

FY 2011 ANNUAL REPORT

Research, Intelligent Transportation Systems, and Technology Transfer Activities



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Executive Summary

Transportation research makes a difference for Iowans and the nation. Implementation of cost-effective research projects contributes to a transportation network that is safer, more efficient, and longer lasting. Working in cooperation with our partners from universities, industry, other states, and FHWA, as well as participation in the Transportation Research Board (TRB), provides benefits for every facet of the DOT. This allows us to serve our communities and the traveling public more effectively. Pooled fund projects allow leveraging of funds for higher returns on investments. In 2011, Iowa led thirteen active pooled fund studies, participated in twenty-one others, and was wrapping-up, reconciling, and closing out an additional 6 Iowa Led pooled fund studies. In addition, non-pooled fund SPR projects included approximately 8 continued, 9 new, and over a dozen reoccurring initiatives such as the technical transfer/training program. Additional research is managed and conducted by the Office of Traffic and Safety and other departments in the Iowa DOT.

In 2011, research efforts primarily focused on these six areas:

- **Safety** – The centerpiece of safety research is the annual Transportation Safety Improvement Program. In addition, Iowa DOT leads three national pooled fund traffic safety projects and administers other widely varied safety projects such as a study of teen crash fatalities, evaluation of Iowa’s Driver Improvement Program, evaluation of dynamic warning signs at high crash curves, commercial driver fatigue, and tests of wet reflective pavement markings.
- **Winter Maintenance** – Iowa continues to lead a significant pooled fund project (Aurora) centered on winter maintenance, and participates in several others. In-state research is funded with State Planning and Research money and includes safety and mobility impacts of winter weather. The Office of Maintenance also conducts a variety of research initiatives every winter, testing new equipment and processes with operation forces and budget.
- **Pavements** – With assistance from the Concrete Pavement Technology (CPT) Center at Iowa State University, the Iowa DOT leads four national concrete pavement pooled fund projects. Objectives include improvements for: pavement design, mix and materials, construction and maintenance methods, and procedures for building more durable, cost-effective concrete pavements.
- **Structures** – The Bridge Engineering Center at Iowa State University has collaborated with Iowa DOT staff for several years developing cutting-edge technology systems for monitoring structural health of new and existing bridges. Iowa has taken the lead on three national pooled fund bridge studies. Other promising research centers on using precast pavement sections for bridge approaches to reduce construction time, reducing inconvenience to motorists, and eliminating “the bump at the end of the bridge.”

- **ITS** – Promoting efficient travel reduces congestion, resulting in increased traveler safety. TripGuide systems have been deployed in the Iowa City and Quad Cities areas, allowing web users to view real time video of roadway conditions. Preparations for similar systems in Council Bluffs and Sioux City are currently underway. Development of the Statewide ITS Management Software (SIMS) project will enable DOT personnel and partner agency staff to control and configure existing and future deployments of ITS devices statewide.
- **Geotechnical** – The Partnership for Geotechnical Advancement (PGA) mission has been expanded into the new Earthworks Engineering Research Center (EERC) at Iowa State University (changed to Center for Earthwork Engineering Research, CEER, in 2011). Iowa also leads a pooled fund study on Improving the Foundation Layers for Concrete Pavements and began a new pooled fund project: Technology Transfer Intelligent Compaction Consortium (TTICC).

Research is a driving force of innovation contributing to the future of transportation and the stability of our nation's infrastructure. New, cost-efficient products and technologies are continually investigated. Those that increase safety, product performance, and long-term viability are implemented, building a future transportation network today based on solid methodologies and cutting-edge investigations.



Contents

Introduction	Page
I. Research & Technology Bureau Programs	
A. State Planning & Research (SPR) Program	1
B. Iowa Highway Research Board (Overview only. Refer to Attachment No. 9 for full report)	35
C. Intelligent Transportation Systems (ITS) Projects	36
D. Primary Road Research	43
E. Technology Transfer	44
II. Other Research, Development and Technology Transfer Activities	
A. Traffic & Safety Research	46
B. Maintenance Research	47
C. Bridges & Structures Research	50
D. Living Roadway Trust Fund Research	51
III. Transportation Research Board	52
IV. University Research Coordination	
A. Iowa Transportation Research Collaboration	54
B. Institute for Transportation (InTrans)	55
Attachments	
1. Annual SPR Plan- Distribution of Funds 1993-2011	58
2. FY 2011 Research Work Program Summary	59
3. FY 2011 SPR Research Work Program by Category	63
4. FY 2011 SPR Allocations by Type of Work (Table)	64
5. FY 2011 SPR Allocations by Type of Work (Chart)	65
6. FY 2011 Traffic Safety Improvement Program – Research Projects	66
7. FY 2011 SPR Approved Technical Training Requests	67
8. FY 2011 Research Funds Leveraged Through Iowa-Led Pooled Fund Projects	68
9. Annual Report of Highway Research Board Research and Development Activities FY 2011	69

Introduction

The purpose of this report is to provide an overview of research, Intelligent Transportation Systems (ITS), and technology transfer activities managed by the Iowa Department of Transportation's (DOT) Research and Technology Bureau (R&T Bureau). The R&T Bureau enhances Iowa DOT's ability to deliver efficient and effective transportation services by actively promoting research, university and industry partnerships, knowledge and technology transfer, ITS and information technology.

Bureau responsibilities include:

- Coordinate, manage, and administer the research portion of the State Planning and Research Program (SPR).
- Coordinate, manage and administer work of the Iowa Highway Research Board (IHRB). The IHRB program and SPR program are coordinated to ensure a continuing effective Iowa highway research program.
- Lead collaborative research efforts with FHWA, other states, universities and industry through national pooled funds and the Iowa Transportation Research Collaboration Agreement. Coordinate, manage, and administer the pooled fund studies.
- Identify, fund, manage, track, and implement research.
- Participate in national and emerging regional ITS programs and administer ITS initiatives.
- Provide leadership for research and technology initiatives within the Iowa DOT.
- Promote participation with other states in emerging research and technology such as 511 travel information system and Highway Advisory Radio/Low Powered FM.

Additional research, technology transfer and implementation activities are carried out in other divisions and offices of the Department. These include:

- The Office of Traffic and Safety administers the Iowa Traffic Safety Improvement Program as well as the Safety Management System, a diverse partnership of Iowa highway safety practitioners in engineering, enforcement, education, and emergency services dedicated to reducing the number and severity of crashes on Iowa's roadways.
- The Office of Maintenance conducts extensive research into winter weather operations and road weather reporting and reports on their work.
- The Office of Bridges and Structures administers the federally funded Innovative Bridge Research/Construction Program.
- The Living Roadway Trust Fund awards research and demonstration grants for integrated roadside vegetation management.
- The Office of Materials conducts materials and testing equipment research and reports on their work.

I. Bureau of Research & Technology Programs

A. State Planning & Research Work Program (SPR)

Title 23 of the United States Code provides federal funding for state research programs by requiring that at least a minimum of ½ percent of certain federal funds apportioned to a state be used for research, development, and technology transfer (RD&T) programs. The R&T Bureau is responsible for formulating the research portion of the annual SPR plan, administering contracts, tracking progress, promoting pooled fund studies, and tracking implementation. The research portion of Iowa's SPR program has generally continued to grow (see *Attachment 1*) so that in FY 11 the total was \$4,000,182.

The research portion of the SPR program covers the four areas listed below. The numbers in parentheses indicate the function code applied to each area.

- General Administration (771) includes contributions to the Transportation Research Board and support of the Iowa DOT Library.
- Research and Technology Transfer (774) includes internal research projects as well as support for technical organizations (National Cooperative Highway Research Program (NCHRP), AASHTO committees, ITS groups), training, and special pilot or demonstration projects
- Research Support (775) covers the cost of specialized equipment purchased to accomplish a research project or to be tested itself.
- Pooled Fund Studies (776) covers the cost of contributions to regional and national studies in which multiple states participate.

Following in this section is a general description of each line item in the FY 11 SPR work program along with a brief statement of its impact on Iowa DOT operations.

The SPR work program (*Attachment 2*) represents a collaborative process of setting research priorities, selecting research activities, and reporting results. New projects are added from needs identified by various offices, solicitations by Federal Highway Administration (FHWA) and American Association of State Highway Transportation Officials (AASHTO), and invitations from individual sponsoring lead states throughout the year upon approval from FHWA. *Attachment 3* illustrates the dollar amounts to SPR program categories. Each year's program is formulated to be diverse, including a variety of work areas such as design, construction, materials, maintenance, safety, structures, and environment. *Attachments 4 and 5* show the distribution of SPR funding among various types of work.

General Administration (771)

The objectives of this section of the SPR program are to monitor transportation research activities at the national and regional levels, keep staff informed of current developments, prepare research proposals and work plans, administer research contracts, and provide assistance to staff and activities that support research in the department.

Accomplishments in FY 2011

Staff continued to review transportation research activities and to participate in the dissemination of research results throughout the department. Staff also provided statistical support to ongoing research activities. The DOT library is jointly supported by the DOT and Iowa State University's Institute for Transportation (InTrans), with InTrans providing the staffing for the library.

2011 Work Program

Transportation Research Board (TRB)

TRB conducts a variety of programs and activities designed to support dialogue and information exchange among researchers, practicing transportation professionals and others concerned with transportation. A more detailed description of Iowa DOT involvement in TRB can be found in Section III of this report.

★ **Result:** Access to new nationwide research and technology developments

DOT Library

The Iowa DOT library is jointly supported by the DOT and Iowa State University's Institute for Transportation (InTrans), with InTrans providing staffing for the library. SPR funds are used to supplement InTrans staffing and to purchase books, periodicals and other relevant materials. The library's web site is

http://www.iowadot.gov/research/lib_home.htm.



★ **Result:** Support for Iowa DOT staff seeking broader knowledge and expertise

Research and Technology Transfer (774)

Technology transfer means those activities that lead to the adoption of a new technique, process, or product by users and involves dissemination, demonstration, training, and other activities that lead to eventual innovation. These activities foster research implementation, utilize staff expertise, and keep the transportation community apprised of the latest advances in the field.

Projects from Earlier Programs That Were Voided in FY 2011

Lost License Resource Pilot

It is not uncommon for drivers who have lost their license to continue driving, creating both law enforcement issues and possible safety hazards. For this pilot project, researchers will create a resource document with information on alternate means of transportation and will examine revoked drivers' responses. The pilot will be implemented in a rural area of the state. If results indicate the resource document is helpful in reducing continued driving incidents, similar documents may be developed for other areas of the state. This project never materialized and the funding obligated for it has been de-obligated.

Reduce Speed on High Crash Curves

The crash rate on curves is about three times that on tangent sections. Reducing speed on curves can be done in the short term and at much less cost than improving geometrics. This project will evaluate the effectiveness of low cost dynamic speed signs in reducing speeds on horizontal curves on rural roadways. It is part of a larger research project submitted to FHWA which called for a national field test of speed-activated warning signs to reduce crashes on curves. Researchers will identify a set of pilot study locations and control locations, install signs and evaluate their effectiveness, and summarize the resulting information in a format that can be easily communicated and used by practitioners. This project never materialized and the funding obligated for it has been de-obligated.

Base Grouted Drilled Shafts Investigation

The purpose of this project is to perform field explorations at test shaft locations to better understand the behavior of base grouting in the sandy soil at the Broadway Viaduct drilled shaft location in Council Bluffs. Soil borings will be performed and possible geophysical testing near the test shafts will be investigated to evaluate possible grout migration away from the shaft base, including up along the sides of the drilled shafts. Data collected will be studied and analyzed to determine if the second phase of construction needs to be changed. Base grouting and improved drilled shaft design will be better understood. A report will be written

Accomplishments in FY 2011

Non Destructive Evaluation of Bridge Decks

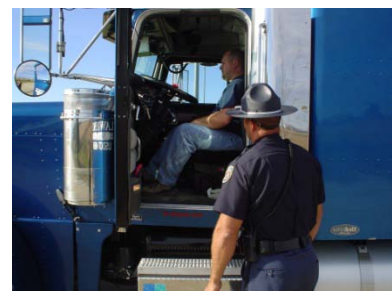
A promising technology for detecting early deterioration in bridge decks has been developed and successfully tested by researchers at Rutgers University. This technology is the combined use of Impact Echo (IE) and Ground Penetrating Radar (GPR) to accurately assess bridge deck conditions. Researchers from Rutgers University used the technology to assess the condition of nine bridge decks in Iowa starting in May 2009. This was a true test of the effectiveness of this technology since the bridges being tested were scheduled for deck repairs shortly thereafter. This project will provide bridge owners with a tool that can increase the life of bridge decks through early deterioration detection and prompt repair. This will reduce maintenance cost, improve safety, and reduce congestion. The final report is available at the following link: <http://www.iowadot.gov/operationsresearch/pdf/SPR-NDEB%2890%29--8H-00%29Final%20ReportNonDestructiveBridgeDeckEvalApril2011.pdf>.

LRFD Training

Manuals and design software have been purchased and training presented. LX series pre-stressed beam standards have been upgraded to LRFD. Training has been presented on LRFD design and rating. Additional work in 2010 included additional training on LRFD culvert programs.

Diagnostic Tools for Identifying sleepy Drivers - Phase I (Commercial Driver Fatigue)

The aim of this pilot project is to identify and evaluate a candidate set of diagnostic tools that can be deployed in the field by Iowa Motor Vehicle Enforcement Officers to provide



objective evidence to identify drivers who are practicing sleep impaired driving. Countermeasures to the sleepy driver danger may seek to prevent the sleepy driver from ever getting on the road, through mandated duty cycles, driver logs, and other tools. Fair and accurate measures are also needed to identify at-risk drivers who have been identified as potentially driving in a sleep deprived state by the Iowa Motor Vehicle Enforcement Officers on the basis of erratic driving behavior. In phase I, a set of computerized cognitive tests was evaluated as a potential diagnostic tool to determine drowsy driving in CMV drivers. The goal of Phase II is to determine a set of behavioral indicators (slow lid closure, fixed gaze, etc.) that can be easily and reliably identified by DOT officers to identify sleepy CMV drivers.

Projects Funded in Earlier Programs, Not Yet Completed

Monitor Red Rock Mile Long Bridge

A data collection system similar to that installed on the Saylorville Reservoir bridge that was used to monitor wind speed and direction and provide notification to DOT personnel when preset thresholds (to be furnished by the DOT) have been reached. Vibration data is collected using controlled loading (with the DOT snooper truck) and ambient traffic loading events. The primary purpose of this is to collect information on the characteristics of the bridge under live load. The installed instrumentation system notifies interested parties, via cellular telephone, that preset thresholds have been reached. Also, when a threshold is breached, a limited amount of behavior data bursts are collected to help diagnose the impact of the wind event. All of the work completed during this project will be summarized in a concise final report/white paper. This report/paper will focus on the behavior of the bridge under the point in time event.

Investigation of Detection Methods of Defects in Existing Concrete Railing

The Illinois DOT has experienced problems with the construction of slip formed barrier rail for bridges. They discovered large voids in the core of the rails that were not visible from the surface. These voids could significantly reduce the structural capacity and shorten the service life of the rail. While we are not aware of a similar situation in barrier rails in Iowa, it may be that we have this problem and have not had the circumstances occur for it to be discovered. The consultant is reviewing methods for testing rebar corrosion at base of rail for finalizing scope of services. The methods they are reviewing are to find nondestructive methods to measure corrosion loss on embedded reinforcing at the construction joint between the deck and the barrier rail.

Need for Washing Weathering Steel Bridges

The findings of this study will assist weathering steel bridge owners to formulate effective management policies on the frequency and location of washing. Proper bridge maintenance practices will increase the service life of weathering steel bridges and increase the confidence level of bridge owners in using non-painted weathering steel. Furthermore, preventing corrosion of steel will result in safer structures. The project scope is still under development.

Concrete Drilled Shaft Testing Database

Concrete drilled shafts are being used more often, particularly in populated areas, as an alternative to driven piles in bridge construction. Bridges & Structures proposes to design and populate a data base for concrete drilled shaft load tests in Iowa based on the limited data available in state and similar databases used by other states. The data base will be used to help in the implementation of LRFD and determine design parameters for future drilled shafts.

GO Team Teen Driver Fatality Study

Based on the crash investigation principles developed in 1967 by the National Transportation Safety Board (NTSB), this project will consist of an interdisciplinary team of crash safety experts to develop short case studies for each fatal teen crash in Iowa. At the core of NTSB investigations is the "Go-Team." The purpose of the NTSB Go-Team is 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. This team will consist of experts in driver behavior and performance, Iowa crash data, traffic engineering, and logistics. In the first year, they will retrospectively examine at one year fatalities (2008) and plan for a 2009 prospective study.

Wind Loads on Dynamic Message Cabinets and Behavior of Supporting Trusses

Large Dynamic Message Signs (DMS) are used to provide timely information to motorists. There is increasing evident that the truss structures supporting these signs are subject to much more complex loadings than are typically accounted for. This study will include a wind tunnel and computational tasks as well as field observation. Field observation will include short-term (one or two days) monitoring of four DMS cabinet/trusses and long-term (three to six months) monitoring of one DMS cabinet/truss.

