Transportation Excellence Through Research

Research Impacts:

Better – Faster – Cheaper

November 2009

*This document is the 2009 collection of High Value Research highlights from across the nation. These highlights were compiled for the AASHTO Research Advisory Committee summer meeting and showcase projects that are providing "**Transportation Excellence Through Research**."*

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Federal Highway Administration

Adaptive Control Systems – Lite Traffic Signal Timing Solution for Medium and Small – Sized Communities

Submitter	***Agency**: Federal Highway Administration (FHWA), Office of Corporate Research, Technology, & Innovation Management* ***Contact:** Joe Conway, Director, Communications & Outreach* ***Email:** joe.conway@dot.gov*
Research program	*Sponsoring agency or organization.* *Federal Highway Administration*
Project Title, ID, Cost, Duration	*Title: Adaptive Control Systems - Lite* *Traffic Signal Timing Solution for Medium and Small-Sized Communities* *Report number: FHWA-HRT-06-083* *Project Cost:* *Project Duration:*
Weblink, if available	*http://www.tfhrc.gov/its/pubs/acsl/index.htm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	**Adaptive Control Software (ACS) Lite** is a traffic signal timing technology that was created to improve traffic flow in small and medium size communities by adjusting signal timing to accommodate changing traffic patterns. The technology works within a *closed loop system*; however, the software is placed on a system-customized Central Processing Unit (CPU), which is located in a local traffic signal controller cabinet. The software then continuously monitors the signals and the flow of traffic and adjusts signal timing accordingly. The average improvements to traffic flow observed in field tests on typical weekday shows a 22 percent reduction in travel time, and over 4,000 gallons of fuel savings per intersection annually. Testing in Florida and other locations around the country have shown an estimated roadway user cost savings from $88,000 to $757,000 annually. In addition, this technology is easily deployable, compatible with existing closed loop systems and can be installed at a low cost. This technology is currently be used in the following states: Ohio, California, Texas and Florida How Can I Obtain ACS Lite? ACS Lite is available from the following vendors: Eagle, Econolite, McCain, Peek, and Siemens. The software was designed to work with these brands of traffic signal systems. A locality currently using a Peek system should contact Peek, for example, while one using Eagle should contact Eagle, and so forth. For contact information, see list at the end of this brochure.

Kansas Department of Transportation

Development of a Vertical Face Barrier for Temporary or Permanent Use on a Bridge or in Work Zones

Submitter	*Kansas Department of Transportation* *Dave Meggers, Research Development Engineer.* *dave.meggers@ksdot.org* *785-291-3845*
Research program	*Federal Highway Administration, Innovative Bridge Research and Construction Program*
Project Title, ID, Cost, Duration	*Title: Development of a Vertical Face Barrier for Temporary or Permanent Use on Bridge Deck or in Work Zones.* *Report number: There is no report number yet.* *Project Number: IBRC-R033(001): RE-0330-01* *Project Cost: Approximately $150,000* *Project Duration:7 years*
Weblink, if available	Not available at this time.
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	 This project began in 2002 with the goal in mind of developing a Fiber Reinforced Polymer (FRP) Bridge Rail for applications on a FRP bridge deck. It was soon obvious that FRP bridge rails were not economical or functional. The focus then shifted to developing bolted connections to an FRP deck with steel thrie beam bridge rails and Safety Shape barriers. The thrie beam connection was done quickly and easily but the safety shape required significant preliminary evaluation previous to a full-scale crash test at the University of Nebraska-Lincoln (UNL) Midwest Roadside Safety Facility. The initial crash test with the Modified F Concrete Safety Shape failed due to a rollover of the test vehicle after impact. This is a typical failure of the F-Shape. After discussion and preliminary modeling a new improved vertical face barrier shape was designed that would work for the FRP deck applications as well as other applications for General Public Safety. A significant amount of time was spent designing, evaluating, and manufacturing sections of the vertical faced barrier. The new vertical barrier was a combined effort between the Kansas Department of Transportation, B G Consultants, and UNL. The new barrier was tested under MASH 2008 requirements on Friday March 13th, 2009 with successful results.

Maine Department of Transportation

Composite Bridge Application in Maine

Submitter	*MaineDOT* *Submitted by Dale Peabody* *Phone: 207-624-3305* *Email: dale.peabody@maine.gov*
Research program	*FHWA's Innovative Research & Construction Program, NCHRP IDEA Program, Maine Technology Institute, State TransCap Program*
Project Title, ID, Cost, Duration	*Title: Composite Bridge Applications in Maine* *Report number: n/a* *Project Cost: n/a* *Project Duration: n/a*
Weblink, if available	Not available at this time.
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Maine DOT is partnering with the Maine Composite Alliance and the University of Maine to develop composite applications in transportation leading to business development and job creation. Maine Dot's interest is development of economical composites applications. Two projects are highlighted in this summary. The first is the Fiber Reinforced Polymer-Arch bridge or "Bridge in a Backpack". On Neal Bridge in Pittsfield, Maine, FRP-arches were manufactured, delivered to the bridge site and placed with small equipment. The arches are filled with concrete and tied together with FRP decking. A concrete fill is placed over decking for lateral stability and the arch structure backfilled. Estimates show this structure was around 10% more costly than a conventional precast concrete arch. A Maine company is being formed that will manufacture and further economize this technology. Maine DOT plans to construct four to six more of these bridges in the next two years. The second project will utilize a hybrid composite beam (HC Beam) on a 540 ft. long, 8 span bridge in Boothbay, Maine. This unique beam consists of a composite outer rectangular shell, a concrete inner arch and tension reinforcing steel. The beam can be designed and detailed to replace conventional steel and concrete beams with concrete deck slab at a competitive cost. The HC Beam has been developed by a structural engineer in Chicago and full scale tested at UMaine. Harbor Technologies of Maine is the beam manufacturer.

