research
Reviews Project Progress
Makes Implementation Recommendations

RESEARCH PROGRAMS

Research Projects Program

Implementation
Consider Implementation from the Beginning and Throughout Each Project
- Research Topic Statement
- Champion
- Sponsor
- Technical Panel
- Research Project Statement
- Scope of Work

RESEARCH PROGRAMS
Research Projects Program

Implementation

Consider Implementation from the Beginning and Throughout Each Project

- Proposal
- Reports
- Consultant Recommendations
- Technical Panel
- Recommendations RRC
- Recommendations

Implementation Summary

- Management Involvement and Support
- Involve the Right People
- Excited Champions/Implementers
- Communication, Coordination, & Collaboration
- Consider Implementation from the Beginning and Throughout Each Project
Research Projects Program

Implementation Summary

- ID implementation Barriers; Reduce or Eliminate Barriers
- Develop Products Necessary for Implementation
- Provide the Tools and Funding to Accomplish Implementation

Research Projects Program

Implementation Challenges

- Follow---Up
- Formalize Process
- Need Additional Tools

Implementation Future

- UDOT Peer Exchange Lessons Learned
- RAC Survey
- Tool Development
- Develop Implementation Action Plan
- Present Plan to MDT and FHWA MT Division Implement the Action Plan
Research Projects Program

⭐ Implementation Examples

⭐ Montana Rest Area Design
  ⭐ Design Document Applicability to MT Rest Areas Questioned
  ⭐ Usage Evaluated
    ⭐ Water Usage
    ⭐ Effluent Flow
    ⭐ Pedestrian Traffic
    ⭐ Vehicle Traffic Counts and Classification
    ⭐ Vehicle Dwell Times for Commercial and Passenger Vehicles
  ⭐ 10 Design Guidelines Developed

⭐ Dena Mora Rest Area
  ⭐ Required Rehabilitation of Wastewater System
    ⭐ 50,000 gallons reduced to 10,000
    ⭐ $1.5 M Estimate Reduced to $0.8 M
  ⭐ Improved Environmental Stewardship
  ⭐ Reduced Overall Lifecycle Costs
  ⭐ 5 Other Sites
  ⭐ 1 New Rest Area (2013) Designed with New Guidelines
  ⭐ Improved MT DEQ Review Time
  ⭐ Monitoring Equipment Part of the Construction Bid
Montana Rest Area Design
- Management Involvement and Support
- Excited Champion/Implementers
- Involve the Right People
- Coordination & Collaboration
- Occurred
- Implementation Considered from the Beginning
- Products Necessary for Implementation Developed
- Tools and Funding Provided to Accomplish Implementation

Portable Concrete Barrier
- Problem Identified by Construction
- Chief Engineer Notified; Requested Research Support
- Two---Pronged Approach
  - Synthesis Research Project
  - Condition Inventory, Analysis, & Prioritization to District Administrators
Research Projects Program

⭐ Implementation Examples

⭐ Portable Concrete Barrier
⭐ Management Involvement and Support
⭐ Excited Champion/Implementers
⭐ Involve the Right People
⭐ Communication, Coordination, & Collaboration Occurred
⭐ Implementation Considered from the Beginning
⭐ Products Necessary for Implementation Developed
⭐ Tools and Funding Provided to Accomplish Implementation

⭐ Ride Specification Review
⭐ Compare MDT Practice with the State of the Practice
⭐ Developed
⭐ Test Method for Surface Smoothness and Profile
⭐ QC/QA Manual for MDT Profiling
⭐ Profiler Operations Manual
⭐ Ride Specification for Flexible Pavements
⭐ Detailed Implementation Activities and
⭐ Timeframe Final Report
⭐ Project Summary Report
Research Projects Program

- Implementation Examples
  - Ride Specification Review
    - Added Two Ride Specification
    - Classifications Changed Pay Adjustment
    - Factors Proactive contractor Education
    - Field Profiling Personnel Training
Research Projects Program

Implementation Examples

- Temporary Erosion and Sediment Control Measures

Research included:

- State of the Practice User Survey
- Organizational Structure Review

Products included:

- Reference Manual
- Field Manual
- BMPs -- Fact Sheets & Detail Drawings
- Training Program
- Users Survey Report
- Organization Structure Survey Report
Research Projects Program

★ Implementation Examples
★ Temporary Erosion and Sediment Control Measures
★ Conducted a Two-Year Implementation Review
★ Added E&SC Staff in HQ & Each District
★ Established an E&SC BMP Rate Schedule Committee
★ Revised Construction Manual to Include BMPs
★ MDT and Contractor Staff Using Field and Reference Manuals
★ Continued Use of Training
Experimental Projects Program

**Purpose**
- Experimental projects allow the testing of new materials and methods in association with a construction or maintenance project.

**Benefits**
- Objective Reporting of Results
- Allows the Specification of Proprietary Products w/o a PIF
- FHWA Participation if Premature Failure Occurs
- Can use 100% Federal Funds

**Conducted in---house, by Experimental Projects Manager**
- Facilitates Experimental Design
- Writes Work Plan
- Obtains FHWA Approval of Work Plan
- Participate in all Project Meetings
- Evaluates Performance
- Writes Reports to Document Results
Experimental Projects Program

- Annual meeting
  - Includes Design, Construction, Maintenance, District (Field Research Coordinators)
  - Communicate Information on Current Experimental Projects
    - Project status
    - Performance
    - Available reports
    - Construction and/or performance issues
    - Implementation
  - Feedback loop

Research Projects Program

- Performance Measures
  - Number of Topic Statements and Disposition
  - Number of Projects and Project Status
  - Expenditures by Subject Area and Type of Project
  - On Time, Budget, and Scope
  - Cost Sharing/Partnering – Leveraging Funds
  - Overhead Costs
Research Projects Program

- Performance Measures
  - Technical Panel Exit Survey
  - Project Reporting
  - Number of Publications Resulting from Project Implementation
  - $ saved
  - NCHRP 20---63 Tool

Questions?

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