Midwest Transportation Symposium – This is a biennial event bringing researchers and transportation professionals together to discuss implementable solutions for challenges experienced by federal and state departments of transportation, cities, and counties. The 2009 Symposium included 135 papers, extended abstracts, and poster presentations and was attended by more than 250 people. Proceedings are at: <http://www.intrans.iastate.edu/pubs/midcon2009/>.

Technology Transfer Peer Exchange

Under SPR rules, each state department of transportation is required to hold a research peer exchange once every three years. Iowa's 2010 peer exchange focused on promising research. Ten states and FHWA were invited to participate. The event was held August 19-21, in conjunction with the Mid-Continent Transportation Symposium.

2011 Work Program – New Items

AASHTO LRFD Support

This is the continuation of what was previously a pooled fund TPF-5(068). It qualifies for 100% federal share.

Tow Plows

The Office of Maintenance is testing and evaluating an unmanned towable plow system that can clear the roadway of snow and ice from two lanes with one truck and a towable trailer. The trailer is equipped with an interchangeable 1,000 gallon liquid tank or 7 cubic yard material spreader on the steerable, dual-axle trailer. Three tow plows will be purchased; one each for metro areas in eastern and western Iowa and one for Des Moines. The tow plow can clear two lanes of snow or ice with one truck, one operator and the towable trailer, rather than the normal requirement of two trucks and two operators to accomplish the same task. The use of one truck with a towable plow system reduces the number of trucks and operators needed to clear the roadway and also allows the roadway to have two lanes plowed simultaneously. Two lanes cleared at the same time may provide a higher level of service to the traveling public. The towable trailer plowing system may also reduce maintenance costs and repairs. A report of results will be written with recommendations for possible future purchases.

Winter Operations Performance Measurement

Winter maintenance performance is often difficult to measure due to difficulties collecting enough meaningful measurements of the impact of our actions to the traveling public. Each storm is different, and each requires a slightly different level of effort to keep roads passable. Recently more work has been done on using traffic speeds during and after a storm as a way to measure the outcome of winter maintenance efforts. The actual speeds (as measured by RWIS, automatic traffic recorders, and third party travel time products) will be compared to the computed speeds to determine if maintenance efforts are keeping up to the requirements, given the winter weather conditions. We propose to build a winter maintenance reporting tool that can be used by an asset manager or garage supervisor to compute performance scores for user-defined time periods and areas, and show weather conditions, crew status, and other supporting information to help determine the conditions surrounding instances of good or bad performance.

Non-destructive Evaluation for Bridge Decks

A consultant will be hired to perform comprehensive non-destructive field testing to evaluate the present condition of several bridge decks. The immediate work will be on an I29 bridge over the Missouri River. Five other bridges have also been identified for evaluation. Possible work could include:

- Visual and delamination surveys.
- Sampling of the existing concrete for purpose of determining chloride contents and obtaining samples for laboratory testing of concrete and reinforcing bars.
- Measurement of reinforcing bar covers.
- Electrical testing of the concrete and reinforcing to establish corrosion potential, corrosion activity, and electrical connectivity.

The consultant will report on results of evaluations and guide the Iowa DOT in the establishment of an in-house testing and evaluation program using the accumulated knowledge.

Performance Evaluation of Epoxy Coated Bars in Iowa Bridge Decks

The purpose of this study is to determine how well the epoxy coating on reinforcing steel is working in bridge decks, and to determine potential causes for those locations where problems have occurred with the coatings. The scope of work for the proposed study includes: visual and delamination surveys of the bridge decks, sampling and testing of the existing concrete to determine chloride contents and to permit inspection of samples of the reinforcing, measurement of reinforcing bar covers, the evaluation of samples of the existing bars and the epoxy coatings, and electrical testing of the concrete and reinforcing to establish corrosion potential, corrosion activity, and electrical connectivity. Six bridges (two small, four medium sized) are to be selected from random locations around the state.

Investigation and Evaluation of Iowa Department of Transportation Bridge Deck Epoxy Injection Process

Bridge deck overlays typically last 15 to 20 years before delamination at the bond interface requires repairs to or replacement of the overlay. The delamination of the overlay is often repaired by Iowa DOT maintenance staff by injecting the deck overlay cracks and voids with epoxy.

Anecdotal observation by Iowa DOT field staff suggests that the epoxy injection process can delay repair of the overlays by 5 to 10 years, but there is currently not documentation to substantiate this. The process for epoxy injecting bridge deck cracks and delaminations is not well documented for DOT staff. There are wide variations in materials, equipment, and procedures used in the various Districts. There is a need to perform this treatment on 120-180 Iowa DOT structures annually.

The objectives of this project will cover three main focus areas; determination of the effectiveness, durability, and typical service life of epoxy injection of delaminated bridge decks, an evaluation of the current state of the practice in the epoxy injection industry, and development of procedures and specifications for epoxy injection.

Mass Concrete for Bridge Foundations

Iowa DOT has a Developmental Specification for Mass Concrete (Control of Heat of Hydration). The specification is based on national industry practices and experiences on the recent WB I-80 over Missouri River Bridge project. Mass concrete is defined as a concrete unit with a least dimension greater than three feet. If the mass concrete heat of hydration maximum temperature is not controlled the concrete can be susceptible to early deterioration through a mechanism called delayed ettringite formation cracking. Mass concrete temperature differentials between the core of the concrete unit and surface of the concrete can also cause immediate cracking when the strain due to the thermal differential exceeds the available tensile capacity of the curing concrete.

This research is an opportunity to tailor and refine Iowa's mass concrete specification for the conditions, materials and construction practices in Iowa. A considerable amount of data was collected on the WB I-80 over Missouri River Bridge. The research will involve analysis of the

data collected, comparative modeling of the mass concrete placements and ultimately recommendations for the Iowa DOT mass concrete specifications. If the project is successful, the Iowa DOT will benefit from predictive models to better manage the risks associated with mass concrete. In turn project mass concrete controls can be better tailored to the location, materials and elements being constructed and potentially reduce the costs bid by contractors for the mass concrete controls.

Hybrid UHPC/HPC for Bridge Deck Applications

The cost of UHPC material is significantly higher than the normal strength concrete which may hinder the routine use of UHPC in bridge decks. Given that deck deterioration occurs due to formation of crack on the top surface, a most cost-effective yet highly durable bridge deck could be formed through a composite bridge deck by overlaying a thin Ultra High Performance Concrete (UHPC) layer over a Normal Strength Concrete (NC) slab. However, a dependable shear friction for the UHPC and NC interface and the factors influencing its behavior needs to be investigated to make this concept a reality for field applications.

This proposed research is a continuation of the work completed in earlier phase which included the structural characterization of different shear friction interfaces that may be appropriate for overlying UHPC on NC slabs and the identification of the most suitable interface for this connection with due consideration to constructability and the benefits of strength and durability characteristics of heat treated UHPC. The research findings of the project will be disseminated to designers and through technical presentations at the local/regional/national conferences. To further disseminate the significance and major outcomes of the project, one journal and one conference paper as well as a technology transfer sheet will be created.

Determining Entrance Loss Coefficients for Twin Pre-Cast and Triple RCB Culvert Designs

Currently the Iowa DOT uses Cast-in-Place (CIP) Twin and Triple RCB's with standard flared wing wall designs. There is increased interest in constructing Pre-Cast (PC) Twin and Triple RCB's. The difference in the geometry of the standard flared wing walls for Twin or Triple Cast-in-Place RCBs from the straight Pre-Cast culverts results in a difference in entrance losses. In the case of single wing wall configurations, wing walls conduct the flow directly into the barrel, reducing contraction losses at the entrance. For the same configuration with multiple barrels, there is minimal contraction loss for interior barrels so losses are much lower. Thus, a multiple barrel system should perform better than the same number of single barrels. Estimating this difference in entrance losses is critical to provide appropriate design for newly built pre-cast culverts.

This project will consist of a physical modeling study to determine entrance losses for Pre-Cast Twin and Triple RCB's designs. In addition, we would like to compare the velocities and shear stresses associated with a straight vs. flared wing wall. This could determine if a certain configuration provides better dissipation of the energy to mitigate potential erosion/scour at the inlet or outlet of a box culvert. In order to optimize the designs of both types of box culverts, the effects of the span-to-rise ratio, skewed end condition, and optimum edge condition should also be determined.

Hydraulics Evaluation of Methods for Deflecting Debris from Bridge Piers

Debris accumulation on bridge piers is an on-going national problem that can obstruct the waterway openings of bridges and cause significant erosion/scour to stream banks and abutments. In some cases, the accumulation of debris can adversely affect the operation of the waterway opening or cause failure of the structure. In addition, removal of debris accumulation is difficult, time consuming and expensive for maintenance programs.

Researchers will identify cost effective methods for mitigating debris on bridges. The construction of several debris deflection methods will allow field evaluation and performance over time for potential implementation on other bridges throughout the State that experience debris problems. It is anticipated that one or more cost effective debris deflector methods will be recommended as part of the Phase I research. Once a cost effective method for mitigating debris on bridges is determined, it is anticipated that several bridge locations would be identified during Phase II of the research.

LRFD Design of Drilled Shafts

The objective of this study is to examine and improve drilled shaft design in accordance with LRFD specifications, thereby increasing its cost effectiveness. Cast-in-place drilled shafts are an alternative to driven steel H-piles that are cost-competitive and relatively easy to construct. In order to make them truly competitive, regional resistance factors should be developed. An SPR project is already underway to build a drilled shaft database of completed static load tests from Iowa and other states. In this study, investigators will analyze the collected data, then calibrate and verify resistance factors.

J Turn Simulation

At-grade intersection collisions on rural expressways reduce the safety benefits that should be achieved through conversion of undivided rural two-lane highways into expressways. Expressway intersections present challenges to crossing and left-turning minor road drivers attempting to select gaps in the far-side expressway traffic stream. One remedy is the J-turn intersection design. J-turn intersections reduce the potential for right-angle collisions (particularly far-side right-angle collisions) by replacing direct crossing and left-turn maneuvers from the minor roads with right-turns and downstream U-turns. For this project, two J-turn simulations will be developed and tested with the North American Driving Simulator (NADS) along with a Micro-station to NADS software converter.

Mobile Mapping

Utilizing Mobile Mapping technology allows pavement elevations to be determined from LiDAR (Light Imaging Distance and Ranging) data captured at highway speeds from a vehicle using a Mobile Mapping System. Mobile Mapping is a system that incorporates the technologies of the Global Positioning System (GPS), Inertia Measurement Units (IMU), cameras, and multiple laser scanners for determining the 3D location of topographic features from a vehicle traveling at posted speeds.

The proposed pilot project would encompass the Warren Co. interchange of IA 92 and I-35. This area was selected because this is the type of project where acquiring pavement elevations is dangerous and difficult and because the survey pavement data to be used for a comparison to

LiDAR was recently acquired. Performance of this technology will be determined on 4 lane divided highway, bridges, superelevated ramps, gore areas, bridge clearances, and divided sideroads within these project limits.

Staff plans to enter into an agreement for collecting point cloud data with a firm that provides Mobile Mapping collection and processing services. Working with the consultant, they will gain an understanding of the tasks, timeframe and effort required in the process of Mobile Mapping. We will compare the data provided to survey data for an accuracy assessment and determine what information can be extracted from the point cloud that meets survey accuracy.

Instrumentation and Monitoring of Accelerated Bridge Construction

The Iowa DOT and the FHWA, in coordination with the Strategic highway Research Program (SHRP2) project F04, Innovative Designs for Rapid Renewal, intend on demonstrating the latest advances in accelerated bridge construction methods. This accelerated project will limit the construction time to a maximum of two- week road closure. It is estimated that the construction time would have been six months under non-accelerated construction procedures.

The technologies incorporated into the proposed bridge project have been successfully used in constructed projects drawn from around the US. The fact that several diverse structural systems have been assembled and incorporated into a single project reinforces the concept that innovation does not necessarily mean creating something completely new, but rather facilitating incremental improvements in a number of specific bridge details to fully leverage previously successful work.

Iowa DOT construction project funds and SHRP II F04 funds will be used for the design and construction of the bridge. The funding for this project will be to instrument and monitor the bridge during and after construction, to determine the loading in various components due to construction forces and traffic.

Improving the Accuracy and Usability of Iowa Falling Weight Deflectometer Data

The objective of this phase II study is to incorporate significant enhancements into the software system for rapid processing of the FWD data and to improve the accuracy and usability of collected FWD data. These enhancements are considered necessary to make the software readily usable by the Iowa DOT engineers on a day-to-day basis. Efforts will be focused on the development of a fully-automated software system for rapid processing of the FWD data. The software system will automatically read the raw data collected by the FWD that Iowa DOT owns and process and analyze the collected data with the algorithms developed during the phase I study. This system will smoothly integrate the FWD data analysis algorithms and the computer program being used to collect the pavement deflection data. With the implementation of the developed software system the FWD data can be filtered, processed and analyzed on-the-fly.

Review of Breath Alcohol Ignition Interlock Devices: Policy and Implementation Implications

The goal of this proposal is to perform a systematic review of breath alcohol ignition interlock devices (BAIID or IID) to understand how other states have integrated such systems into administrative and judicial practice and to make recommendations for best practices in the state of Iowa. Towards this end, the University of Iowa and Iowa State University team proposes an

analytical framework and plan that examines how such systems have been implemented and evaluated. Understanding the history of such devices will help the state of Iowa enhance their OWI programs.

2011 Peer Exchange

Under SPR rules, each state department of transportation is required to hold a research peer exchange once every three years. Iowa's 2011 peer exchange will focus on promising research. Eleven states and FHWA have been invited to participate. The event will be held August 18-19, in conjunction with the Mid-Continent Transportation Symposium.

2011 Mid-Continent Transportation Research Symposium

This is a biennial event bringing researchers and transportation professionals together to discuss implementable solutions for challenges experienced by federal and state departments of transportation, cities, and counties.

RFID Rebar Corrosion Detection

This project will evaluate the use of low-cost RFID tags for detection of rebar corrosion at the interface between the bridge deck and the concrete barrier rail. Tiny radio transponders known as RFID tags will be embedded in the concrete barrier rail at the rebar during bridge construction. These tags are commercially available and cost in the range of 5 cents to 1 dollar (primary uses are asset tracking, logistics, contactless door locks, etc.). A tag embedded in concrete will fail once sufficient water and chloride ion have penetrated to corrode the tag's antenna connection. The bridge deck would be scanned by simply driving over it with an RFID scanner and GPS. As tags fail (can no longer be detected by the scanner), that would indicate deep chloride penetration to the layer of the tags.

2011 Work Program – Projects Continued from 2010, Funded in 2011

InTrans Support

Iowa DOT support for InTrans (formerly CTRE) ensures that research will be oriented toward real-world results and applications. A more detailed discussion of InTrans can be found in Section IV B of this report.

IOWA STATE UNIVERSITY
Institute for Transportation

★ **Result:** Continued support for InTrans provides technology transfer assistance to the Iowa DOT with technology transfer activities.

AASHTO Partnerships

Iowa DOT supports six AASHTO cooperative projects:



- Product Evaluation (NTPEP)
- Approved Product Evaluation List (APEL)
- Technology Implementation Group (TIG)
- Environmental Technical Assistance Program
- Transportation System Preservation Program (TSP2)

★ **Result:** Access to nationwide knowledge, expertise, and new technology

Remote Sensing Support

This is a long-term project for Iowa DOT. Funds are allocated for partnerships, training and upgrades of existing infrastructure and for promoting more efficient and effective use of the technology.

Geotechnical Support (formerly PGA) – Pavement performance issues sometimes relate to subgrade problems which can cause premature failure of the pavement system. Geotechnical research is performed by the new Earthworks Engineering Research Center (EERC) at Iowa State, which expands the mission of the Partnership for Geotechnical Advancement (PGA). For more information, see <http://www.eerc.iastate.edu>.



★ **Result:** Longer lasting pavement with lower life-cycle cost.

Information Technology Development

This is a multi-year pilot project that employs student programmers through InTrans to develop several management tools for use in DOT. The initial project was Resource Management System (RMS), Daily Log phase. RMS will be used by maintenance staff for managing both human and physical resources. A current application being developed is the Laboratory Information Management System (LIMS) for the Office of Materials.

★ **Result:** New systems developed at lower cost to meet existing needs

Pavement Marking Management System

Phase 4 of this project was requested by the Offices of Traffic & Safety and Maintenance. This phase extends across two years. Tasks include:

- Enhance pavement marking management tools
- Incorporate spring and fall assessment data into the marking tool
- Continue monitoring and analysis of existing demonstration sites statewide
- Complete an analysis of All Weather Pavement Markings (I-35)
- Provide support to the Pavement Marking Task Force (monthly meetings)
- Provide training to central and district staff on management tools
- Implementation and Operation

★ **Result:** More effective pavement marking management

Bridge Construction Web Management

This research project proposed to investigate DOT requirements for a web-based construction project management and collaboration tool, review industry “best-practices”, review commercially available software options, make a recommendation for implementation of an available tool, and conduct a pilot project.

★ **Result:** The pilot project is underway.

Safety and Mobility Impacts of Winter Weather

The primary objectives of Phase 1 of this project are to: 1) identify habitual, winter weather-related crash sites on state-maintained rural highways in Iowa, 2) investigate highway agency practices regarding integration of traffic safety- and mobility-related data in winter maintenance activities and performance measures, and 3) develop a preliminary work plan focusing on

systematic use of safety- and mobility-related data in support of winter maintenance activities and collateral performance monitoring.