Mississippi Department of Transportation

Hot Mix Asphalt (HMA Characterization for the 2002 AASHTO Design Guide

Submitter	*Mississippi Department of Transportation* *Research Division* *William (Bill) Barstis* *wbarstis@mdot.state.ms.us*
Research program	*Federal Highway Administration* *Mississippi Department of Transportation*
Project Title, ID, Cost, Duration	*Title: Hot Mix Asphalt (HMA) Characterization for the 2002 AASHTO Design Guide* *Report number: FHWA/MS-RD-07-166* *Project Cost: $115,000* *Project Duration: October 1, 2002 - December 31, 2007*
Weblink, if available	*http://www.gomdot.com/Divisions/Highways/Resources/Research/pdf/Reports/InterimFinal/SS166.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	The two study objectives were to conduct dynamic modulus and APA rutting tests of selected Mississippi HMA mixtures. Twenty-five mixtures were tested including aggregate combinations of gravel and gravel/limestone; 9.5mm, 12.5mm and 19.0mm NMAS gradations; asphalt binder grades of PG 67-22, PG 76-22 and 82-22; and compaction Ndesign levels of 50, 65 and 85. Sample preparation proved to be problematic. Target air void content for the dynamic modulus samples was 7.0±0.5 percent, however air voids for a given compaction level can vary with gradation, aggregate type, asphalt content and mass of mix compacted. Another problem is the density gradient of Superpave gyratory compacted cylindrical samples. Developers of the test method minimized the density gradient by cutting a 100mm core from the original 150mm sample. To achieve the target air void content for cored dynamic modulus test specimens, the 150mm samples were compacted to an air void level of approximately 8.0±0.5 percent. Due to uncertainty in the air void level being produced, four to five 150mm samples of a mixture were compacted with a goal of producing three with the target air void level. The cored 100mm diameter test specimens were checked that the target 7.0±0.5 percent air void level was achieved. In some cases, new samples and cored specimens had to be prepared with an adjusted air void level. Results of the study were parameters of the fitted sigmoid functions and associated shift factors of the master curve for twenty-five HMA mixtures. MDOT will use these functions to estimate HMA dynamic modulus as input for calibrating the 2002 pavement design guide.

Missouri Department of Transportation

Early Permeability Test for Asphalt Acceptance

Submitter	Mara Campbell MoDOT Organizational Results Director Missouri Department of Transportation 2217 St. Mary's Blvd/PO Box 270 Jefferson City, MO 65102 (573) 526-2908 Fax (573) 526-4337
Research program	*Organizational Results Division of the Missouri Department of Transportation*.
Project Title,	***Title:*** *Early Permeability Test for Asphalt Acceptance*
ID, Cost,	***Report number:*** *OR09-017*
Duration	**Project Cost:** $71,174.87 **Project Duration:** December 1, 2007 thru March 5, 2009
Weblink, if available	*http://library.modot.mo.gov/RDT/reports/Ri07053/or09017.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	One of the primary assumptions in structural pavement design for conventional pavements is that a flexible (hot-mix asphalt) pavement be impermeable. The basis for this design approach is to minimize moisture infiltration and thus maintain adequate support from the underlying unbound materials. In recent years, with the implementation of the Superpave mix design system, hot-mix asphalt (HMA) pavements have been produced with coarser gradations than previously achieved with the Marshall mix design method. A non-destructive method, such as permeability testing, also has the potential to partially characterize the HMA quality more timely than destructive methods, and not leave imperfections in a newly constructed pavement. This study identified the nominal maximum aggregate size, the theoretical maximum specific gravity of the mixture (Gmm), and thickness of the pavement or core as statistically important factors influencing permeability and air voids. Three methods of permeability testing were identified as viable: the Kentucky Air Permeameter, the Karol-Warner Permeameter, and the NCAT Permeameter. This report recommends utilizing an NCAT Permeameter for field testing as part of the quality assurance/quality control process.

National Cooperative Highway Research Program

Highway Maintenance Quality Assurance

Submitter	*Crawford Jencks* *National Cooperative Highway Research Program (NCHRP)* *Transportation Research Board (TRB)* *cjencks@nas.edu*
Research program	*The NCHRP is administered by the TRB and sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA).*
Project Title, ID, Cost, Duration	*NCHRP Project 17-17 & 17-17(02), "Development of Guidelines for Nighttime Road Work to Improve Safety and Operations"* *NCHRP Report 475: A Procedure for Assessing and Planning Nighttime Highway and Construction and Maintenance* *NCHRP Report 476: Guidelines for Design and Operation of Nighttime Traffic Control for Highway Maintenance and Construction* *CRP-CD-50: Training Materials for Night Road Work to Improve Safety and Operations* *Project Cost: $472,000* *Project Duration: Phase 1-44 months; Phase 2-44 months*
Weblink, if available	*http://www.trb.org/NotesDocs/NCHRPImpacts_475.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Work zones pose safety problems for both motorists and workers. While work zones result in significant amounts of congestion and associated delay, lead to accidents and related losses, cause adverse impacts on communities and business, and increase driver frustration, the need to construct new highway facilities, preserve existing roadways, and perform maintenance make work zones unavoidable. Growth in traffic volume has led many agencies to defer roadwork activities to off-peak hours to avoid congestion. Nighttime work, however, raises additional safety problems. Some guidance and minimum requirements for dealing with these situations are provided in the *Manual on Uniform Traffic Control Devices* (MUTCD), but are not considered sufficient for the planning, design, implementation, and operation of roadwork at night. The research resulted in (1) enhanced guidelines for nighttime roadwork, (2) case studies to verify the applicability and demonstrate the flexibility of procedures, and (3) a fully self-contained training package to introduce the Procedures and Guidelines.

National Cooperative Highway Research Program

Investigation of the Restricted Zone in the Superpave Aggregate Gradation Specification

Submitter	*Crawford Jencks* *National Cooperative Highway Research Program (NCHRP)* *Transportation Research Board (TRB)* *cjencks@nas.edu*
Research program	*The NCHRP is administered by the TRB and sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA).*
Project Title, ID, Cost, Duration	*NCHRP Project 09-14, "Investigation of the Restricted Zone in the Superpave Aggregate Gradation Specification"* *NCHRP Report 464: The Restricted Zone in the Superpave Aggregate Gradation Specification* *Project Cost: $500,000* *Project Duration: 36 months*
Weblink, if available	*http://www.trb.org/NotesDocs/NCHRPImpacts_464.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	The recommended aggregate properties and criteria that appeared in the original Superpave mix design method included a restricted zone along the maximum density gradation between the intermediate size and the 300-micrometer size. The original basis for inclusion of the restricted zone requirement was to help reduce the incidence of tender or rutting-prone paving mixes. The restricted zone was presented in the Superpave mix design system as a recommended guideline and not a required specification, but it was commonly interpreted as being based on experience and appropriate to use, if at all possible, to produce acceptable paving mixes. Research determined, through evaluation of the performance properties of hot mix asphalt (HMA), that the restricted zone requirement in the Superpave mix design method was redundant with fine aggregate angularity (FAA) and volumetric mix criteria. The research team concluded that the restricted zone requirement is not necessary to ensure satisfactory performance when all other relevant Superpave design requirements are met; the recommended change to AASHTO MP2 was adopted by the AASHTO Highway Subcommittee on Materials.

New Hampshire Department of Transportation

Ground Vibrations Emanating from Construction Equipment

Submitter	*New Hampshire Department of Transportation* *Glenn Roberts, Chief of Research* *groberts@dot.state.nh.us*
Research program	*New Hampshire Department of Transportation*
Project Title, ID, Cost, Duration	*Ground Vibrations Emanating from Construction Equipment* Report No: FHWA-NH-RD-12323W *Project Cost - $20,000 (24 months)*
Weblink, if available	*Available soon*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Highway construction within New Hampshire has trended toward increased reconstruction and rehabilitation projects in congested urban areas. This has resulted in a greater concern for vibrations generated by non-blasting construction activities, a greater potential for complaints or damage, and an increased need to monitor vibrations during construction. NHDOT researchers developed a Vibration Assessment Impact Rating Procedure to gauge the impact of construction-induced vibrations at project sites. The procedure enables assessments to be conducted for each type of vibration-producing activity anticipated during a project in relation to various types of man-made structures and vibration sensitive operations onsite. A variety of non-blasting construction activities were investigated including vibratory compaction, excavation and splitting of rock with a hoe-ram, sheet pile driving, pavement breaking, demolition, track mounted vehicles and heavy construction traffic. Vibration assessments compare different construction activities at the same site or the potential impact of an activity at one site versus the same activity at another site. Data are collected, stored and tracked in a database. The vibration assessment procedure and database allow for development of preliminary cost estimates for vibration monitoring services and provide a resource for decision-making during various phases of NHDOT projects. Procedures are modified and refined as more data becomes available.

Wisconsin Department of Transportation

Wisconsin High – Speed Rail Peer Exchange

Submitter	Wisconsin Department of Transportation *Daniel Yeh* *E-mail: daniel.yeh@dot.wi.gov* Phone: (608) 267-6977
Research program	*Wisconsin Department of Transportation*
Project Title, ID, Cost, Duration	*Wisconsin high-speed rail peer exchange* *Report number TBD (not yet completed)* *Project cost: $10,000* *Event date: June 2-4, 2009*
Brief summary of the research project and potential impact, of implementing research results	Concept and need For many years, Wisconsin has undertaken planning for high-speed passenger rail service, but there has never been funding to expand service beyond the Chicago-Milwaukee corridor. The American Recovery and Reinvestment Act (ARRA) has finally provided a capital program for high-speed rail. Wisconsin is looking to receive about $400 million to initiate service from Madison to Milwaukee. Although funding may be available, there is currently little experience in WisDOT to build, maintain or operate a rail service. WisDOT's Research Program offered a peer exchange for the department to tap the expertise of states, agencies and private entities with more experience in passenger rail issues. Participants The event involved about 40 people for a three-day session to review key elements of constructing, financing, operating, maintaining and supporting high-speed rail service: • WisDOT and state staff from construction, environmental, utility, planning and other disciplines; • The Federal Railroad Administration; • Local government agencies; • Freight railroads; and • Other state departments of transportation. Findings and future results Findings from the event are still being compiled into several categories of best practices and lessons learned: • Agency coordination; • Communication; • Contracting; • Grade crossings; • Ongoing resource needs; • Operations; • Station development; and • Utilities. The findings of the peer exchange will greatly assist WisDOT in establishing a passenger rail program not only to address the initial Madison-Milwaukee project, but to ensure long-term stability for operation and maintenance and to deliver future projects.

FASTER
Transportation through research

Federal Highway Administration

Geosynthectic Reinforced Soil Bridge Abutments

Submitter	***Agency**: Federal Highway Administration (FHWA), Office of Corporate Research, Technology, & Innovation Management* ***Contact:** Joe Conway, Director, Communications & Outreach Team,* ***Email:** joe.conway@dot.gov*
Research program	*Sponsoring agency or organization.* *FHWA,*
Project Title, ID, Cost, Duration	*Title: Geosynthectic Reinforced Soil Bridge Abutments* *Report number: FHWA-RD-01-118* *Project Cost:* *Project Duration:*
Weblink, if available	*http://www.tfhrc.gov/about/geotech.htm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	**Geosynthetic Reinforced Soil (GRS)** is a new technology being used in place of conventional bridge abutments. It eliminates the need for mechanical connections between blocks and the reinforcement and unnecessary excavation by using a low-tech approach of alternating layers of compacted soil and sheets of geotextile fabric to provide support for a bridge. The soil composite is made from generic and readily-available (local) materials such as soil, natural rock, concrete block, timber, etc., and can be applied using common construction equipment, without the need for highly skilled workers. Because the mass is internally supported, it reduces the size of the structure. This can result in less construction time and reduce construction costs by 25 to 50% (per tests that have been performed in the field). Researchers at the U.S. Forest Service and the Colorado State DOT pioneered the early development of the technology, and a number of counties in Ohio have already built bridges using GRS. As more state and local agencies learn about its benefits, FHWA's next step will be to develop design and construction guidelines on using this new technology.

Iowa Department of Transportation

Intelligent Construction Workshop and Demo Projects on Intelligent Compaction of Soils, Subbase, HMA Overlays and Cold – in – place Recycling

Submitter	*Sandra Larson, Iowa DOT* *Sandra.larson@dot.iowa.gov* *515-239-*
Research program	*Iowa State University/InTrans* *Earthworks Engineering Research Center*
Project Title, ID, Cost, Duration	*Intelligent Construction Workshop and Demo Projects on Intelligent Compaction of Soils, Subbase, HMA Ovcrlays and Cold-in-place Recycling*
Weblink, if available	*http://www.eerc.iastate.edu/publications.cfm for IC Workshop Report #1*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	**Summary**: In 2007 the Iowa DOT identified a strategic goal: To successfully implement intelligent compaction (IC) technologies through research and training, leading to improved road-building quality, efficiency, and costs for grading subbase and asphalt projects. Partnering with Iowa State University's Earthworks Engineering Research Center (EERC), a work plan targeting new research and demonstration projects, implementation strategies, specifications, and training programs was developed. A three day workshop was conducted in Des Moines, IA, in April 2008. About 100 attendees representing state DOTs, the Federal Highway Administration (FHWA), contactors, manufacturers, and researchers participated in the workshop. One key outcome from the workshop was the *IC Road Map for Research and Education*. A second workshop was held during April 2009, and the workshop report is in preparation for a summer 2009 release. Planning for a third workshop is in progress. Recently, a detailed IC Work Plan has been developed outlining a multi-phased research program for accelerating the implementation of IC technologies for earthwork and hot mix asphalt (HMA) construction projects in Iowa. These projects will demonstrate correlations between IC measurement technologies and in situ point measurement testing for a range of pavement foundation materials and involve comparisons of compaction process efficiency using IC and conventional methods. **State and Regional Value**: This research will be implemented through a wide range of products and events, including open houses at demonstration and pilot project sites, and preparation of special provisions and developmental specifications during the next two construction seasons. Technology transfer will be realized through publications such as tech briefs, DVD presentations, interactive websites, and conference and workshop presentations.