Technical Training and Conferences

The Iowa DOT has a high demand for technical training due to the nature of our work. Technology and best practices evolve constantly and require constant updating. Conferences attended using SPR funds are those at which the trainee will gain new technical knowledge directly applicable to his or her work. Employees who attend SPR-funded training and conferences must be working on a Federal-aid project, the cost must be reasonable and the training must be necessary to perform the federally funded work. Technical training is made available to DOT staff and to county and city staff when possible. In FY 10, a total of 5 NHI and other technical courses were scheduled to be attended by more than 110 employees of Iowa DOT, FHWA, and local agencies. A detailed list of courses planned can be found in *Attachment 7*. Not all the courses have been held yet.



★ **Result:** Better technically trained staff

Research Support (775)

The objective of this section of the SPR program is to promote and provide support for essential priority research and data collection activities in support of further development of the highway engineering program. This permits purchase of equipment or software not normally used in day-to-day work of the department.

Accomplishments in FY 2011

Moisture Induced Sensitivity Testing (MIST)

The existing standard test (AASHTO T283) for moisture sensitivity requires approximately 5 days for results. The Contractor will not become aware of potential problems (and penalties) until results are available. A new test that is currently being evaluated (Hamburg Wheel Tracking Device) can reduce the time to 2-3 days with superior repeatability. While the Hamburg can identify superior performing mixtures, it cannot definitively identify those with marginal performance. The MIST device is hypothesized to provide a quick (completed in 4 hours) test to identify moisture susceptibility in asphalt mixtures during the production phase.

The equipment has been purchased and is being used to test mixtures that are known to be susceptible to moisture damage in Iowa. Results will be compared with those from the Hamburg (AASHTO T324) and AASHTO T283. The Materials Laboratory Staff is performing the testing and assisting in the final report. Bituminous Engineer Scott Schram is analyzing the data and writing the final report.

Hach 2100Q Portable Turbidimeter

This equipment measures turbidity of water. Use of this equipment may possibly improve the DOT's storm water permit compliance by measuring effectiveness of our sediment and erosion control measures. The transparency tube results will be compared with the turbidimeter results

from field measurements in the 2011 construction season. Melissa Serio will work with others to evaluate and report on the effectiveness of the turbidimeter.

Profile of OWI Offenders and Recidivism

This study focuses on OWI offenders and the sanctions that are used to deter additional offenses. Researchers will create a descriptive profile of first and second-time OWI offenders and seek to answer specific questions such as “What demographic variables, attitudes, and behaviors and sanctions are associated with Driving Under Suspension and second OWI offenses?” Results can be used to strengthen the effect of both civil and criminal sanctions as well as improve the quality of several traffic safety programs in the state.

Intelligent Compaction Pilot Project

Following on the success of the IC workshop, the Office of Construction began an evaluation of intelligent compaction on active construction projects in the 2009 construction season. A preliminary data report has been submitted to Iowa DOT on April 8, 2010 with results obtained from three demonstration projects held during summer-fall 2009. Detailed data analysis on the 2009 projects has been completed. The Phase I report presents detailed findings from each project site, and empirical correlations between roller IC measurements and in-situ density, modulus, and shear strength measurements based on measurements obtained from various calibration and production test beds.



The research team had discussions with Iowa DOT and the contractor on upcoming Harrison County and Ida County IC-HMA overlay projects. Harrison County project involved obtaining roller compaction measurement values (Sakai CCV system). The research team worked with the Iowa DOT in obtaining HMA box samples from intermediate and surface course layers to conduct dynamic load testing on the samples. Results from these tests were used to correlate with field falling weight deflectometer (FWD) measurements and roller measurements on the two layers at several core locations.

★ **Result:** A clearer understanding of changing technology and how to use it most effectively.

Phase 2 investigated the effectiveness of existing roadway/roadside improvements, identify specific mitigation strategies (such as targeted/reprioritized maintenance activities, roadway/roadside improvements, and application of ITS technologies) for use in Iowa, and begun implementation of these strategies, particularly at problem areas identified in Phase 1.

★ **Result:** Better understanding of the causes of winter weather crashes and possible preventive strategies.

2011 Work Program

Moisture Induced Sensitivity Testing (MIST)

The existing standard test (AASHTO T283) for moisture sensitivity requires approximately 5 days for results. The Contractor will not become aware of potential problems (and penalties) until results are available. A new test that is currently being evaluated (Hamburg Wheel Tracking Device) can reduce the time to 2-3 days with superior repeatability. While the Hamburg can

identify superior performing mixtures, it cannot definitively identify those with marginal performance. The MIST device is hypothesized to provide a quick (completed in 4 hours) test to identify moisture susceptibility in asphalt mixtures during the production phase.

The equipment will be used to test mixtures that are known to be susceptible to moisture damage in Iowa. Results will be compared with those from the Hamburg (AASHTO T324) and AASHTO T283. The work will be done during the 2010-2011 winter period in the Bituminous Materials Section. The Materials Laboratory Staff will perform the testing and assist in the final report. Bituminous Engineer Scott Schram will analyze the data and author the final report.

Hach 2100Q Portable Turbidimeter

This equipment measures turbidity of water. Use of this equipment may possibly improve the DOT's storm water permit compliance by measuring effectiveness of our sediment and erosion control measures. The transparency tube results will be compared with the turbidimeter results from field measurements in the 2011 construction season. Melissa Serio will work with others to evaluate and report on the effectiveness of the turbidimeter.

★ **Result:** The unit is being evaluated.

Pooled Fund Studies (776)

Transportation Pooled Fund (TPF) study means a planning, research, development, or technology transfer activity administered by the FHWA, a lead State DOT, or other organization that is supported by two or more participants and that addresses an issue of significant or widespread interest related to highway, public, or intermodal transportation. A transportation pooled fund study is intended to address a new area or provide information that will complement or advance previous investigations of the subject matter.

According to Code of Federal Regulations 23 §420.205, "To promote effective use of available resources, the State DOTs are encouraged to cooperate with other State DOTs, the FHWA, and other appropriate agencies to achieve RD&T objectives established at the national level and to develop a technology transfer program to promote and use those results. This includes contributing to cooperative RD&T programs such as the NCHRP, the TRB, and transportation pooled fund studies as a means of addressing national and regional issues and as a means of leveraging funds."

Pooled fund studies are a very effective means of leveraging precious research funds.

Iowa currently leads 13 national pooled fund projects and is an active participant in 22 others. Each pooled fund study and its anticipated impact (i.e. ★ **Result**) are described here.

Iowa-led Inactive Pooled Fund Projects (776)

ITS Pooled Fund (ENTERPRISE) – SPR-3(020)

The purpose of this project is to develop, evaluate, and deploy Intelligent Transportation Systems. Participants include eight other U.S. states, one Canadian province, Transport Canada, and the Dutch Ministry of This project will involve the following tasks that establish the protocols for design and construction of non-fracture critical structures:

- Experimental study of fracture in I-girders to determine supplemental toughness requirements
 - o Full scale fracture tests
 - o Fracture Mechanics Tests
- Establish damage tolerant design concepts to utilize toughness and set in-service inspection requirements.
- Detailed, 3D Finite element modeling of a two girder bridge system to set detailing requirements for redundancy. Ideally this will include analysis of a two girder concept for an actual bridge project.
- Develop a guide specification for design and fabrication of non-fracture critical low redundancy structures. Transportation. ENTERPRISE provides a forum for member agencies to communicate and pursue ITS projects that might be difficult to initiate on their own. Statewide projects and the establishment of a 511 travel information program are two examples of areas that are of interest to members. ENTERPRISE is an ongoing project started in 1991 and has a \$250,000 annual budget. Its web site is www.enterprise.prog.org.

★ **Result:** Project completed, objectives fulfilled, and financials being closed out. See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/159>

Highway Maintenance Concept Vehicle – SPR-3(060)

Four phases of this project to apply new technology to a maintenance vehicle have been completed. In Phase 5, which is co-sponsored by the Clear Roads pooled fund, researchers have designed and built a prototype snowplow to remove snow more efficiently than plows in use today.



The plow developed in this project has a contour-following blade, or alternative to a blade, capable of clearing a roadway in one pass, reducing snow residue behind the plow, and plowing at a speed that is within ten mph of traffic speed-about 40-45 mph.

★ **Result:** Project completed, objectives fulfilled, and financials being closed out. See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/206>

Midwest States Work Zone Deployment – SPR-3(075)

Through this five state pooled-fund study which began in 1999; researchers investigate better ways of controlling traffic through work zones. Work is accomplished via a variety of projects carried out by researchers in the member states. During the first four years of the study, a total

of 35 technologies were deployed and evaluated. A list of past and current projects can be found at www.ctre.iastate.edu/smartwz/index.cfm.

★ **Result:** Project completed, objectives fulfilled, and financials being closed out. See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/223>

REPORT (CARS) – SPR-3(079)



The CARS (Condition Acquisition and Reporting System) consortium was formed to promote the deployment of road condition reporting systems and road weather prediction systems. The resulting CARS program is used in Iowa as described in the next section under ITS Projects. A description of the various aspects of CARS used by Iowa and other states can be found at www.carsprogram.org.

★ **Result:** Project completed, objectives fulfilled, and financials being closed out.

Long Term Maintenance of LRFD – TPF-5(068)

To provide timely assistance to the AASHTO Highway Subcommittee on Bridges and Structures in interpreting, implementing, revising, and refining the AASHTO load and resistance factor documents.

★ **Result:** Project completed, objectives fulfilled, and financials being closed out. See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/286>

Iowa-led Active Pooled Fund Projects (776)

Snow and Ice Control (SICOP) – TPF-5(009)

SICOP is the Snow and Ice Pooled Fund Cooperative Program - developed by AASHTO. SICOP is under the oversight of the Winter Maintenance Technical Service Program. The goals of the winter maintenance program are to

- 1) Sustain or improve levels of winter maintenance service with significant benefit/cost improvements,
- 2) Provide an enhanced level of environmental protection, and
- 3) Place technology in service on operational maintenance sections within two winter seasons.

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/4>



Aurora – SPR-3(042)



The Aurora Program is a consortium of agencies focused on collaborative research, evaluation, and deployment of advanced technologies for detailed road weather monitoring and forecasting. Its projects result in technological advancement and improvement of existing Road Weather Information Systems (RWIS). Participants include eight other U.S. states, two Canadian provinces, and the Swedish National Road



Administration. Aurora is an ongoing project started in 1995 and has an annual budget of about \$200,000. The Aurora Work Plan can be found at the website, www.aurora-program.org.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/128>

Smart Work Zone Deployment Initiative – TPF-5(081)



Through this five state pooled-fund study which began in 1999; researchers investigate better ways of controlling traffic through work zones. Work is accomplished via a variety of projects carried out by researchers in the member states. During the first four years of the study, a total of 35 technologies were deployed and evaluated. A list of past and current projects can be found at www.ctre.iastate.edu/smartwz/index.cfm.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/303>

Technology Transfer Concrete Consortium – TPF-5(159)



This project continues the collaborative effort begun in TPF-5(066) Materials and Construction Optimization. The TTCC will be open to any state desiring to be a part of new developments in concrete paving leading to the implementation of new technologies which will lead to longer life pavements through the use of the innovative testing, construction optimization technologies and practices, and technology transfer. This partnership is also part of the Track Team for the CP Road Map Mix Design and Analysis Track. The Track Team will include state representatives along with FHWA representatives, industry representatives (from ACPA, ACPA chapters, and material suppliers), consultants, and academic representatives.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/390>

Investigation of Curved Girder Bridges with Integral Abutments – TPF-5(169)

The purpose of the research is to investigate the use of integral abutments on curved girder bridges through a monitoring and evaluation program for in service bridges. The research will be conducted as a multiple phase study.



★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/396>

Improving the Foundation Layers for Concrete Pavements – TPF-5(183)

The objective of this research is to improve the construction methods, economic analysis, and selection of materials, in-situ testing and evaluation, and development of performance-related specifications for the pavement foundation layers. Quality pavement foundation layers are

essential to achieving excellent pavement performance. In recent years as truck traffic has greatly increased, the foundation layers have become even more critical to successful pavement performance. Although the focus of this research will be PCC concrete pavement foundations, the results will likely have applicability to ACC pavement foundations and, potentially, unpaved roads.

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/408>

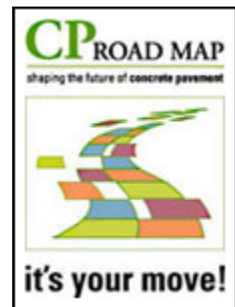
Mix Design and Analysis – TPF-5(205)

The vision behind the work described in the Mix Design and Analysis (MDA) Track of the CP Road Map is to develop tools to help specify and make mixtures for concrete pavements that are consistently long-lasting, constructible, and cost efficient. The activities are intended to meet some of the needs identified by the track including

- Evaluation of emerging testing equipment,
- Modeling,
- Mixture testing and analysis guidelines (specifications), and
- Training and outreach.

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/430>



Novice Drivers, the Million Mile Study – TPF-5(207)

The million-mile study of 14½ year-old drivers is the first study of its type to provide parents and teens context-related information on their driving development using video feedback. Using the DriveCam event triggered video recorder, this study will provide a unique and sustained look into young driver skill development for state and federal policy makers, and the automotive and insurance industries.



★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/432>

Joint Deterioration in Concrete Pavements – TPF-5(224)

The goal of this research project is to investigate the causes of this joint deterioration, estimate impacts based on an understanding of the problem and to develop repair, material, and construction strategies to minimize the sources. The objectives are:

- Determine the causes of anomalous concrete joint deterioration nationwide.
- Quantify any contributions to joint deterioration due to deicing chemicals and develop estimates of service reduction and life cycle costs.
- Develop recommendations based on research results for minimizing future joint deterioration on both existing pavements and new construction including possible repair methodologies and specification modifications.

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/452>

Impacts of Implements of Husbandry on Bridges – TPF-5(232)

The objective of this study is to determine how the implements of husbandry distribute their load within a bridge structural system and to provide recommendations for accurately analyzing bridges for these loading effects. To achieve this objective the distribution of live load and dynamic impact effects for different types of agricultural vehicles will be determined by load testing and evaluating two general types of bridges. The types of equipment studied will include but will not be limited to; grain wagons/grain carts, manure tank wagons, agriculture fertilizer applicators, and tractors. Once the effect of these vehicles has been determined, recommendations for the analysis of bridges for these non-traditional vehicles will be developed. Since Iowa DOT has already identified bridges needing evaluation, Iowa DOT is providing the funding sufficient for the completion of Phase I. Iowa State University (ISU) researchers associated with the Bridge Engineering Center will be performing the tasks associated with Phase I.

A proposed Phase II will provide the opportunity for other states to participate, including suggesting additional bridges/bridge types for evaluation or for the expansion of the Phase I plan to include a more comprehensive analytical component.

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/460>

Tech Transfer Intelligent Compaction Consortium (TTICC) – TPF-5(233)

The proposed project is for the establishment of a pooled fund for state representatives to continue this collaborative effort regarding intelligent compaction. The TTICC will be open to any state desiring to be a part of new developments in intelligent compaction leading to the implementation of new technologies which will lead to longer life pavements through the use of an integrated system of emerging innovative technologies. Two workshop meetings will be conducted each year. One of the meetings will be in person and is anticipated to occur during fall. The location of the in-person workshop meetings will be determined by the Executive Committee and moved regionally each year to participating states. The second meeting will be a webinar and occur in early spring hosted by the EERC. The objectives are:

- Identify and instigate needed research projects
- Develop pooled fund research projects for solutions to intelligent compaction issues
- Act as a technology exchange forum for the participating entities
- Be a forum for states and researchers to share their experience with IC technologies
- Identify and guide the development and funding of technology transfer materials such as tech brief summaries and training materials from research results
- Review the IC Road Map as updated annually and provide feedback to the FHWA, industry, states, and the EERC on those initiatives
- Provide research ideas to funding agencies
- Include current activities and deliverables of the pooled fund on the TTICC website
- Maintain pooled fund project website with current activities and deliverables
- Contribute to a technology transfer newsletter on intelligent compaction research activities every six months in cooperation with the EERC
- Post minutes to the website following web meetings
- Post a report following each in-person workshop to the website

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/461>

Pooled Fund Projects with Iowa Participation (776)

Transportation Curriculum Coordinating Council: Training Management and Development (TCCC) – TPF-5(046) – FHWA led

A well-trained workforce is a more efficient and effective workforce. With that goal in mind, the Transportation Curriculum Coordination Council (TCCC), formed in the summer of 2000, has dedicated itself to improving training opportunities for transportation workers. The Council's goals also include developing a national core curriculum that can be used by any agency and building partnerships among State highway agencies and industry associations so as to save time and costs in developing training materials. For more information on TCCC, visit <http://tccc.gov/>



★ **Result:** Current needs identified for this region include developing field construction courses, basic materials courses for maintenance staff, and train-the-trainer courses for lab technicians.