Texas Department of Transportation

TxDOT Administration Research

Submitter	*Texas Department of Transportation* *Rick Collins, P.E.* *Director, Research and Technology Implementation Office* *(512) 465-7632* *rcollins@dot.state.tx.us*
Research program	*Texas Department of Transportation*
Project Title, ID, Cost, Duration	*Title: TxDOT Administration Research* *Project number: 0-6581* *Project Cost: Budgeted $300,000 between two universities – Texas Transportation Institute and Center for Transportation Research* *Project Duration: One year but will be extended another year.*
Weblink, if available	*Not available*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	This is a unique project in that the tasks are not specifically identified in the contract. The tasks are determined by TxDOT Administration on an "as needed" basis. The following tasks have been conducted or are currently ongoing. • Relationships between Vehicle Operating Costs and Ride Quality • Nationwide DOT Per Unit Production Cost Analysis and Comparison • Optimization of Emergency Response Among TxDOT Maintenance Sections • The Needs and Funding Options for Texas Mega-Bridge Replacement Projects • Monitoring Economic Impact of Stimulus Package • Technology Transfer and Technical Support Services Related to Mileage-Based User Fee Revenue Scenarios • Analysis of Trade Flows through the Rio Grande Valley • Developing a Congestion Performance Measure • Improving Near-Term Analysis Capabilities of Texas Congestion Estimation Tools The significant benefit to this project is that it allows TxDOT Administration to gather information in a very timely manner. This assists in providing this information to the Legislature or using it immediately for implementing a policy or practice.

CHEAPER
Transportation through research

Georgia Department of Transportation

Submitter	*Georgia Department of Transportation Office of Materials and Research David M. Jared, P.E. djared@dot.ga.gov*
Research program	*Georgia Department of Transportation research program*
Project Title, ID, Cost, Duration	*Project Title: Assessing Techniques and Performance of Thin Porous European Mix Overlay on Micro milled Surface Report Number: N/A (active project) Project Cost: $254,882 Project Duration: 36 months*
Weblink, if available	*Not available at this time*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Georgia DOT investigated the viability of micro milling technology for pavement preservation. Micro milling was confirmed to be viable for prolonging the service life of intact pavement layers underlying a thin, distressed surface layer by removing the surface layer with micro milling and overlaying the intact layers. Researchers evaluated micro milling done in conjunction with 15.6 miles of Porous European Mix (PEM) overlay on Interstate 75 south of Macon. The Georgia DOT Special Provision for the micro milling and PEM overlay stipulated that the micro milling must produce a milled surface with a ridge to valley depth (RVD) in the surface texture of 1.6 mm and would require corrective action when RVD exceeded 3.2 mm. The Circular Track Meter and the Ultra Light Inertia Profiler were used for measuring the macro texture of the milled surface. Results obtained from the eight test sections indicated that the requirements were achievable and cost effective with micro milling technology currently available. Bond strengths between the PEM and underlying layers were also evaluated and reached acceptable levels over time after the overlay. The estimated cost savings for the project evaluated was $58,000 per lane mile, or $5.4 million for the entire project. Because of the successful pilot demonstration, the specification confirmation, and large cost savings, Georgia DOT has specified micro milling on a large interstate resurfacing project in southeast Georgia.

Florida Department of Transportation

Improvements in Design Scour Prediction

Submitter	*Florida Department of Transportation, Research Center* *Jerry Hicks, jerry.hicks@dot.state.fl.us* *Project Manager: Rick Renna, rick.renna@dot.state.fl.us*
Research program	*Florida Department of Transportation*
Project Title, ID, Cost, Duration	*Improvements in Design Scour Prediction- BD545-34* *(Related research: BD545-19, BC354-69)* *Cost: $120,000.00* *Duration: 24 Months*
Weblink, if available	*http://www.dot.state.fl.us/research-center/Completed_RD.shtm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results --- **An example of leading-edge research, done by an excellent research team, championed by panel members and state DOTs who assisted in implementing and applying research results.**	Over the past 15 years, the Florida Department of Transportation has sponsored research to develop equations that more accurately predict design scour depths for both simple and complex pier structures. These equations, dubbed Sheppard's Pier Scour Equations, function as alternatives to HEC-18. When used to design new or evaluate existing simple pier structures for scour, these equations can significantly reduce over predictions that can result from the use of the HEC-18 pier scour equation. The equations are built on extensive lab data and employ parameters that are overlooked in the HEC 18 equation. The most recent research (BD545-34) on these produced data that was used to improve and simplify the methods for predicting scour depths for complex piers. The equations have been implemented in Florida for approximately the last seven years and are now being evaluated for use nationally. To assess the potential benefits of the research, the principal investigator, Dr. Max Sheppard (University of Florida), developed conservative estimates of the construction cost savings realized on four bridge projects based on the use of the equations for design scour prediction. Estimated Savings: St. George Island Bridge: $783,000.00 or $1.00/sq ft of bridge deck Hathaway Bridge: $486,000.00 or $1.00/sq ft of bridge deck Jensen Beach Causeway Bridge $ 94,000.00 or $2.00/sq ft of bridge deck *Ft. George Inlet Bridge $157,000.00 or $1.00/sq ft of bridge deck*

Georgia Department of Transportation

Assessing Techniques and Performance of Thin Porous European Mix Overlay on Micro milled Surface

Submitter	*Georgia Department of Transportation Office of Materials and Research David M. Jared, P.E. djared@dot.ga.gov*
Research program	*Georgia Department of Transportation research program*
Project Title, ID, Cost, Duration	*Project Title: Assessing Techniques and Performance of Thin Porous European Mix Overlay on Micro milled Surface Report Number: N/A (active project) Project Cost: $254,882 Project Duration: 36 months*
Weblink, if available	*Not available at this time*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Georgia DOT investigated the viability of micro milling technology for pavement preservation. Micro milling was confirmed to be viable for prolonging the service life of intact pavement layers underlying a thin, distressed surface layer by removing the surface layer with micro milling and overlaying the intact layers. Researchers evaluated micro milling done in conjunction with 15.6 miles of Porous European Mix (PEM) overlay on Interstate 75 south of Macon. The Georgia DOT Special Provision for the micro milling and PEM overlay stipulated that the micro milling must produce a milled surface with a ridge to valley depth (RVD) in the surface texture of 1.6 mm and would require corrective action when RVD exceeded 3.2 mm. The Circular Track Meter and the Ultra Light Inertia Profiler were used for measuring the macro texture of the milled surface. Results obtained from the eight test sections indicated that the requirements were achievable and cost effective with micro milling technology currently available. Bond strengths between the PEM and underlying layers were also evaluated and reached acceptable levels over time after the overlay. The estimated cost savings for the project evaluated was $58,000 per lane mile, or $5.4 million for the entire project. Because of the successful pilot demonstration, the specification confirmation, and large cost savings, Georgia DOT has specified micro milling on a large interstate resurfacing project in southeast Georgia.

Indiana Department of Transportation

Characterization of Fresh and Land filled Cement Kiln Dust (CKD) and its Applications in Highways

Submitter	*Dr. Tommy E. Nantung* *Indiana Department of Transportation* *Division of Research and Development* *P.O. Box 2279* *1205 Montgomery Street* *West Lafayette, IN 47906* *Phone: (765) 463-1521 ext. 248* *Fax: (765) 497-1665* *e-mail: tnantung@indot.in.gov*
Research program	*Indiana Department of Transportation and* *Joint Transportation Research Program – Purdue University*
Project Title, ID, Cost, Duration	*"Characterization of Fresh and Landfilled Cement Kiln Dust (CKD) and its Applications in Highways"* *Report number: FHWA/IN/JTRP-2005/10* *Project Cost: $77,893* *Project Duration: 3 years and 9 months- 45 months*
Weblink, if available	*www.purdue.edu/JTRP*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	This research identified and evaluated in the laboratory two possible applications for fresh and landfilled CKD. The first application involves the use of the CKDs as "drying agents" in combination with small percentages of Portland cement for the treatment of wet subgrade soils. In the second, the CKDs are used as the fine component of controlled low strength materials (CLSM). Research also produced specifications and procedures for the use of CKD and by testing Indiana supplies, approved sources. Implementation was performed on an INDOT project in Indianapolis. A test pad of CKD treated material was constructed to develop compaction criteria. This pad was tested and compared with a lime modified subgrade section with comparable engineering results, at a lower cost. CKD is cheaper than lime by $10/ton. In 2007, INDOT consumed more than 1 million tons of lime to treat poor subgrades. INDOT estimates that approximately 60-70% of this volume could be replaced by CKD if supplies are available. This represents a significant amount of potential savings for INDOT. Indiana has four major cement plants that produce various amounts. In 2002, these plants produced over 3,000,000 tons of cement. At low end levels of CKD produced (1% = 30,000 tons), this represents significant supplies available to INDOT. A cost/benefit analysis that capitalized these expected savings over a 20-year period at a 4% discount rate, shows this research is capable of producing a 52 to 1 benefit cost ratio.

Indiana Department of Transportation

Technical Issues Related to the Use of Fly Ash and Slag During the Late – Fall Construction Season

Submitter	*Dr. Tommy E. Nantung* *Indiana Department of Transportation* *Division of Research and Development* *P.O. Box 2279* *1205 Montgomery Street* *West Lafayette, IN 47906* *Phone: (765) 463-1521 ext. 248* *Fax: (765) 497-1665* *e-mail: tnantung@indot.in.gov*
Research program	*Indiana Department of Transportation and* *Joint Transportation Research Program – Purdue University*
Project Title, ID, Cost, Duration	*"Technical Issues Related to the Use of Fly Ash and Slag During the Late-Fall Construction Season"* *Report number: FHWA/IN/JTRP-2005/5* *Project Cost: $120,000* *Project Duration: 3 years and 6 months- 42 months*
Weblink, if available	*www.purdue.edu/JTRP*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Based on the results of this research study, it was recommended that INDOT should revise their standard specifications to allow slag and fly ash in concrete pavements to be placed after October 15th, providing that the contractor understands the risk involved when the target strength for adequate F-T resistance (3500 psi) is not achieved. As a result of the findings in this study, INDOT issued a Construction Memorandum extending the allowable period for the use of fly ash and slag. Allowing fly ash in concrete provides for concrete material savings. On projects where concrete paving goes into November, savings can be significant. Winter mix has typically cost INDOT approximately $2.59/CY more than summer mix which contains the additional fly ash. Annual benefits would be dependent on the amount of concrete pavement placed during the October 15—November 15 time period. Another benefit is environmental, allowing the additional consumption of fly ash and avoiding disposal. On a recent project in Indianapolis named Super 70, during the October 15 to November 15 period, 58,300 cubic yards of concrete was placed, producing a savings of $151,000. A formal benefit/cost analysis was performed assuming that annually one such project would be doing late fall pavement, which is a conservative number. This annual savings extended to a 20-year period, at a 4 % discount rate, experiences a 17 to 1 benefit cost ratio.