Traffic Control Device (TCD) Consortium – TPF-5(065) – FHWA led

The TCD Consortium is composed of regional, state, local entities, appropriate organizations and the FHWA. Its goals are to:

- Establish a systematic procedure to select, test, and evaluate approaches to novel TCD concepts as well as incorporation of results into the MUTCD;
- Select novel TCD approaches to test and evaluate.
- Determine methods of evaluation for novel TCD approaches.
- Initiate and monitor projects intended to address evaluation of the novel TCDs.
- Disseminate results.
- Assist MUTCD incorporation and implementation of results.



★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/281>

Evaluation of Low Cost Safety Improvements – TPF-5(099) – FHWA led

This project will encompass safety-effectiveness evaluations of priority strategies from the NCHRP Report 500 Guidebooks, Guidance for Implementation of the AASHTO Strategic Highway Safety Plan.

The goal of this research is to develop reliable estimates of the effectiveness of the safety improvements that are identified as strategies in the National Cooperative Highway Research Program (NCHRP) Report 500 Guides. These estimates are determined by conducting scientifically rigorous before-after evaluations at sites in the U.S. where these strategies are being implemented

Additional information can be found at the URL: <http://www.fhwa.dot.gov/research/>

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/332>

Deer Vehicle Crash Information and Research (DVCIR) Center – TPF-5(120) – FHWA led

A significant amount of money has been spent on the implementation and study of deer-vehicle crash (DVC) countermeasures in the last several decades, but their expected crash reduction effectiveness is still largely unknown. The complexity and interdisciplinary requirements of implementation and long-term study of the correct potential DVC countermeasure(s) in the appropriate locations has limited the usefulness and transferability of past studies. A need exists to create a focal point for the definition and implementation of DVC-related research. This pooled fund would allow for the creation of a DVC Information and Research Center (DVCIR Center) to more properly address issues related to the DVC problem.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/352>

Low Temperature Cracking of Asphalt Pavement, Phase 2 - TPF-5(132) – Minnesota led

The research proposed in this field study will build on all the previous research in the area of low temperature cracking performed in Minnesota and around the country. The next step is to validate the new models and laboratory test methods with field performance tests at MnROAD. The models being developed for top-down cracking and reflective cracking may be of some use for modeling thermal cracking. New asphalt materials, including modified PG binders, can be tested according to the principles developed in past research. Finally, upgrades to the AASHTO 2002 Design Guide could be proposed based on new innovations in modeling.



★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/395>

Mississippi Valley Freight Coalition – TPF-5(156) – Wisconsin led

The Coalition seeks to work closely with the ten states of the Mississippi Valley region to maximize the operational efficiency of the freight transportation system within our region. The objectives are:

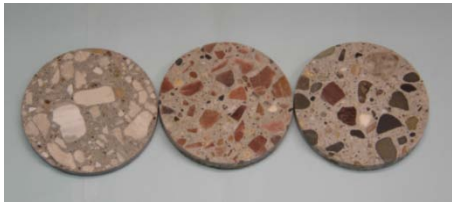
- Share information between agencies that will improve the understanding of freight issues and the management of freight services and facilities
- Reach out to and share ideas with private sector shippers and carriers on approaches to making freight flow more smoothly through the region
- Gather, analyze and share information on the movement of freight throughout the region with sister agencies and with private sector interests
- Define a system of regionally significant freight highway, rail and water corridors and facilities and establish performance expectations for those facilities that will guide their management and operations
- Evaluate, implement and operate technologies and other roadway appurtenances from a regional perspective and in a manner that supports the reliable, efficient and safe movement of freight

- Evaluate, implement and enforce traffic and vehicle regulations that promote the reliable, efficient and safe movement of freight
- Identify corridors or bottlenecks that frustrate the movement of freight and then taking actions, individually or as a group, to improve those corridors or bottlenecks
- Define and support national transportation policies that will support and improve the movement of freight in the region

★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/382>

Evaluation of Test Methods for Permeability - TPF-5(179) – Indiana led



Historically, concrete has been specified and placed using prescriptive specifications. As a result DOT specifications for concrete pavements and bridge decks typically contain a specified compressive strength and prescriptive limitations on water-to-cement ratios, minimum cement contents, and supplementary cementitious addition rates. This project

will investigate whether an alternative to these prescriptive limits can be developed.

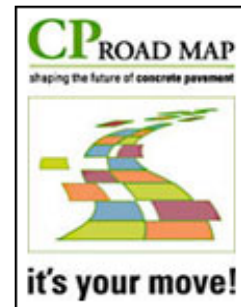
★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/406>

CP Roadmap Administration – TPF-5(185) – FHWA led

The CP Road Map is a strategic Long-Term Plan for Concrete Pavement Research and Technology that guides the investment of concrete pavement research dollars toward the development of specific technologies and systems identified by stakeholders as critical for accomplishing customer-driven goals. It is comprehensive in that it helps the concrete pavement community meet today's paving needs and tomorrow's pavement challenges.

Composed of integrated research tracks, with more than 250 research problem statements, it provides a collaborative management structure for existing local, state, and national concrete pavement research programs to focus their investments (about \$300 million over 10 years) on stakeholder-identified priorities.



★ **Result:** See following web site for progress reports –

<http://www.pooledfund.org/Details/Study/409>

Enhancement of Welded Steel Girders – TPF-5(189) – Kansas Led

Distortion-induced fatigue cracks constitute a serious national problem given the large number of steel girder bridges constructed before 1985 that are affected by this type of failure. It is estimated that 90% of all fatigue-related cracks in bridges have arisen due to out-of-plane distortion. Finding, repairing, and potentially preventing fatigue cracks at details susceptible to out-of-plane distortion represents a significant expense to State DOTs.

The main objective of the proposed research is to explore the use of composite materials and hole treatments (ultrasonic impact treatment and bolt interference) to develop new retrofitting techniques aimed at extending the fatigue life of bridges with connection details susceptible to distortion-induced fatigue. The techniques that will be studied were selected because they are

relatively inexpensive, easy to implement, and can be carried out without significant disruptions to traffic.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/413>

Midwest States Crash Test Program – TPF-5(193) – Nebraska led

The purpose of this program, established in 1990, is to crash test highway roadside appurtenances (guardrails, bridge rails, signposts, barriers, etc.) to assure that they meet criteria established nationally. Full scale crash testing is performed at the Midwest Roadside Safety Facility, University of Nebraska.



★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/418>

HY-8 Culvert Analysis Program – TPF-5(202) – FHWA led

The HY-8 is a computerized implementation of FHWA culvert hydraulic approaches and protocols. The objective of this research effort is to continue the phased development of HY-8. The anticipated scope of work consists of continued development efforts on the HY-8 software (beginning with phase three of the on-going development effort). The improvements would include hydrograph routing, analyzing hydraulic jumps, broken back culverts, and bottomless culverts.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/428>

Clear Roads – TPF-5(218) – Minnesota led



Clear Roads is an open, cooperative research program aimed at funding highly relevant research to meet the needs of winter operations professionals around the world. This is an ongoing pooled fund project that proposes and funds new research projects or related

activities on an annual basis. The Technical Advisory Committee proposes new research projects for funding every year. For more information see the web site at www.clearroads.org.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/446>

Accommodating Oversize/Overweight Vehicles at Roundabouts – TPF-5(220) – Kansas led

Roundabouts are intentionally designed to operate at slower speeds by using narrow curb-to-curb widths and tight turning radii. However, if the design is too restrictive roundabout use by superloads may be difficult or impossible. Typical superloads are routed around restrictions such as bridges and narrow roads. With the growing popularity of roundabouts, such routing is becoming more difficult. Also, roundabouts can be damaged by too-wide loads which have difficulty making the narrow turns.



The objectives of this project are to: 1) compile current practice and research by various states and countries related to the effects that oversize/overweight vehicles (also called super loads) have on roundabout location, design and accommodation, and 2) fill in information gaps with respect to roundabout design and operations for these classes of vehicles.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/448>

ITS Pooled Fund (ENTERPRISE) – TPF-5(231) was SPR-3(020) – Michigan led

The purpose of this project is to develop, evaluate, and deploy Intelligent Transportation Systems. Participants include eight other U.S. states, one Canadian province, Transport Canada, and the Dutch Ministry of This project will involve the following tasks that establish the protocols for design and construction of non-fracture critical structures:

- Experimental study of fracture in I-girders to determine supplemental toughness requirements
 - o Full scale fracture tests
 - o Fracture Mechanics Tests
- Establish damage tolerant design concepts to utilize toughness and set in-service inspection requirements.
- Detailed, 3D Finite element modeling of a two girder bridge system to set detailing requirements for redundancy. Ideally this will include analysis of a two girder concept for an actual bridge project.
- Develop a guide specification for design and fabrication of non-fracture critical low redundancy structures. Transportation. ENTERPRISE provides a forum for member agencies to communicate and pursue ITS projects that might be difficult to initiate on their own. Statewide projects and the establishment of a 511 travel information program are two examples of areas that are of interest to members. ENTERPRISE is an ongoing project started in 1991 and has a \$250,000 annual budget. Its web site is www.enterprise.prog.org.

★ **Result:** See following web site for progress reports –
<http://www.pooledfund.org/Details/Study/459>

Solicited Pooled Fund Projects with Iowa Participation (776)

Design and Fabrication Standards to Eliminate Fracture Critical Concerns in Two Girder Bridge Systems – Solicitation 1257 – Indiana led

The FHWA currently has the authority to allow owners to forego fracture critical inspection for low redundancy bridge structures on a case by case basis, but this has rarely been done since no guidance is available for ensuring bridge safety. This project will establish guidance that provides a high level of bridge safety that can then form the basis for in-service inspection decisions.

When considering the estimated projects costs, it must be recognized that the results of this research will be transformative for the steel bridge industry. For the first time, material selection, design, and inspection will be rationally integrated to eliminate fracture concerns. This can result in significant cost savings for medium and long span bridges and facilitate introduction of modular concepts for short span bridges.

This project will involve the following tasks that establish the protocols for design and construction of non-fracture critical structures:

- Experimental study of fracture in I-girders to determine supplemental toughness requirements
 - Full scale fracture tests
 - Fracture Mechanics Tests
- Establish damage tolerant design concepts to utilize toughness and set in-service inspection requirements.
- Detailed, 3D Finite element modeling of a two girder bridge system to set detailing requirements for redundancy. Ideally this will include analysis of a two girder concept for an actual bridge project.
- Develop a guide specification for design and fabrication of non-fracture critical low redundancy structures.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1257>

Bulb-T Beam as Alternate ABC to Side-By-Side Box-Beam – Solicitation 1264 – Michigan led

To analyze and evaluate the decked bulb-T beam (or decked I- beam) as a viable replacement for the side-by-side box-beam bridge. The project's description uses the term bulb- T beam as a general description of an I- beam shape, with a wide top flange that can serve as a deck surface. For this type of beam to be a viable replacement to a box beam, it must have a very robust cross-section designed to have a shallow depth-to-span ratio; which makes it very different than the standard AASHTO section used by some states. The use of a bulb- T beam cross section would eliminate inherent problems associated with the ability to inspect and repair box-beam type structures. The Bulb-T beam cross-section will provide enough space at the section bottom for ease of periodical inspections and maintenance of critical elements; such as beam web and the soffit of the bridge deck slab.

The purpose of this proposed study is to collaborate and share common interests with State DOTs in the Midwest area, and other research stakeholders, regarding alternative/innovative solution(s) to environmental and structural challenges in building and maintaining a sustainable transportation infrastructure. In correlation with analyzing the bulb- T beam this study includes comparing alternative non-corrosive materials, including, but not limited to carbon fiber, stainless steel and stainless clad reinforcement materials. The study's analysis and evaluation will include the evaluation of top flange connection details including the use of ultra-high performance concrete (UHPC) to fill the joint between the adjacent decked bulb-t beams (as used in New York).

The goal is to have a bridge structure with a service life exceeding 100 years, and have rapid

construction applicability.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1264>

Transportation Library Connectivity and Development – Solicitation 1271 (was TPF-5(105) – Missouri led

To support the coordinated development of transportation libraries, help implement TKNs and extend efforts beyond those of the TPF-5(105) Transportation Library Connectivity pooled fund, the following objectives have been adopted. These will be accomplished through member activities, partnerships with professional groups such as TRBs Library and Information Science for Transportation Committee, SLAs Transportation Division and the services of a qualified consultant:

1. Provide technical guidance to eligible members, focused on smaller libraries that are served by only one librarian, while emphasizing an increased reliance on self-sustaining networks.
2. Promote the value of transportation library and information services through the following activities:
 - a. Create key information products to demonstrate the value of, and further the contribution of, libraries to the field.
 - b. Deliver presentations to gatherings of DOT administrators, such as meetings of AASHTO and TRB Committees (Highways, Planning, Environment, etc...).
 - c. Share training materials and provide training sessions, with an added marketing component, for library users at member institutions.
3. Conduct an annual meeting and workshop, in conjunction with other events, to help members demonstrate the value of library and information services to their customers.
4. Develop an interactive content management system (CMS) based project website, including tracking and reporting information, as well as provide limited access to server space.
5. Collaborate with the National Transportation Library, the AASHTO RAC Task Force on TKNs and other stakeholder groups to enhance communication between transportation librarians, specifically to support their projects as they help implement Transportation Knowledge Networks.
6. Pay OCLC and TLCat subscriptions for eligible pooled fund members.
7. Implement focused research and technology projects, as proposed by members, on an annual basis. Potential projects which have already been identified include:
 - a. Financial, technical, and logistical support for the creation of an NTKN portal website as envisioned in NCHRP Report 643.
 - b. The completion of a return-on-investment case study highlighting the tangible contributions of libraries to research.
 - c. A collaborative cataloging project to expand access to transportation resources, possibly done in conjunction with the National Transportation Knowledge Network, alleviating member time constraints.
 - d. Pooled subscriptions for online databases to improve the accessibility of electronic information while reducing access costs to member libraries.
 - e. Digitization support for institutions wishing to convert printed copies of older materials to digital formats.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1271>

Accelerating Maintenance Innovation Implementation & Tech Transfer – Solicitation 1272 – Missouri led

Through this pooled fund project, the Missouri Department of Transportation plans to work with other State Departments of Transportation (DOTs) to establish a program in order to facilitate the implementation of promising innovations and technologies. This project will provide a forum for State DOTs to share their maintenance innovations with each other, support technology transfer activities and develop marketing and deployment plans for the implementation of selected innovations. Resources will be provided for implementing the innovations that includes travel, training and other technology transfer activities.

It is anticipated that this consortium would become the national forum for state involvement in the technical exchange needed for collaboration and new initiatives, and be a forum for advancing the application and benefit of research technologies. State participation in this process will be through the pooled fund. FHWA, industry and others will be invited to participate in the project discussions and activities.

Workshops could be provided for the states participating in the pooled fund project. This project will help DOTs to save time and money by not investing in the same research that has already been performed by other State DOTs. Hence rather than having each DOT identify and implement research separately, DOTs can work collectively through this pooled fund project. The Missouri DOT will serve as the lead state for the execution of the pooled fund project described in this proposal. The Missouri DOT will handle all administrative duties associated with the project.

- 1) Identify promising innovations and technologies ready for implementation within Maintenance activities, developed by the participating State DOTs;
- 2) 2) Develop marketing plans for selected ready to deploy innovations and technologies;
- 3) 3) Organize training classes about specific research topics for member State DOTs.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1272>

Next-Generation Transportation Construction Management – Solicitation 1280 – Colorado led

The Transportation Construction Management Group (TCM) is a coordinated effort between AASHTO, FHWA, ARTBA, AGC, and academia with representatives whose shared goal is the improvement of transportation construction management practices. This group was initiated to facilitate the sharing of best practices and to expedite the dissemination of information regarding new technology, procedures and programs. The TCM will accomplish this by:

- Sharing current practices through case studies, reports, evaluations, web pages, webinars, etc.;
- Developing and publishing sample guidelines, specifications and model procedures;

- Hosting meetings, conferences, webinars, and other means of exchanging information;
- Coordinating issues with industry associations representatives;
- Designating lead states for implementation efforts.

Those participating in this pooled fund will be involved with the creation of the annual work plan. The annual work plan will be created in June of each year for work from July 1 through June 30 of the following year. Prioritization of work items will depend on the amount of funding available and the consensus decisions of the participating agencies.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1280>

Field Testing Hand-held Thermo-graphic Inspection Technologies Phase II – Solicitation 1291 – Missouri led

This research is focused on the development and application of practical Nondestructive Evaluation (NDE) tools for use in the routine inspection and maintenance of highway bridges to ensure safety. Thermal (infrared) imaging is used to detect and image subsurface damage (delaminations) in concrete.

The previous pooled fund study entitled TPF-5(152) ¿Development of Hand-held Thermographic Inspection Technologies¿ explored the application of thermal imaging technologies for the NDE of highway bridges. Phase I of the research included experimental testing and field testing by participating states. The outcome of phase I testing included a draft guideline for utilizing thermal imaging to detect deterioration in concrete bridges.