Indiana Department of Transportation

Construction of Tire Shreds Test Embankment

Submitter	*Dr. Tommy E. Nantung* *Indiana Department of Transportation* *Division of Research and Development* *P.O. Box 2279* *1205 Montgomery Street* *West Lafayette, IN 47906* *Phone: (765) 463-1521 ext. 248* *Fax: (765) 497-1665* *e-mail: tnantung@indot.in.gov*
Research program	*Indiana Department of Transportation and* *Joint Transportation Research Program – Purdue University*
Project Title, ID, Cost, Duration	*"Construction of Tire Shreds Test Embankment"* *Report number: FHWA/IN/JTRP-2002/35* *Project Cost: $72,935* *Project Duration: 3 years and 11 months- 47 months*
Weblink, if available	*www.purdue.edu/JTRP*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	The research project consisted of construction of a test tire shred and soil embankment as well basic laboratory tests for material property characteristics and instrumentation of the embankment. The instrumentation includes settlement monitoring, vertical and horizontal inclinometer monitoring, temperature monitoring, and groundwater quality analysis. The objective of this project is to evaluate the feasibility of using a mixture of tire shreds and soil as fill material for embankments on the basis of field instrumentation and tests. Due to this research, a specification for the use of tire shreds for lightweight fill material was developed. This has resulted in several projects use of tire shreds. SR 110 in Marshall county was experiencing significant settlement problems due to a deep peat deposit. A 12 in. lift of tire shreds and sand mixture was used. A total of 2300 cubic yards of material was used that contained 65000 tires. The use of this material in the embankment saved $94,000 on the project. SR 31 Plymouth bypass is using tire shreds as lightweight fill material in lieu of Extruded Polystyrene (EPS). Tire shred mix costs $30/CY compared to $240/CY for EPS. This use will result in project savings of $2.75 million. SR 19 in Elkhart improvements included a new culvert and widening the roadway over a peat bog. Approximately 1800 CY of tire shred mix was used as lightweight fill material. This resulted in estimated savings of $375,000. A cost/benefit analysis that looked at the savings achieved from these three projects calculated a cost/benefit ratio of 44 to 1.

Louisiana Department of Transportation and Development

Use of High Performance, High Strength Concrete Bulb – Tee Girders

Submitter	*Louisiana DOTD, LTRC, Chris Abadie or Mark Morvant, chris.abadie@la.gov*
Research program	*LTRC*
Project Title, ID, Cost, Duration	*"Use of High Performance, High Strength Concrete Bulb-Tee Girders"* *LTRC Implementation update for Report 310,382 and,395* *Project Cost for 3 research projects $1.3 million; Duration: 10 years.*
Weblink, if available	*Ltrc.lsu.edu.*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	*Full Size Bulb Tee girder testing to determine Fatigue and Shear behavior. Initial cost savings for one project,* *I-10 Twin span, of $17 million. Attached Implementation Update*

New Hampshire Department of Transportation

Assessing the Condition and Estimating the Longevity of Rock Reinforcement Systems

Submitter	*New Hampshire Department of Transportation* *Glenn Roberts, Chief of Research* *groberts@dot.state.nh.us*
Research program	*Phase I - New Hampshire DOT* Phase II – NH, NY, CT DOTs through pooled-fund study TPF-5(096)
Project Title, ID, Cost, Duration	*Assessing the Condition and Estimating the Longevity of Rock Reinforcement Systems* Report Nos: FHWA-NH-RD-13733L, FHWA-NH-RD-14282C *Phase I - $66,600 (6 months)* *Phase II - $186,000 (9 months)*
Weblink, if available	*http://www.nh.gov/dot/org/projectdevelopment/materials/research/projects/13733l.htm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	The New Hampshire DOT has utilized metal reinforcements to stabilize highway rock slopes for more than 35 years. Annual inspections of 10 rock reinforcement sites are conducted; however, inspectors have lacked a consistent method of determining the actual condition of these systems. In 2003, the Department initiated a two-phase research study to assess the condition of rock reinforcements along I-93 in Woodstock. The first phase involved measuring the corrosiveness of the surrounding environment and performing nondestructive testing (NDT) on selected elements. In Phase II, anomalies identified by the NDT were investigated through destructive testing and exhumation to calibrate and validate the results of the initial investigation. The research provided an effective method for identifying areas of possible corrosion, assessing the overall condition of the reinforcements, and estimating remaining service life. As a result, it was determined that only a portion of the existing reinforcements required replacement or rehabilitation, resulting in an estimated savings of $1.1 million for the site. Benefits can be realized by applying this technology at other sites in New Hampshire and in other states. The approach used in this study provides a sound technical basis for planning future maintenance and rehabilitation activities on reinforced rock slopes.

Virginia Transportation Research Council

Recycling of Salt – Contaminated Stormwater Runoff for Brine Production

Submitter	Virginia Transportation Research Council (VTRC) Michael Perfater mike.perfater@vdot.virginia.gov
Research program	Virginia Department of Transportation
Project Title, ID, Cost, Duration	Title: *Recycling of Salt-Contaminated Stormwater Runoff for Brine Production* Report number: VTRC 08-R17 Project Cost: $135,000 Project Duration: 24 months
Weblink, if available	*http://www.virginiadot.org/vtrc/main/online_reports/pdf/08-r17.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Based on average precipitation rates and the number and size of its salt storage facilities, the Virginia Department of Transportation has the potential to collect approximately 60 million gallons of salt-laden stormwater each year. Current disposal options for this waste water are both limited and costly, ranging from $0.13 to $0.55 per gallon. And if not managed properly, this same waste has the potential to contaminate both surface and ground water. To address these issues the VTRC performed extensive field measurements along with both and field and lab experiments to develop specific waste minimization recommendations by improving on current site designs and management practices. Included in this effort was the evaluation of treatment and reuse alternatives. As a part of this, a benefit/cost analysis was conducted for several reuse alternatives using historical disposal costs and deicing chemical usage data to project volumes of salt water that could be reused in conjunction with VDOT's anti-icing program. The research has resulted in specific practices and designs for reducing the volume of waste generated. When fully implemented, the collection of salt-laden stormwater should be decreased by nearly 50%. While no feasible treatment methods were identified, reusing the captured stormwater for pre-wetting and direct brine application was deemed to be both technically feasible and cost-effective. Specifically, proper management and reuse of the stormwater runoff for brine creation will not only result in significant savings ($1 million to $6 million annually depending on total annual precipitation), roadway chloride loading will be significantly reduced (35%), fewer fresh water resources will be needed for anti-icing, and the potential for offsite contamination of ground and surface water sources will be decreased.