Phase II, of the research, consists of field testing and evaluation of thermal imaging to evaluate the reliability of the technology, validate previously developed guidelines for field use, and evaluate implementation barriers.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1291>

Motorcycle Crash Causation Study – Solicitation 1300 – FHWA led

The primary objective of the Motorcycle Crash Causation Study is to investigate the causes of motorcycle crashes and to enable the development of countermeasures that can be effective in reducing these crashes. Using the field tested methodology developed by the OECD, the study will focus on all relevant aspects of motorcycle crashes that could be susceptible to countermeasures that will either prevent motorcycle crashes from occurring or will lessen the harm resulting from them. The objective of this transportation pooled fund study is to provide additional funding to increase the number of crash investigations that will be used to expand the database.

For further description of the solicitation go to :

<http://www.pooledfund.org/Details/Solicitation/1300>

Pooled Fund Projects still active with Iowa Past Participation (776)

North Central SuperPave Center – TPF-5(021) – Indiana led

This pooled fund project will provide for continued operation of the North Central Superpave Center to assist agencies and industry with Superpave implementation and hot mix asphalt issues. The NCSC will provide technical assistance, training, communication, and research and development work to meet the needs of the region

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/9>

Pacific Northwest Snowfighters – TPF-5(035) – Washington led

Public agencies throughout the Northwest buy and use corrosion inhibited deicing chemicals in an attempt to reduce the effects of corrosion due to the deicers that they apply during winter. These inhibitors are organic (typically carbohydrates which are biodegradable) and add about \$30-50 per ton to the cost of deicing chemicals. Laboratory test data indicates that we can reduce the corrosive effects of all deicers by 70% or more by the addition of inhibitors, but what we don't know is how long the inhibitors stay with the chlorides after application in a field environment. The deicing chemicals are stored in covered and uncovered facilities in the field and testing needs to be performed to determine if these inhibitors deteriorate and the limit to their effectiveness. Also, the actual field performance of these products needs to be documented to assist maintenance personnel.

Objectives:

Phase 1: Determine the longevity and cost effectiveness of corrosion inhibitors added to liquid and solid deicing chemicals

Phase 2: Evaluate the performance of liquid and solid deicing chemicals

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/302>

Transportation Asset Management – TPF-5(036) – Wisconsin led

To enable participating states to leverage limited resources in an ongoing program of synthesis, research and analysis to facilitate implementation of asset management. The intent is to supplement current national asset management research efforts of the MRUTC, prevent duplicity of existing efforts, and provide a means for regional state DOTs to share resources, technology and ideas in a coordinated environment. MRUTC Contact is Jason Bittner, (608) 262-7246.

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/31>

KSU Accelerated Pavement Testing Laboratory – TPF-5(048) – Kansas led

This is an ongoing project that has an annual program determined by the TAC. It's objective is to evaluate various pavement components such as bases, ACP and ACCP using full scale accelerated pavement testing as determined by the TAC.

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/236>

Development of Maintenance Decision Support System – TPF-5(054) – South Dakota led

To provide safe transportation to motorists, state transportation agencies in northern states must apply effective highway maintenance treatments appropriate to a wide range of winter and year-round conditions. Maintenance personnel must decide what treatments to apply, and when to apply them, based on their knowledge of current pavement conditions, current and forecast weather conditions, and available maintenance techniques and resources. In large part, the decisions are based upon prior experience of maintenance personnel and supervisors.

Objectives:

- 1) To assess the need, potential benefit, and receptivity in participating state transportation departments for state and regional Maintenance Decision Support Systems.
- 2) To define functional and user requirements for an operational Maintenance Decision Support System that can assess current road and weather conditions, forecast weather that will affect transportation routes, predict how road conditions will change in response to candidate maintenance treatments, suggest optimal maintenance strategies to maintenance personnel, and evaluate the effectiveness of maintenance treatments that are applied.
- 3) To build and evaluate an operational Maintenance Decision Support System that will meet the defined functional requirements in the participating state transportation departments.
- 4) To improve the ability to forecast road conditions in response to changing weather and applied maintenance treatments.

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/240>

Transportation Library Connectivity – TPF-5(105) – Wisconsin led

This pooled fund project on Transportation Library Connectivity focuses on making transportation information more readily available through better communication and coordination among state, federal, academic and private sector libraries. The study aims to institutionalize the best practices of individual transportation libraries and regional Transportation Knowledge Networks.

★ **Result:** See Following website for progress reports –

<http://www.pooledfund.org/Details/Study/337>

Impact of Implements of Husbandry on Bridges – TPF-5(148) – Minnesota led

The objectives of this study are to determine the pavement response under various types of agricultural equipment (including the impacts of different tires and additional axles) and to compare this response to that under a typical 5-axle semi tractor-trailer. This may be accomplished by constructing new instrumented test sections at MnROAD and/or to retrofit instrumentation into the existing test sections. The final scope and work plan for the study will be developed by the participating agencies.

This pooled fund study, with contributions from Mn/DOT and other participating organizations, will fund both the possible construction of pavement test sections and the research on heavy farm equipment. This research will allow policy and design decisions to be driven by direct experimental results rather than by models that may not have been calibrated for the types of

loadings and tire configurations of current and evolving agricultural equipment.

★ **Result:** See Following website for progress reports –
<http://www.pooledfund.org/Details/Study/375>

Updating US Precipitation Frequency Estimates for the Midwestern Region – TPF-5(187) - FHWA

The purpose of this study is to determine annual exceedance probabilities (AEP) and average recurrence intervals (ARI) for durations ranging from 5 minutes to 60 days and for ARIs from 1 to 1,000 years. The point estimates will be spatially interpolated to a spatial resolution of approximately 4km x 4 km. The study results will be published as volumes of NOAA Atlas 14, a wholly web based publication available at www.nws.noaa.gov/ohd/hdsc. The publication will include the artifacts provided in Volumes 1 and 2 including access through the Precipitation Frequency Data Server, base grids in standard formats, electronic copies of maps, results of trend analyses, charts of seasonal distributions and probabilistic temporal distributions, and detailed documentation. Updated areal reduction factors are being developed as a separate appendix to NOAA Atlas 14 for the entire U.S. including Alaska. The project will review and process all reasonably available rainfall data. It is recognized that the rainfall data archived by NOAA's National Climatic Data Center (NCDC) may not be sufficient to accomplish the objectives of this project. Therefore, other data available from sources such as State Climatologists and other Federal, State and local agencies will be examined and included if appropriate. The state of the art techniques and processes developed and applied for NOAA Atlas 14 Volumes 1 and 2 will be applied. They include regional frequency analysis based on L-moments including error estimates, a combination of PRISM based techniques and CRAB for spatial interpolation, techniques for the analysis of climatic trend, temporal distribution and seasonality, internal consistency checks and variety of automated processes designed to enhance productivity. Intermediate results in the form of hourly and daily estimates at several ARIs will be distributed for peer review as will the final documentation

★ **Result:** See Following website for progress reports –
<http://www.pooledfund.org/Details/Study/410>

Performance of Recycled Asphalt Shingles in Hot Mix Asphalt – TPF-5(213) – Missouri led

The primary goal of this study is to address research needs of state DOT and environmental officials to determine the best practices for the use of recycled asphalt shingles in hot-mix asphalt applications. The study will address the following research objectives:

1. To address the concerns of quality assurance (QA)/ quality control (QC) in the sourcing, processing and incorporation of the RAS to achieve a final product that would meet the requirements for use in state HMA applications. Create a specification that includes sufficient language to cover the QA/QC concerns.
2. To conduct demonstration projects to provide laboratory testing and field surveys to determine the behavior and performance of RAS in HMA at varying percentages, climates and traffic levels.

3. To create a comprehensive database on the performance of RAS in HMA applications.

★ **Result:** See Following website for progress reports –
<http://www.pooledfund.org/Details/Study/441>

Ultra-High Performance Concrete Deck Joint Testing – TPF-5(217) – FHWA led

The objective of this study is to investigate the structural performance of ultra-high performance concrete (UHPC) connection details developed for implementation in precast concrete bridge deck systems.

★ **Result:** See Following website for progress reports –
<http://www.pooledfund.org/Details/Study/445>

Accelerated Bridge Construction (ABC) Decision Making and Economic Modeling Tool – TPF-5(221) – Oregon Led

This pooled fund effort will develop a project-level tool for engineers and decision-makers to quantitatively assess the utility of ABC in the early project development stage and to determine whether or not ABC is more economically effective than conventional construction for a given bridge replacement or rehabilitation project.

★ **Result:** See Following website for progress reports –
<http://www.pooledfund.org/Details/Study/449>

Instrumentation to Aid in Steel Bridge Fabrication – TPF-5(226) – Virginia led

This research will deliver a laser based bridge measurement system that will greatly improve the quality and reduce the cost of complex bridge fabrication. This system will reduce or eliminate the need for shop fit-up and assembly by providing a virtual assembly capability using specialized solid modeling and analysis software specifically targeted at large-scale complex structures. This laser system will be specifically designed for steel bridge fabrication and will accurately and precisely measure all aspects of a bridge component, including splice hole locations, camber, sweep, and end-kick in a nearly full-automated manner. The completed system can be used as a quality control tool to document as-built conditions of girders and as a virtual fit-up tool to eliminate shop assembly. There is no existing laser-based measurement system that can measure very large and very complex girders with the accuracy, as rapidly, and with as little operator intervention as that being proposed.

The use of this laser system on just one complex bridge job could result in benefits that exceed the cost of this entire research project. The stakeholder group that can potentially benefit the most from the use of the proposed laser system are the State DOTs, who could save millions of dollars on the cost of steel bridges and receive greater quality assurance on the end product. Elimination of shop assembly of complex structures could save millions of dollars. The proposed system can identify fabrication errors at the fabrication shop allowing repairs to be made prior to painting and shipment to a job site. Documentation from the proposed system is a permanent record that is certifiable and traceable. This documentation can be used to help reduce construction claims and could serve as evidence in legal disputes in cases where there are problems during bridge erection. Avoiding the legal expenses from one such dispute of this type could more than pay for the cost of this research.

Three phases are proposed for this research in order to proceed in an incremental and effectively managed fashion as well as to manage the risk of delivering an expensive system that is ready for full-scale implementation. Phase I will define measurement requirements on large-scale complex components and assess commercial software analysis tools. Phase II will extend this work to the development of virtual fit-up analysis tools for large-scale components, validated with testing in a fabrication plant. Phase III will incorporate the software tools developed in the previous phase and deliver a system at a fabricator. The Phase III project deliverable will be a dedicated laser-based bridge measurement system installed at a bridge fabricator or a group of fabricators. The final Phase III task will apply the laser measurement system to an actual complex structure bridge job, coordinated with a State DOT partner, where no shop assembly is employed.

★ **Result:** See Following website for progress reports –

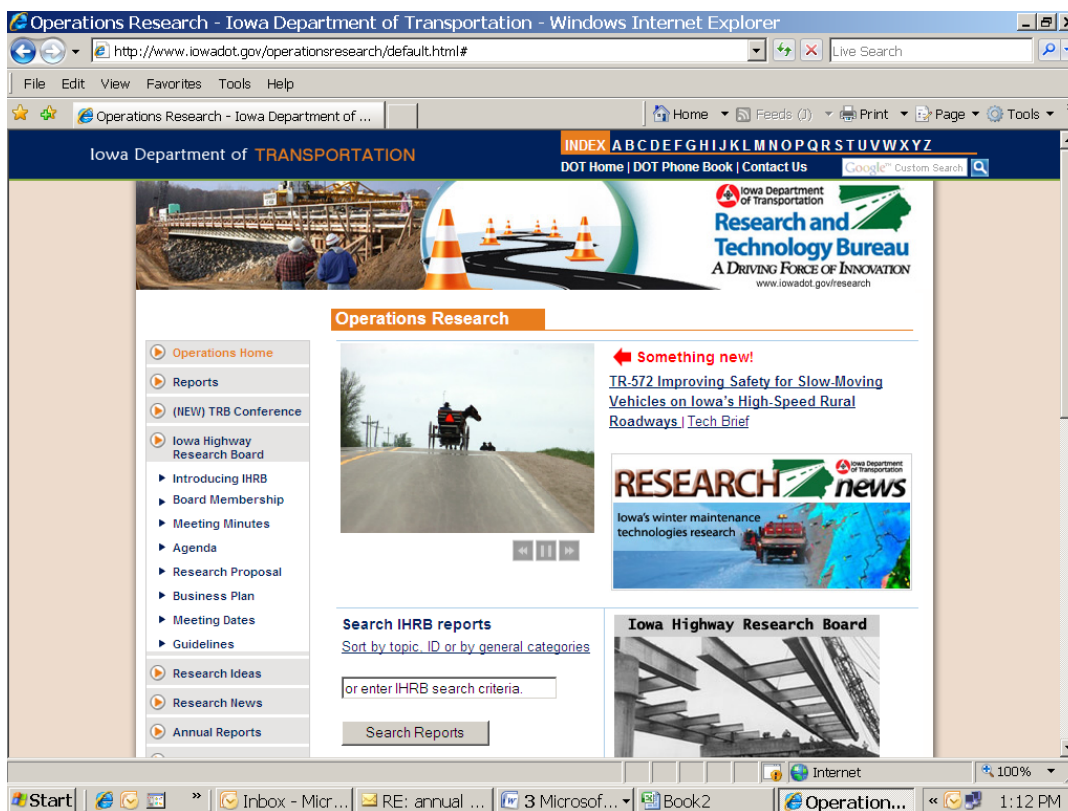
<http://www.pooledfund.org/Details/Study/454>

B. Iowa Highway Research Board - REFER TO ATTACHMENT 9

The Iowa Highway Research Board (IHRB) has provided a distinctive partnership for the Iowa Highway community with a collaboration of city, county, state and university research expertise and oversight. Pooling a portion of funds for research from the Primary, Secondary, and Street Funds provides benefits to all levels of the Iowa highway community. Board membership includes representatives from Iowa's city and county government highway agencies, the Iowa DOT, and Iowa's public universities with civil engineering programs. Staff assistance is provided by the Iowa DOT.



The IHRB assists the Iowa DOT in the development and continuation of an effective program of research in highway transportation. Each year it oversees numerous projects on transportation issues in Iowa. Most of the projects are conducted by state universities. The Board supports engineering research studies and projects on topics ranging from soils and structures to pavements, markings, and winter maintenance. All are designed to find more efficient uses of funds and materials for the construction and maintenance of Iowa's highway system. Projects conducted under this program are summarized annually. The FY 2011 Annual Report is included as the final attachment to this document. For additional information, visit the board's web site at: <http://www.iowadot.gov/operationsresearch/default.html#>.



C. Intelligent Transportation System (ITS) Projects

Transportation problems have historically been solved by investing in infrastructure and services. Governments now also turn to innovative solutions collectively known as ITS, applications of information and technologies to improve the movement of people and goods. These applications typically rely on computer and communication technologies, potentially resulting in shorter travel times, increased traveler information, more travel options, increased safety, and a more efficient flow of people and goods. The Iowa DOT programs and coordinates ITS projects through the Research & Technology Bureau.

CARS/511 Implementation

CARS is a situation reporting system software that allows state agencies to input information regarding road incidents, weather conditions and roadway conditions that are reported to the public. CARS/511 information can be accessed from almost anywhere in Iowa by dialing 511, or from anywhere in the world at www.511ia.org.

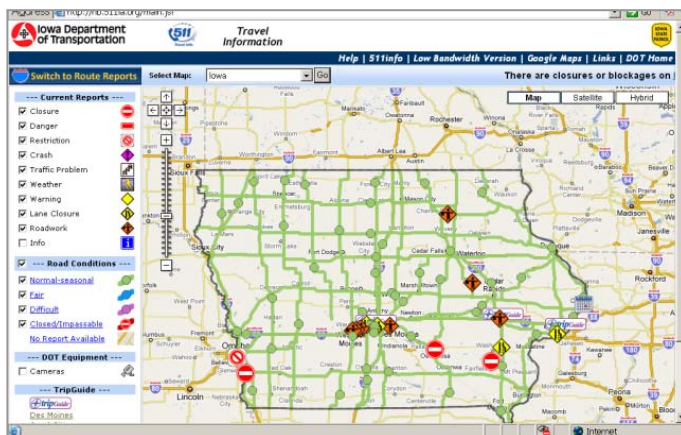


CARS/511 Usage				
Month	FY 10 Calls	FY 09 Calls	FY 10 Web Visits (high & low band)	FY 09 Web Visits (low band only)
July	10,091	21,932	19,439	28,040
August	10,704	10,647	20,869	12,222
September	7,694	10,410	15,500	13,158
October	9,663	8,885	19,075	9,590
November	8,325	17,770	15,165	37,323
December	242,007	154,311	424,006	267,121
January	134,706	112,435	1,902,303	154,714
February	96,886	30,106	1,548,586	61,831
March	15,024	22,324	146,019	31,116
April	7,537	22,943	unknown	28,031
May	8,410	10,101	34,802	17,886
June	14,634	12,186	45,655	19,964
Total	565,681	434,050	4,191,419	680,996

As expected, statistics on calls and web visits show much higher use of the 511 system during winter months, probably because winter weather and road conditions can change from hour to hour as well as from day to day.

The high-bandwidth 511 web site (below) was launched in 2008, but counters were not attached until 2009. This accounts for the significantly higher number of web visits registered in FY10 than the previous year. This site allows users to select and view various types of situations by

clicking on the menu list at the left of the page. Users can pan across the state or zoom in on a particular area. TripGuide cameras in Des Moines, Iowa City and Quad Cities can also be accessed from this site.



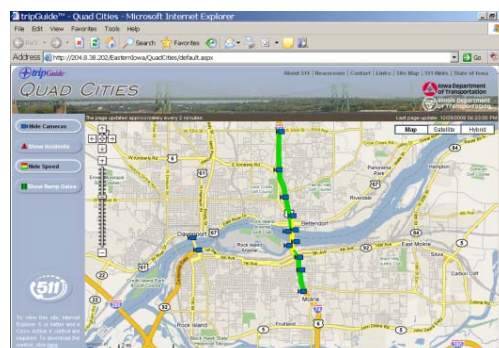
High Bandwidth 511 page

Eastern Iowa ITS

The Eastern Iowa ITS Project entails deployment of ITS technology and systems in both the Iowa City and Quad Cities (Davenport-Bettendorf-Moline-Rock Island) metropolitan areas.

The technology included in these projects includes pan-tilt-zoom cameras, side-firing, radar-type traffic sensors, dynamic message signs (DMS), highway advisory radio (HAR) transmitters and, in the Quad Cities, ramp gates to control access to the I-74 Mississippi River Bridge. The public can view live streaming video via www.511ia.org.

The Quad Cities *tripGuide* system (right) is focused on the I-74 corridor across the Mississippi River. This corridor from Bettendorf to Moline experiences significant delay frequently due to traffic incidents on the high volume, narrow twin suspension bridges.



*Quad Cities tripGuide (above)
Iowa City camera view (below)*

The Iowa City network of 22 cameras and 27 sensors (right) will help address traffic needs anticipated during the reconstruction of Interstate 80, existing daily congestion on I-80 and I-380 and special event needs generated by University of Iowa athletic events.

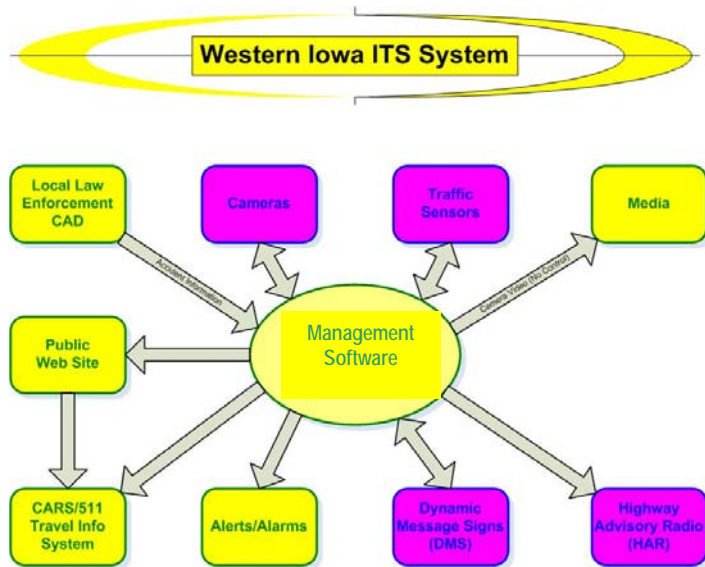


Both the Iowa City and Quad Cities projects have been developed in close coordination with local law enforcement, emergency responders, and traffic officials. The project was funded jointly by the Iowa and Illinois Departments of Transportation.

Western Iowa ITS

The Western Iowa ITS Project will encompass deployment of ITS technology and systems in both the Council Bluffs and Sioux City metropolitan areas.

The technology included in these projects includes pan-tilt-zoom cameras, side-firing radar-type traffic sensors, dynamic message signs (DMS), and highway advisory radio (HAR) transmitters. The public will be able to view live streaming video via 511ia.org.



The Council Bluffs system will include a series of 38 cameras and 49 sensors along I-29, I-80, U.S. 6 and U.S. 275. The Sioux City network will consist of 26 cameras and 26 sensors on I-29, U.S. 20, Lewis Blvd and Gordon Drive. Each system also includes one HAR transmitter. As with similar systems, these projects have been developed in close coordination with local law enforcement, emergency responders, and traffic officials

The goals of the systems are:

- Provide accurate and timely traffic information to the public.
- Provide traffic management tools to aid public officials in addressing traffic needs resulting from construction activities, incidents, special events, congestion, etc.

Statewide Dynamic Message Signs (DMS)



A statewide system of DMS has been developed to provide on-site just-in-time information to the traveling public. The system is designed for traffic management (primarily congestion mitigation) and for public safety (emergency operations, homeland security, amber alert, weather emergencies, etc.). DMS communications and messages will be coordinated with other states as well as with local governments and agencies. In actual practice, it functions as more than merely a statewide system. Operations are integrated with bordering cities and states such as Nebraska, South Dakota, and Illinois as well as metropolitan areas such as Omaha, Rock Island/ Moline, etc.

By June 2010, Iowa DOT had 54 overhead and 14 side-mount DMS installed statewide. The signs are located primarily in urban areas on or near the interstate system. A DMS plan is prepared and reviewed annually and amended to maintain a five year outlook.

In addition to overhead and roadside DMS, Iowa DOT also maintains a system of small DMS in each of 37 highway rest areas.

Highway Advisory Radio

Highway Advisory Radio (HAR) provides traffic information to motorists along our highway system. Four low-power FM (LPFM) HAR sites in Iowa have been licensed and are operating on I-80 at DeSoto and Adair, on the I-29 corridor at Sloan, and on I-380 near Urbana. Information supplied to travelers includes information that is available through the CARS/511 system as well as local incidents and alerts.



Due to FCC restrictions on available frequencies, use of LPFM is not feasible in metropolitan areas. In Des Moines, the Iowa DOT is using the new generation of AM radio (SuperHAR) technology to reach greater numbers of motorists with real-time traffic information. The AM SuperHAR uses the same CARS/511 voice recognition technology and programming utilized in automating the LPFM HAR stations. Other SuperHAR locations are Quad Cities and Iowa City. HAR transmissions can be monitored at http://www.iowadot.gov/research/har_listen.htm.

Two portable HAR units can be placed anywhere in the state within a few hours to assist with disaster recovery, special events, major road closures, or construction projects.

Ia RTN SmartNet - Statewide Real Time Kinematic Global Positioning System Network



Ia RTN SmartNet is a statewide high precision global positioning referencing network. Activated in February 2009, the network consists of eighty Iowa DOT-owned and vendor-managed base stations that provides real-time positioning with instantaneous centimeter-level accuracy to support applications of survey, construction and mapping. The goal is to provide a system that will improve the efficiency and accuracy for all GPS users and meet or exceed the Iowa DOT's requirements relating to accuracy, precision, reliability, and scalability. Any authorized user, public or private sector, using a late-model, survey-grade, single- or dual-frequency rover equipped with a cellular modem or data-capable cell phone will receive near-instantaneous GPS satellite corrections anywhere in Iowa. The system uses DOT facilities for base stations, DOT communications network, and DOT servers and is accessible without charge to public and private users. For more information, see <http://www.iowadot.gov/rtn/index.html>.

Statewide ITS Management Software (SIMS)

Statewide ITS Management Software (SIMS) will provide an integrated software package enabling DOT personnel and partner agency(s) staff to control and configure existing and future deployments of ITS (Intelligent Transportation System) devices statewide. SIMS will interface with CARS, the Iowa DOT's 511 Traveler Information Service, to enable the delivery of real time traffic information to the general public. The SIMS project also involves the replacement of cameras in the Des Moines metro area.

Prior to the SIMS project, the Iowa DOT had installed three deployments of ITS networks across the state; Des Moines, Iowa City and the Quad Cities. The Western Iowa ITS project is also currently in the process of installing a fiber optic communications system to support the deployment of ITS devices (e.g., PTZ cameras, traffic sensors, wireless communications) in the Council Bluffs/Omaha and Sioux City metropolitan areas.



These ITS deployments have utilized stand-alone software packages, which require users to exit out of one deployment's software in order to control the devices in another metropolitan area. In 2009 the Iowa DOT opened a Statewide Emergency Operations Support Center (SEOP Center) in Ames. The Center had a need to utilize ITS devices throughout the state, highlighting the cumbersome nature of moving from one metro area to another. The Center was a driving force behind the development of the SIMS project.

Electronic Speed Limit Signs



Two electronic school zone speed limit signs were installed at United Community Elementary School near Boone, Iowa, to test for speed reduction impacts. The school is situated along U.S. 30, a rural four-lane divided expressway. Due to concerns about high speeds in the area, Iowa DOT replaced the original static school zone speed limit signs, which had flashing beacons during school start and dismissal times, with electronic speed signs that only display the school speed limit of 55 mph during school arrival and dismissal.

A speed evaluation of the area was conducted one week before, one month after, and seven months after the new signs were installed. Overall, the new school zone speed limit signs were more effective in reducing speeds than the original signs at both one month after as well as seven months after. The signs were effective for both directions of traffic and for both the school's start and dismissal periods. While an increase in speeds was seen when the signs were active for the eastbound direction seven months after the signs were installed, this increase was less than the increase in speeds seen in the overall (24 hour) period. The results of the data analysis showed that the signs seemed to have a more significant effect for westbound traffic than for eastbound. This difference may be due to the fact that the school is visible to westbound traffic when those vehicles encounter the sign, while the school is not similarly visible for eastbound traffic.

Sioux City Railroad Warning System

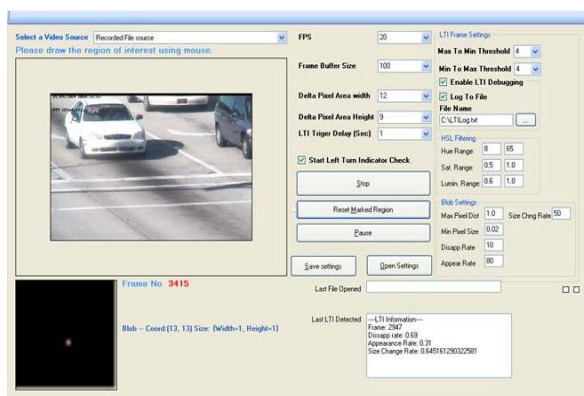
This system senses when a train is present and is blocking streets into downtown Sioux City, then relays information to a pair of Dynamic Message Signs on I-29 in advance of the affected interchanges. Both the frequency and length of trains in the Sioux City area have been increasing. This increase of rail traffic has an effect on the downtown Sioux City street system. Some of these local street blockages then impact the operation of I-29 mainline and ramps.



I-29 currently has four interchanges serving downtown Sioux City. The routes from two of these interchanges into downtown have at-grade railroad crossings (Hamilton Blvd. and Nebraska Street). The other two interchanges (Wesley Parkway and Floyd Blvd.) do not have at-grade crossing issues and can be used as alternate routes when trains are present.

Prototype Tool to Detect and Identify Left Turning Vehicles

Researchers are currently working with industry to use video detection to help detect left turning vehicles where no left turn lane exists. This could benefit safety in that cities could modify signal operations to give exclusive left turn indications when needed. The proposed device would take an analog video feed input, analyze a specified region to identify a vehicle with an activated left-turn signal and provide that information through a contact closure interface. In order to gauge accuracy, video could be recorded and compared to the vehicle log created by the detector.



Portable Closed Circuit TV (CCTV)



During the summer of 2008, Iowa DOT rented a portable CCTV unit in order to monitor the highway flooding in Eastern Iowa (see photo). This was so successful that DOT has now acquired two trailer-mounted solar powered video camera systems for monitoring traffic conditions on construction projects, special events, major road closures, disasters, and traffic studies.



Interstate Gate Closures

For better access and control of closing the Interstate system, DOT is conducting a pilot project using gates with remote controls to create hard closures. Three locations have been selected for gates, each of which has a history of closures. They are: Southbound I-35 at US 18, Northbound I-35 at US 30, and Northbound I-29 at US 30. Cameras will be used at each gate to monitor the closing period, give visual confirmation that the gates are down and not broken, and monitor traffic backups.



Dyersville Traffic Warning System



A first of its kind in Iowa traffic-activated warning system was installed in Dyersville on US 20 and 7th Street on June 10th. There have been 6 fatalities in the last 9 years at this at-grade intersection. The system detects approaching traffic on US 20 and alerts drivers on the side-road by use of a sign with yellow flashers. These signs are designed to aid side road motorists by providing a warning when U.S. 20 traffic is approaching the intersection.

Many younger and older drivers have a difficult time identifying an approaching vehicle and its approaching speed when attempting to cross a four lane highway.

These new signs inform the motorists that a vehicle is approaching the intersection. Signs only assist motorists in making their driving decisions.

D. Primary Road Research

The Primary Road Research Fund receives \$750,000 annually for contracted research, training, and project-specific research supplies or equipment. Primary Road Research projects in 2010 included the following.

InTrans Administration and Shared Faculty Support

Four shared research faculty positions are funded along with support for InTrans administration. These include Bridge Engineer, Materials Engineer, PCC Engineer, and Safety Engineer. For more information about InTrans and these positions, see Section IV of this report.

Nondestructive Bridge Deck Evaluation

Iowa DOT, like many other State DOTs, is faced with the need to identify and deploy means for rapid, nondestructive, and accurate condition assessment and performance monitoring of bridge decks. A series of bridge decks along I-80 in western Iowa were examined. All the decks are PC concrete decks with or without dense low-slump concrete overlay. The work concentrated on bridge deck evaluation by technologies such as ground penetrating radar (GPR) and impact echo (IE).

The data collected from nondestructive testing (NDT) of bridge decks should complement other information in understanding of its lifecycle costs, deterioration mechanisms, and the effectiveness of preservation techniques at various stages of the aging process, and most important, prevent premature and unexpected failure.



E. Technology Transfer

Newsletters <http://www.iowadot.gov/operationsresearch/researchnews.aspx>

The Bureau's newsletter contains current and timely research articles published quarterly to highlight recent transportation achievements for those looking for a bit more detail, description, and analysis of projects. Articles are written by Principal Investigators, collaborating researchers and key Iowa DOT personnel. Packed with photos and project information, notifications are emailed to an ever-growing recipient list when newsletters are posted online. To have your name added to the notification list, e-mail your request to mary.starr@dot.iowa.gov.



Video <http://www.iowadot.gov/research/index.htm>

Users can now enjoy the convenience of watching to-the-point research videos online or on media-ready cell phones. A developing avenue for technical transfer, the Research Bureau's collection of informative videos is growing steadily, with a variety of new short films in production to educate and assist engineers and other transportation personnel on the latest developments.

Videos currently online:

- Non-Destructive Bridge Testing & Evaluation
- Intelligent Compaction Techniques
- Iowa DOT Implementation of LIDAR
- 2009 Mid-Continent Research Symposium Opening Session and Presentations
- Iowa's road weather information system at work
- Transportation Research Projects at Work – Making a Difference
- The U.S. 20 Iowa River Bridge: Providing for the future, preserving Iowa's past
- 2009 Human Factors and Roadway Safety Workshop

Web site <http://www.iowadot.gov/research/index.htm>

Feedback on the Bureau's Web site indicates it has become a highly regarded centralized hub for transportation-related research information and news shared by Iowa with others throughout the United States and abroad. Implementing advanced applications found on the site can help accelerate construction time, save energy, resources, and lower repair and lifetime maintenance costs for many transportation projects and help contribute to lower injury and fatality rates.

There are also links to the Operations Research Web site, a portal for the Iowa Highway Research Board (www.iowadot.gov/operationsresearch/default.html) and the Iowa DOT Transportation Library (www.iowadot.gov/research/lib_home.htm).



II. Other Research, Development, and Technology Transfer Activities

Additional research, development, and technology transfer activities are carried out in several other divisions and offices of the Department. *Attachment 6* shows the distribution of research funds throughout the Department.

A. Traffic & Safety Research

Shared Faculty Research Projects

The Traffic Safety Engineer (TSE) program associated with the Institute for Transportation (InTrans) at Iowa State University (ISU) provides traffic engineering support and research expertise. This includes support of the Office of Traffic and Safety in the development of project level and detailed work plans, support in professional and agency associations, conduct of research, support of special projects, and support in training. Sample duties include:

- Support DOT staff in developing policies and practices regarding deployment of centerline rumble strips
- Lead efforts on lane departure aspect of comprehensive Highway Safety Plan
- Develop standards and guidelines for interchange lighting
- Improving traffic flow through improved signal operations
- Support efforts to improve work zone safety

Traffic Safety Improvement Program (TSIP)

The Office of Traffic & Safety sponsors a variety of highway safety related research and demonstration projects each year. Although some safety projects are funded by IHRB or the SPR program, the primary funding source is the Iowa Traffic Safety Improvement Program (TSIP), which provides about \$500,000 annually. TSIP projects can be safety studies, research, or public information initiatives. The Traffic Safety Fund, which funds the TSIP, is ½% of annual Iowa gas tax receipts. The FY10 awarded research projects are listed in *Attachment 9*. Because proposals are received in August, projects often don't get underway until the next fiscal year. Some projects underway in FY10 are described below.

Lane Departure Safety Countermeasures

Lane departure crashes are a significant percentage of the total number of crashes each year. Possible outcomes of lane departures are sideswipe or head-on crash. Objectives of this study are to identify strategies, policies, and practices adopted by other states to reduce lane departure crashes and update Iowa's Lane Departure Strategic Action Plan.