California Department of Transportation

Mobile Work Zone Barrier (Balsi Beam)

Submitter	*California Department of Transportation* *Division of Research and Innovation* *Juan Araya* *Chief of Deployment Support Branch* *(916) 654-8170* *juan_araya@dot.ca.gov*
Research program	*California Department of Transportation* *Division of Research and Innovation*
Project Title, ID, Cost, Duration	Mobile Work Zone Barrier (Balsi Beam) *Project Cost: $2 million* *Project Duration: 5 years*
Weblink, if available	*http://www.dot.ca.gov/research/researchreports/two-page_summaries/balsi_beam_2-pager.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	*The Balsi Beam is a mobile work zone protection device developed by the California Department of Transportation (Caltrans) to protect highway workers from moving traffic. The device is composed of a modified trailer pulled by a tractor truck at normal highway speeds and without the need for special permits. Upon arrival at the work site, the trailer can extend its telescoping side beams to create a protected work area of up to 30 feet in length.* *Maintenance crews report the feeling of greater efficiency and safety when the device is deployed in their work zone. Currently, the set-up and break-down of a lane closure requires approximately three hours with current safety measures. In contrast, the device requires only 10-20 minutes each for set-up and break-down.* *Caltrans generally closes one or more lanes in order to provide a safe work zone around its workers, thus resulting in increased congestion and traffic delays. The maintenance crew currently using the device found that it has eliminated approximately 15% of the lane closures previously required to perform necessary maintenance. The number of avoided lane closures equates to a potential annual savings of $115,464,000 in public user road costs, due to reduced travel delay.* *A more complete product evaluation is currently being conducted. Findings will be available in June 2010.*

District of Columbia

Impact of Countdown Pedestrian Signals on Pedestrian Behavior and Perception of Intersection Safety in the District of Columbia

Submitter	*District Department of Transportation Peggy Tadej* *Peggy.Tadej@dc.gov*
Research program	*District Department of Transportation: Research Unit with Howard University*
Project Title, ID, Cost, Duration	*Title:* Impact of Countdown Pedestrian Signals on Pedestrian Behavior and Perception of Intersection Safety in the District of Columbia *Report number: N/A* *Project Cost: $150,000* *Project Duration: 18 months*
Weblink, if available	*www.hutrc.howard.edu*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Countdown pedestrian signals (CPS) are increasingly being used as a supplementary device for improving safety at signalized intersections. This research examined the impact of CPS on pedestrian crossing behaviors in the District of Columbia where the display of the remaining time for crossing the intersection begins with the steady "WALK" indication and continues through the flashing DON'T WALK indication. The research also examined pedestrians' perception of safety in crossing intersections equipped with CPS. Data on a number of pedestrian behaviors were collected at the 14 intersections before and after the installation of the CPS through video playback in morning and evening peak periods. The frequency of pedestrian involvement in running, balking, vehicular conflicts, crossing violations, and compliance were among the variables observed. In addition, a survey was conducted at the intersections with high pedestrian traffic to assess pedestrians' perception of safety in relation to the CPS. Statistical analyses were conducted at 5% level of significance to ascertain the significance of changes in variables used as measures of effectiveness. From the results, pedestrians overwhelmingly attributed their increased perception of safety in crossing intersections to the presence of the CPS.

Federal Highway Administration

Divergent Diamond Interchange

Submitter	***Agency**: Federal Highway Administration (FHWA), Office of Corporate Research, Technology, & Innovation Management* ***Contact:** Joe Conway, Director, Communications & Outreach Team,* ***Email:** joe.conway@dot.gov*
Research program	*Sponsoring agency or organization.* *FHWA*
Project Title, ID, Cost, Duration	*Title:* Divergent Diamond Interchange *Report number: FHWA-HRT-07-048* *Project Cost:* *Project Duration:*
Weblink, if available	*http://www.tfhrc.gov/safety/pubs/07048/index.htm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Intersections account for 28% of all crashes on U.S. roads, and according to FHWA's ITS Joint Program Office, "are among the most dangerous locations on U.S. roads," and nearly equal to the percentage of rear-end collisions. In recent years, FHWA researchers have been evaluating alternative intersection designs to improve road safety, as well as increase roadway capacity and reduce congestion while minimizing the cost of new infrastructure. The **Divergent Diamond Interchange** eliminates the need for a left turn lane by allowing vehicles to continue on to a limited access ramp, rather than having to stop at an intersection. The design allows for two directions of traffic on a minor road to cross to the opposite side on both sides of the bridge at the freeway, and for traffic on the freeway overpass (or underpass) to briefly drive on the opposite side of the road. Traffic modeling results have shown that this design allows for the roadway to operate at only 60% of its traffic capacity, rather than the conventional diamond exchange, which would operate at 95% capacity on the same roadway, thus decreasing the possibility of congestion occurrence. A DDI design implemented by the Missouri State DOT in Kansas City reduced costs for the project from $11 million to $7 million, almost half the cost of retrofitting a conventional diamond interchange. A second DDI design is under construction in Utah, and is currently being considered in other states, including New York, Ohio and Kentucky. FHWA researchers will be monitoring plans to build this type of intersection across the country so that their actual safety and operational performance can be documented.

Federal Highway Administration

Rural Road Low Cost Safety Improvements

Submitter	***Agency**: Federal Highway Administration (FHWA), Office of Corporate Research, Technology, & Innovation Management* ***Contact:** Joe Conway, Director, Communications & Outreach Team,* ***Email:** joe.conway@dot.gov*
Research program	*Sponsoring agency or organization.* *FHWA,*
Project Title, ID, Cost, Duration	*Title: Rural Road Low Cost Safety Improvements* *Report number: FHWA-HRT-08-045, 046, 047, 048*
Weblink, if available	*http://www.tfhrc.gov/safety/pubs/09032/index.htm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	About half of all roadway fatalities occur on rural, two-lane roads. As part of its strategic highway effort, the Federal Highway Administration (FHWA) organized a pooled fund study of 26 States to evaluate low-cost safety strategies for these types of roads. The purpose of the ***FHWA Low-Cost Safety Improvements Pooled Fund Study*** was to evaluate the safety effectiveness of several low-cost safety strategies presented in the *National Cooperative Highway Research Program (NCHRP) Report 500 Series.* A target of 20 strategies totaling $4.38 million for 7 years are planned to be studied within five phases. Phase I (which has been completed) includes 4 studies that have been published by FHWA in April 2008, and include the following: • *Safety Evaluation of STOP AHEAD Pavement Markings* analyzes the effectiveness of this strategy in 4 types of intersections (Three-legged, Four-legged, All-Way Stop Control and One-Way Stop Control) in Arkansas and Maryland. The study found that pavement markings were cost effective (2:1 benefit cost ratio) and **reduced the likelihood of a crash up to 15%** in intersections with a high frequency of crashes. • *Safety Evaluation of Center Two-Way Left-Turn Lanes on Two-Lane Roads* analyzes the effectiveness of this strategy on primarily rural roads in Arkansas, Illinois, California and North Carolina. The study found that the markings can be cost effective for rural areas and that the strategy, which involves removing vehicles from the primary travel lane to make a left turn, and providing a buffer between opposing directions of travel with the addition of a center lane could **reduce total crashes by 29%, injury crashes by 19% and rear-end crashes by 36%** in areas with a high frequency of crashes. • *Safety Evaluation of Increasing Retroflectivity of STOP Signs* analyzes the effectiveness of the intensity of reflective sheeting on STOP signs at rural and urban intersections in South Carolina and Connecticut. The study found that crashes were significantly reduced in certain areas (particularly rear-end crashes in South Carolina) and not so much in other areas. It was concluded that this strategy may affect the likelihood of crashes particularly at unsignalized and lower-volume intersections, and given its low cost, the **improved retroflectivity of signage would benefit all drivers, including older ones**. • *Safety Evaluation of Flashing Beacons at Stop-Controlled Intersections* analyzes the effectiveness of this strategy at rural, urban and suburban stopped-controlled intersections equipped with flashing beacons in North Carolina and South Carolina. The study found that this strategy is most effective **in reducing angle crashes by 4%**, particularly at rural intersections with a high frequency of crashes (where driver awareness is an issue), and that depending on the type of beacon installed, the standard flashing beacon can be economically justified at a benefit cost ratio of 2:1. Participating States in the *FHWA Low-Cost Safety Improvements Pooled Fund Study* include the following: AZ, CA, CT, FL, GA, IA, IL, IN, KS, KY, MA, MD, MN, MS, MT, NC, ND, NY, OK, PA, SC, SD, TN, TX, UT, VA, and WI.