Wet Reflective Pavement Marking Demo

One of the leading complaints from drivers is the inability to see pavement markings under wet night conditions. Driving under such conditions is stressful and fatiguing for all drivers, but particularly for elderly drivers. This project provides the opportunity to test the performance of wet reflective pavement marking materials and treatments and assess where these types of markings may be most effective in improving visibility and overall safety.

B. Maintenance Research

The Office of Maintenance conducts a variety of research projects, mostly around the topic of winter road management. The following testing and evaluation projects were conducted in the winter. These are internal efforts, managed and conducted by Department field maintenance personnel, generally without additional funding. Maintenance is also active in implementing new technology, particularly for road weather information.

RWIS Improvements

Today, the Department maintains 62 RWIS sites throughout the state. Most sites are equipped with the traditional atmospheric and pavement sensors found on the majority of RWIS sites;



however, new sensors and upgrades are anticipated over the next 24 months for most sites. This will include installation of color cameras capable of taking still frame images (left) or video to provide more detailed information about actual roadway surface conditions in the area.

Also being added to the RWIS sites are new precipitation sensors called Weather Identifier and Visibility Sensors (WIVIS), which interpret the rate and kind of precipitation falling as well as the visibility distance at that particular tower's location. The WIVIS sensor will provide direct feedback to maintenance supervisors regarding potential problems in their areas and give motorists real-time roadway information that can proactively influence their travel plans. Information from RWIS sites will be available to the public and garage personnel online at the Iowa DOT's Weatherview Web site at www.dotweatherview.com.

Also new in 2009 is the Temperature Data Probe (TDP). This state-of-the-art probe measures road subsurface temperature every three inches for the first 18-inches and then every six inches down to six feet below the surface, providing precise information on temperatures at different levels under the road's surface. Maintenance personnel will be able to use information from these sensors to help determine what will happen at the road's surface when precipitation falls. Cold temperatures six inches below the surface may cause surface temperatures to be much colder than air temperatures on a warm day in early spring. The TDP probes may also contribute to a better understanding of conditions causing asphalt blow-ups during the summer months and stresses on roadways due to freeze-thaw cycles during the winter.

Current conditions		Cedar Rapids Hwy 30 East
Air temp: 34	Visibility: 1.2 mi.	Wind speed: 9 mph
Dew point: 32	Road condition: Wet	Wind direction: SE
Traffic Speed: 67 mph.	Pavement temp: 40	

Traffic sensors are currently being added to all interstate RWIS sites and will eventually be placed on most of the RWIS sites throughout the state. These sensors measure traffic speeds and count and classify traffic. Data collected from these systems may eventually be linked to the

existing traffic counting and classification system used by the Department, providing information to supervisors about traffic speeds in their area. This information will also be available to the traveling public through the Weatherview Web site. The Department plans to link information from these traffic sensors (in addition to weather information from RWIS and forecast information) to measure performance of winter maintenance operations. Monitoring traffic speeds during winter storms or the time required to return traffic speeds to normal may be used as performance measures for winter snow removal operations.

Ceramic Blades

Improvements in materials have provided new alternative materials (other than traditional carbide inserts) for cutting edges of plow blades. For decades the primary blade in snow and ice removal operations used a carbide insert—a very hard compound that withstands the rigors of winter maintenance. In recent years, however, the price of carbide has nearly tripled with resulting costs becoming a much larger portion of the snow and ice budget.



Developed in Germany, the Gummi-Kuper ceramic blades appear to have the same level of hardness as carbide blades but are reportedly lightweight, maintain a better cutting edge, and may eventually be cheaper than carbide blades when they become more widely available in the United States. Limited testing was done in 2008-2009 on the blades; however, the Iowa DOT will continue testing two sets of ceramic blades during the winter of 2009-2010 at several garages in District 2. Operators will continue measuring blade wear and provide feedback on other operational issues that impact snow removal operations such as noise and vibrations.

Joma 6000 Blades



First tested by the Iowa DOT in 2000, the cost of JOMA 6000 blades (JOMAs) was prohibitive—the price for a set these (ceramic) blades was nearly five times more expensive than traditional carbide ones. However, wear tests performed at the time indicate that they lasted approximately three times as long. Operators who tested the JOMAs thought they were quieter than traditional

blades, and because they include rubber cushioning, vibrations in the cab were reduced.

Wear tests done this year on the JOMAs at six different maintenance garages across District 2 are helping to determine if the blade's life expectancy can offset the higher price. Currently, the difference in cost between these and traditional blades is 2:1. With recent price increases for carbide blades, the JOMA 6000 blades appear to be a viable alternative. If testing verifies results from 2000, these blades may prove more even more cost effective in the future.

Flexible Edge Blades

A prototype, flexible edge blade developed at the central repair shop is divided into one-foot sections and attached to the front plow with bolts surrounded by rubber. The rubber around the bolt holes allows the one-foot sections to move both horizontally and vertically for



adjustment with variations of the road's surface, keeping the blade's cutting edge in contact with the road along its entire length and providing more efficient removal of snow or ice.

Operators at the Hanlontown maintenance garage who tested this new blade report that the one-foot sections allow the plow to adjust to any contours in the road and that the rubber surrounding the bolts reduced noise and vibrations in the cab. In addition, operators observed less wear on blades and more uniform wear across their lengths. Traditional blades wear on the leading edge but the trailing edge wears very little; this means blades need to be discarded while they still contain carbide. The flexible edge blade wears evenly across its length so it can be used in its entirety until carbide is exhausted. Also, because they're in one-foot sections weighing about 15 lbs., changing any flexible edge blades that wear out is much easier than changing traditional ones which usually weigh 45-60 lbs.

Multiple Blade Plows

The triple-blade plow is showing promising results in clearing more snow and ice per pass. The lead blade is a typical carbide plow blade to remove most of the snow. Following that is a scarifying or scraping blade to break up packed ice. Finally, a trailing squeegee blade clears any remaining ice and snow.

To encourage participation from manufacturers in the multiple-edge plow project, the states of Ohio, Minnesota, Indiana and Wisconsin joined Iowa in a pooled fund to test prototypes developed by several plow manufacturers based on the Iowa design. After a competitive bidding process early in July, 2008, four manufacturers were selected to provide test models during the 2008-2009 winter season. One manufacturer prototype was tested in each state. Maintenance personnel at the Hanlontown garage tested the plow built by Flink and were very pleased with the results after the first year, reporting that it removed more snow and ice from the road and there was reduced noise and vibration in the cab. The Iowa DOT plans to work with manufacturers to develop a retrofit kit for adding a squeegee or scarifying blade to existing plows in the fleet.

Cameras with mobile recorders were sent to the testing locations to get video footage of all the snow plows operating in an actual winter storm. Video of the plow in operation is an excellent means of determining if the plow is actually cleaning the road surface in one pass and how much extra snow, slush, ice and water is being removed by the use of multiple blades versus the single bladed plow we use today. Additional testing of the multiple-blade plow will continue during the 2009-2010 winter season.



Nal/CaCl – Spicy Salt

This project was continued to determine if a blend of Calcium Chloride and salt brine can lower the eutectic temperature of salt brine and allow



it to be more effective at lower temperatures. It is also designed to save on material versus the straight use of calcium chloride alone.

C. Bridges & Structures Research

Shared Faculty Research Projects

The Bridge Engineer (BE) program associated with the Institute for Transportation (InTrans) at Iowa State University (ISU) provides bridge engineering support and research expertise. This includes support of the Office of Bridges and Structures in the development and conduct of research, support of special projects and support in training. Current research projects conducted by the BE program include the following.

Load rating tests on bridges

The Office of Bridges and Structures at the Iowa Department of Transportation (Iowa DOT) is charged with evaluating and maintaining the primary bridge system. Conventional bridge rating processes are typically used for this process, but on occasion the Office uses diagnostic load testing procedures for the load rating, including superload permit vehicles. The Bridge Engineer program at Iowa State University provides the personnel to perform these tests and works directly with the Iowa DOT Rating Engineer. In addition, the load testing program provides support to other Office research associated with the structural performance of bridges constructed with advanced materials and for determining the effectiveness of strengthened bridges.

9th Street Bridge Monitor

This project involved monitoring and evaluation of a drilled shaft and integral abutment bridge on 9th Street in Des Moines. It includes instrumentation on several drilled shafts at both the north and south abutments.

Innovative Bridge Research and Deployment Program

Broadway/U.S. 6 Viaduct in Council Bluffs

The proposed innovations for this project will be the use of special foamed concrete as a lightweight fill material and base grouted drill shafts. Base grouting is used to develop/increase end bearing capacity as an economical alternative to bedrock supported drilled shafts.



D. Living Roadway Trust Fund Research

The Iowa Living Roadway Trust Fund (LRTF) is administered by the Office of Road Design. Recognizing the value of native plants in our roadsides, the Iowa Legislature established the LRTF program in 1988. Appropriations for the LRTF are allocated from the road use tax fund, the Resource Enhancement and Protection (REAP) fund, and other sources. This annual competitive grant program provides funding for integrated roadside vegetation management (IRVM) activities, including the preservation, establishment, and maintenance of native vegetation along Iowa's roadsides. Information about the program can be found at www.iowalivingroadway.com.

LRTF projects directly benefit Iowans in many ways, including the beautification of roadsides, the enhancement of children's education through the establishment of outdoor classrooms, and the improvement of water and air quality through the use of plant communities best adapted to, and sustainable along, our living roadways. The LRTF encourages the submission of proposals for research addressing aspects of integrated roadside vegetation management. The statewide research projects listed below were accepted for LRTF funding in 2010 totaling \$106,657.

LRTF Grants Awarded FY 2010		
Researcher	Amount	Research Topic
Kirk Larsen, Luther College	\$ 9,253	Impact of roadside prairie plantings on plant and insect communities
Brian Wilsey & Lee Ann Martin, Iowa State University	\$ 10,675	Do fire and seed additions alter strong seed timing and priority effects on prairie establishment?
Daryl Smith, University of Northern Iowa	\$21,928	The effects of mycorrhizal inoculants and micronutrients on early plant establishment in prairie reconstruction
Daryl Smith, University of Northern Iowa	\$ 22,900	The effects of seeding time on emergence and growth of prairie grasses, sedges, legumes and forbs
Daryl Smith, University of Northern Iowa	\$ 30,712	Comparison of water interception and infiltration by selected grass dominated communities
Jennifer Hopwood, Iowa State University	\$ 11,189	Use of roadside prairie plantings by native bees

III. Transportation Research Board

The mission of the Transportation Research Board (TRB) is to promote innovation and progress in transportation through research. TRB is one of six major divisions of the National Research Council, a private institution administered by the National Academy of Science and National Academy of Engineering. Payment of TRB and NCHRP fees enables Iowa to participate in the selection of more than \$30 million of transportation research each year, addressing every business area of the agency.



TRB provides an extensive range of services, including:

- Opportunities for information exchange on current transportation research and practice
- Management of cooperative research and other research programs
- Analyses of national transportation policy issues and guidance on federal and other research programs, and
- Publication and access to research information from around the world

Information exchange opportunities are provided through the annual TRB meeting, field visits by technical staff, conferences and workshops, and standing committees and task forces. There are over 200 committees composed of engineers, administrators, researchers and educators who identify research needs, review papers for presentation and publication, and encourage implementation of research findings.

TRB administers both the National Cooperative Highway Research Program (NCHRP) and the Strategic Highway Research Program (SHRP II). All state highway departments contribute annually to NCHRP research activities. Research priorities are set by AASHTO's Standing Committee on Research. Another program administered by TRB is Innovations Deserving Exploratory Analysis (IDEA) which encourages exploration of untested concepts with potential technological breakthroughs.

TRB committees with Iowa DOT participation:

- Committee on General Structures - Sandra Larson, member
- Portland Cement Concrete Pavement Construction - Sandra Larson, member
- Task Force on Surface Transportation Weather - Sandra Larson & Tina Greenfield, members
- NCHRP Project Panel on IDEA - Sandra Larson, member
- NCHRP Project Panel on Research for AASHTO Standing Committee on Planning: Support for Improved Transportation Planning and Project Development – Stu Anderson, member
- Alternative Transportation Fuels and Technologies – Ed Engle, member
- NCHRP Project Panel on Evaluation of Safety Strategies at Signalized Intersections – Troy Jerman, chair
- Properties of Concrete – Bob Younie, member
- NCHRP Project Panel on Improvement of Procedures for the Safety-Performance Evaluation of Roadside Features – Dave Little, member

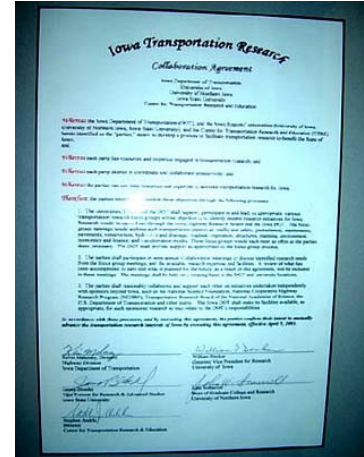
- SHRP 2 Expert Task Group on Freight Demand Modeling and Data Improvement Strategic Plan – Phil Mescher, member
- Transportation Planning Applications – Phil Mescher, member
- Urban Transportation Data and Information Systems – Phil Mescher, member
- Using National Household Travel Survey (NHTS) Data for Transportation Decision Making: A Workshop – Phil Mescher, member
- NCHRP Panel on Development of Cost-Effective Treatments of Roadside Ditches to Reduce the Number and Severity of Roadside Crashes – Chris Poole, chair
- NCHRP Project Panel on Administration of Highway and Transportation Agencies – Nancy Richardson, chair
- Application of Emerging Technologies to Design and Construction – Mark Dunn, member
- Construction of Bridges and Structures – Mark Dunn, member
- Roadside Maintenance Operations – Joy Williams, member
- NCHRP Project Panel on Development of Rational Loading, Analysis, and Inspection Criteria for High Mast Lighting Towers – Ahmad Abu Hawash, member
- NCHRP Project Panel on Revision of the AASHTO Guide for the Development of Bicycle Facilities – Steve Bowman, member
- Statewide Transportation Data and Information Systems – Peggi Knight, member
- NCHRP Project Panel on Next Generation of Pooled Fund Web Site – Carol Culver, member
- NCHRP Panel on Performance of Warm Mix Asphalt (WMA) Technologies: Stage 1 – Moisture Susceptibility – Scott Schram, member

IV. University Research Collaboration

A. Iowa Transportation Research Collaboration

The Iowa DOT has a collaboration agreement with The University of Iowa, Iowa State University, the University of Northern Iowa, and InTrans. The purpose of the collaboration is to facilitate transportation research to benefit the state of Iowa.

Semi-annual collaboration meetings are held to order priorities among groups, bring new ideas to the table, review needs, expertise, and facilities available. The group also collaborates on independent transportation research, looking for new ways to serve the state through regional and national research interests. Meeting sites rotate among member agencies, enabling participants to get to know each other's capabilities.



Many research projects come about as a result of focus groups comprised of DOT staff, city and county engineers, consultants, industry and university representatives. Focus groups are initiated by the DOT, based on types of work as outlined in the Iowa Transportation Research Collaboration Agreement. Focus group topics include pavement, construction, hydraulics, drainage, environment, geotechnical issues, and planning.

A page for information about the collaboration is included in the R&T Bureau's web pages (<http://www.dot.state.ia.us/research/collaboration.htm>). Researchers can visit the site to find the business plan, focus group information and a contact list developed to facilitate collaboration among researchers at different universities.

B. Institute for Transportation (InTrans)

The Institute for Transportation (InTrans) coordinates transportation research activities for Iowa State University. InTrans's mission is to develop and implement innovative methods, materials, and technologies for improving transportation efficiency, safety, and reliability while improving the learning environment of students, faculty, and staff in transportation-related fields.

InTrans's work with the Iowa DOT is structured with a three-year rolling Basic Agreement and Management Agreement, Annual Work Plans and individual research project addenda.

InTrans supports the work of Iowa DOT through a variety of activities, including:

- Conducting research
- Administering the Local Technical Assistance Program (LTAP)
- Continued development of a technician training program
- Support for pavement management and geographic information systems (GIS) development
- Statewide Urban Design & Specifications program (SUDAS)
- Support for remote sensing activities as part of the GIS program
- Statewide traffic safety database system.
- Conducting training, technology transfer workshops and conferences
- Leading focus groups

Each year the Iowa DOT and InTrans develop work plans for shared faculty in four major transportation research areas: structures, materials, PCC pavements, and traffic safety. These shared faculty provide the DOT with expertise in specialized technical areas. The bridge engineer conducts research projects and assists the Office of Bridges & Structures as needed. The materials engineer conducts research, provides training, and assists with special investigations, particularly with regard to hot mix asphalt. The PCC engineers conduct research projects, develop and execute the research program for the CP Tech Center and help the Center develop and execute training and technology transfer programs. The CP Tech Center develops concrete research in its testing and teaching laboratory and administers several Iowa-led pooled fund projects. The Traffic Safety Engineer provides traffic engineering support and research expertise for the Office of Traffic and Safety.