Federal Highway Administration

Cable Median Barrier

Submitter	***Agency**: Federal Highway Administration (FHWA), Office of Corporate Research, Technology, & Innovation Management* ***Contact:** Joe Conway, Director, Communications & Outreach Team,* ***Email:** joe.conway@dot.gov*
Research program	*Sponsoring agency or organization.* *FHWA,*
Project Title, ID, Cost, Duration	*Title: Cable Median Barrier* *Report number: FHWA-HRT-06-058* *Project Cost:* *Project Duration:*
Weblink, if available	*http://www.fhwa.dot.gov/crt/lifecycle/cable.cfm*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Cross-median crashes are 3 times more likely to cause fatalities than any other freeway accident, according to research conducted through the North Carolina Department of Transportation. As a result of these findings, the agency pioneered the use of **cable median barriers** to prevent a car from entering opposing traffic lanes. From 1999-2005, NCDOT estimates that more than 95 cross-median crashes were prevented using this new technology, saving more than 145 lives. To further improve the technology, NCDOT worked with FHWA to use simulation techniques to analyze the dynamics of a vehicle when it crosses a median, including its dynamics in relationship to the placement of the cable within the median. The research team discovered that the placement of the cable within the median is very important, as it may be more or less effective depending on the location. The findings were confirmed by a series of full-scale crash tests at the Turner Fairbank Highway Research Center's Outdoor Impact Laboratory (FOIL). The findings confirmed at the FOIL have been expanded to cover the use of different barriers in a wide range of median configurations. They are currently being used to develop cable median standards in other states and will be incorporated into guidelines for the American Association of State Highway and Transportation Officials' Roadside Design Guide.

Illinois Department of Transportation

Evaluation of Lighting Glare for Highway Construction in Illinois

Submitter	*Illinois Department of Transportation* *Bureau of Materials and Physical Research* *Amy M. Schutzbach, P.E* *Engineer of Physical Research* *Amy.Schutzbach@illinois.gov*
Research program	*Illinois Department of Transportation* *Bureau of Materials and Physical Research* *Illinois Center for Transportation*
Project Title, ID, Cost, Duration	*Nighttime Construction: Evaluation of Lighting Glare for Highway Construction in Illinois* *@$220,000* *2 years*
Weblink, if available	*http://ict.illinois.edu/Publications/report%20files/FHWA-ICT-08-014.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results	Nighttime highway construction is often advocated to minimize inconvenience for the traveling public and to reduce the potential for work zone accidents. However, poor utilization and placement of the lighting equipment to illuminate the work zone can cause glare that is dangerous to drivers and workers. Researchers analyzed and compared the levels of glare and lighting performance generated by typical as well as innovative lighting arrangements and identified the factors that affect glare measurement.  This research provided recommendations for lighting arrangements to reduce and control lighting glare in nighttime work zones that were incorporated into a statewide specification. In addition, the study identified a practical method that can be used to measure and quantify glare during nighttime highway construction. A major advantage of this new method is that it saves significant costs by not requiring a pavement luminance meter.

National Cooperative Highway Research Program

Development of Guidelines for Nighttime Road Work to Improve Safety and Operations

Submitter	*Crawford Jencks* *National Cooperative Highway Research Program (NCHRP)* *Transportation Research Board (TRB)* *cjencks@nas.edu*
Research program	*The NCHRP is administered by the TRB and sponsored by the member departments (i.e., individual state departments of transportation) of the American Association of State Highway and Transportation Officials (AASHTO) in cooperation with the Federal Highway Administration (FHWA).*
Project Title, ID, Cost, Duration	*NCHRP Project 14-12, "Highway Maintenance Quality Assurance"* *NCHRP Report 422: Maintenance QA Program Implementation Manual* *Project Cost: $325,241* *Project Duration: 41 months*
Weblink, if available	*http://www.trb.org/NotesDocs/NCHRPImpacts_422.pdf*
Brief Summary of the Research Project and Impact, or Potential Impact, of Implementing Research Results --- **An example of leading-edge research, done by an excellent research team, championed by panel members and state DOTs who assisted in implementing and applying research results.**	Highway agencies spend large sums of money to maintain their facilities, and ensuring the quality of the products of these investments is important to an effective and efficient highway-maintenance program. Quality assurance programs have to be capable of detecting insufficient maintenance efforts, poor material performance, and incorrect procedures when evaluating end-product performance. In their development and application, highway-maintenance QA programs must be integrated with other management-information systems and quality programs to ensure mutual benefits. ERES Consultants, Inc., prepared guidance for developing and implementing a QA program for maintenance of highway facilities. An implementation manual was also developed and subsequently used in six workshops conducted by ERES across the country. The six workshops took place in conjunction with cooperating state departments of transportation (DOTs) in Dubuque, Iowa; Lake Havasu City, Arizona; Bristol, Virginia; Galveston, Texas; Kansas City, Missouri; and Portland, Oregon. The assistance provided by the state DOTs was critical to the success of the workshops and was greatly appreciated by ERES and the NCHRP. The workshops were well received and provided input for further refinements to the manual. The version published as *NCHRP Report 422: Maintenance QA Program Implementation Manual* incorporates the knowledge gained through these efforts.