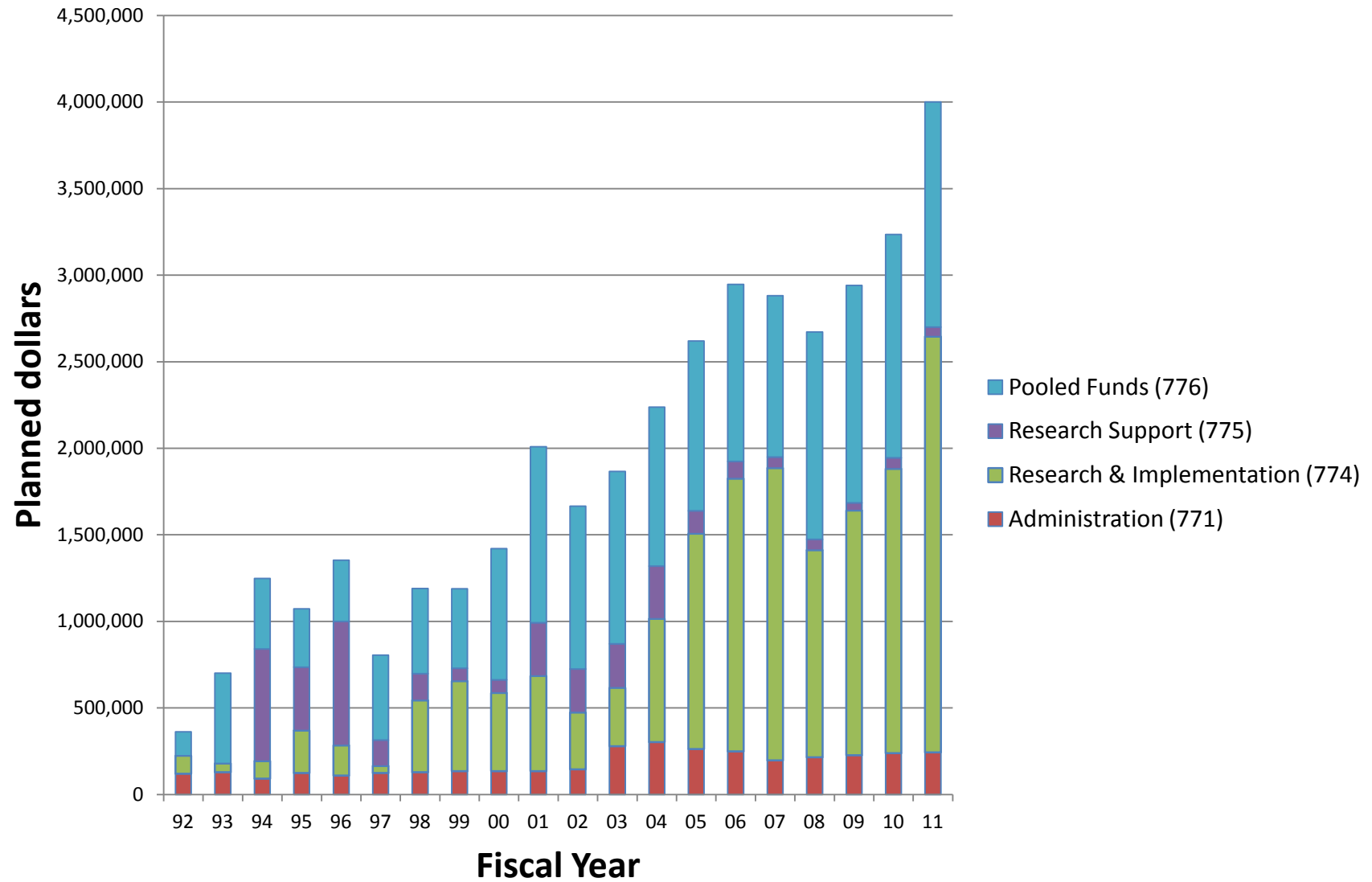
InTrans also supports the Iowa DOT through administration of the DOT Library. The librarian selects, catalogs and retains materials for the library, conducts literature searches for researchers, posts research activities to the Transportation Research Information System (TRIS) and Research in Progress (RIP) databases and represents Iowa in the Midwest Transportation Knowledge Network (MTKN).

Other ongoing research includes traffic and safety, winter operations, remote sensing and long-term transportation planning. More than 100 individual research contracts are structured as Addenda to the Management Agreement.

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V. Attachments

Annual SPR Plan - Distribution of Funds 1993-2011



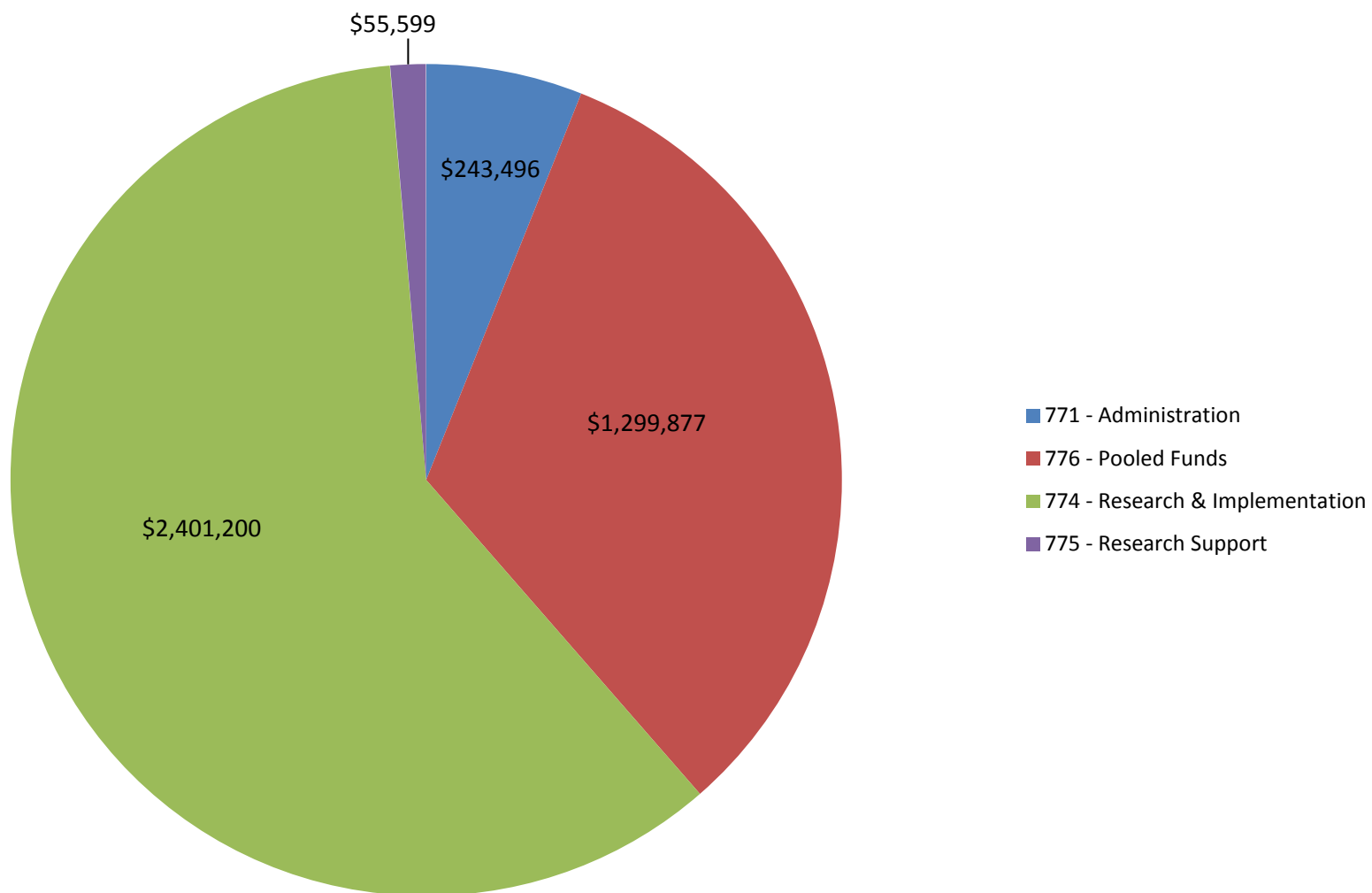
FY 2011 Research Work Program Summary					Rev #5 – 1/28/13	
771 - Administration & Support						
	Title	FY 11	Federal Funds	Iowa DOT Contact	FHWA Contact	# Yrs
	*TRB Research Correlation Service	105,905	105,905	Larson	Grogg	
	Library	122,000	97,600	Larson	Grogg	
	General Funds for Future Needs	15,591	14,591	Larson	Grogg	
	Total w/ TRB	243,496	218,096			
776 - Pooled Fund Studies (100% Federal)						
Project #	Title (bold print = Iowa led)	FY 11	Federal			
TPF-5(411)	NCHRP	532,602	532,602	Larson	Grogg	Ongoing
SPR-3 (042)	Aurora Program	25,000	25,000	Greenfield	Roche	5+
SPR-3 (060)	Highway Maintenance Concept Vehicle	0	0	Greenfield	Grogg	Complete
SPR-3 (079)	REPORT (CARS)	0	0	Whited	Grogg	Complete
TPF-5 (009)	SICOP: AI/RWIS Computer Based Training	4,000	4,000	Greenfield	Grogg	5+
TPF-5 (046)	TCCC	25,000	25,000	C. Anderson	Grogg	3
TPF-5 (065)	Traffic Control Device Consortium	20,000	20,000	Crouch	Roche	1
TPF-5 (081)	Smart Work Zone Deployment Initiative	45,000	45,000	Sprengeler	Roche	5+
TPF-5 (099)	Evaluation of Low Cost Safety Improvements	30,000	30,000	Gent	Roche	1
TPF-5(120)	Deer Vehicle Crash Information Center	10,000	10,000	Jerman	Roche	1
TPF-5 (132)	Low Temp Cracking of Asphalt Pavement - Ph 2	5,000	5,000	Hinrichson	Grogg	2
TPF-5(156)	Mississippi Valley Freight Coalition (Planning funds)	50,000	50,000	O'Riley	Hiatt	1
TPF-5 (159)	TTCC	7,000	7,000	T Hanson	Grogg	1
TPF-5 (169)	Curved Girder Bridges with Integral Abutments	50,000	50,000	McDonald	Monk	1
TPF-5(179)	Evaluation of Test Methods for Permeability	12,000	12,000	Hanson	Grogg	1
TPF-5(183)	Foundations for Concrete Pavements	35,000	35,000	Larson	Grogg	2
TPF-5(185)	CP Roadmap Administration	25,000	25,000	Larson	Grogg	1
TPF-5(189)	Enhancement of Welded Steel Bridge Girders	25,000	25,000	Abu Hawash	Monk	1
TPF-5(193)	Midwest States Pooled Fund Crash Test Program	65,000	65,000	Maifield	Roche	5+
TPF-5(202)	Hy-8 Culvert Analysis Program – Ph 3	10,000	10,000	McDonald	Monk	1
TPF-5(205)	Mix Design and Analysis	25,000	25,000	Hanson	Grogg	2

TPF-5(207)	Novice (School Age) Drivers	20,000	20,000	Falb	Roche	1
TPF-5(218)	Clear Roads was TPF-5(092)	25,000	25,000	Greenfield	Grogg	5+
TPF-5(219)	Structural Health Monitoring	50,000	50,000	McDonald	Monk	1
TPF-5(220)	Oversize/Overweight Vehicles at Roundabouts	15,000	15,000	Dillavou	Grogg	3
TPF-5(224)	Joint Deterioration in Concrete Pavements	15,000	15,000	Hanson	Grogg	3
TPF-5(226)	Instrumentation to Aid in Steel Bridge Fabrication	0	0	Abu Hawash	Monk	1
TPF-5(231)	Enterprise (IVHS Study) was SPR-3(020)	30,000	30,000	Whited/Stolle	Grogg	5+
Sol 1257	Fracture Critical Concerns in 2 Girder Bridge Systems	20,000	20,000	McDonald	Monk	3
Sol 1272	Accelerating Maintenance Innovation Implementation and Tech Transfer was Sol 1259	12,000	12,000	Dunn	Grogg	3
TPF-5(233)	Tech Transfer Intelligent Compaction Consortium	9,000	9,000	Dunn	Grogg	5
TPF-5(232)	Impacts of Implements of Husbandry on Bridges	0	0	Engle	Grogg	5
Sol 1271	Transportation Library Connectivity &Development was TPF – 5(105)	5,000	5,000	Larson	Grogg	5
Sol 1264	Bulb-T Beam As Alternate ABC to Side-By-Side Box-Beam	15,000	15,000	Abu Hawash	Monk	4
Sol 1280	Next-Generation Transportation Construction Management	25,000	25,000	Smythe	Grogg	3
Sol 1291	Field Testing Hand-held Thermo-graphic Inspection Technologies Phase II	30,000	30,000	Port	Grogg	2
Sol 1300	Motorcycle Crash Causation Study	15,000	15,000	Vortherms	Grogg	3
	General Funds for Future Projects	13,275	13,275	Larson	Grogg	
	Total w/ NCHRP	1,299,887	1,299,887			
774 - General Implementation						
	Title	FY 11	Federal			
	Basic Agreement with InTrans	240,000	192,000	Larson	Grogg	5+
	*AASHTO - NTPEP	7,500	7,500	Berger	Grogg	5+
	*AASHTO - APEL (Approved Product Eval List)	1,200	1,200	Dunn	Grogg	5+
	*AASHTO - TIG (Technology Implementation Group)	6,000	6,000	Larson	Grogg	5+
	*AASHTO - TSP2	20,000	20,000	Todey	Grogg	5+
	*AASHTO – LRFD Specification Maintenance	10,000	10,000	McDonald	Monk	5+

	*AASHTO – Env Tech Assistance Program	8,000	8,000	Rost	Grogg	5+
	Remote Sensing Support	10,000	8,000	Larson	Grogg	5+
	Geotechnical Support	50,000	40,000	Larson	Grogg	5+
	Information Technology Development	170,000	136,000	Peperkorn	Grogg	2
	LRFD Training	10,000	8,000	McDonald	Monk	1
	Pavement Marking Management System	25,000	20,000	Crouch	Roche	5+
	Bridge Construction Web Management	50,000	40,000	J Nelson	Monk	3
	OWI Recidivism Study (Profile of OWI Offenders and Recidivism)	50,000	40,000	Falb	Roche	2
	Safety and Mobility Impacts of Winter Weather	75,000	60,000	Gent/Bradley	Roche	2
	Diagnostic Tools for Identifying sleepy Drivers - Phase I (Commercial Driver Fatigue)	15,000	12,000	Lowe	Roche	2
	Intelligent Compaction Field Pilot	50,000	40,000	Smythe	Grogg	1
	J Turn Simulation	62,000	49,600	Simodynes	Roche	1
	Tow Plows	281,000	224,800	Younie	Grogg	1
	Winter Operations Performance Measurement	50,067	40,054	A Dunn	Grogg	1
	Non Destructive Evaluation of Bridge Decks	200,000	160,000	Abu-Hawash	Monk	1
	Performance Evaluation of Epoxy Coated Bars	120,000	96,000	Abu-Hawash	Monk	1
	Bridge Deck Epoxy Injection Process	100,000	80,000	Dunn	Monk	7
	Mass Concrete for Bridge Foundations	50,000	40,000	J Nelson	Monk	2
	Hybrid UHPC/HPC Bridge Applications	50,000	40,000	Abu-Hawash	Monk	1
	Entrance Loss Coefficients for Culvert Designs	90,000	72,000	Claman	Monk	2
	Methods for Deflecting Debris from Bridge Piers	20,000	16,000	Claman	Monk	1
	LRFD Design of Drilled Shafts	50,000	40,000	Abu-Hawash	Monk	2
	Base Grouted Drilled Shafts Investigation	50,000	50,000	Abu-Hawash	Monk	1
	Mobile Mapping	75,000	60,000	A Welch	Grogg	1
	Instrumentation and Monitoring of Accelerated Bridge Construction (Keg Creek Bridge)	20,000	16,000	Abu-Hawash	Grogg	1
	Improving the Accuracy and Usability of Iowa Falling Weight Deflectometer Data	25,000	20,000	Omundson	Grogg	2
	Review of Breath Alcohol Ignition Interlock Devices	55,800	44,640	Larson	Grogg	1
	<u>“Go Team” Teen Driver Fatalities Study</u>	45,733	36,586	Falb	Grogg	1

	2011 Peer Exchange	20,000	16,000	Goetz	Grogg	1
	2011 Mid-Continent Transportation Research Symposium	35,000	28000	Dunn	Grogg	1
	RFID Rebar Corrosion Detection	20,000	16,000	Abu-Hawash	Grogg	1
	Technical Training & Conference Plan	180,000	144,000	Larson	Grogg	5+
	Research Implementation	0	0	Larson	Grogg	5+
	General Funds for Future Projects	3,900	3,120	Larson	Grogg	1
	Total	2,401,200	1,931,500			
	*Item with 100% Federal Share					
	775 - Highway Research Support (80% Federal)					
	Title	FY 11	Federal			
	MIST	15,600	12,480	Jones/Schram	Grogg	1
	Hach 2100Q Portable Turbidimeter	1,000	800	Serio	Grogg	1
	General Funds for Future Projects	38,999	34,199	Larson	Grogg	
	Total	55,599	47,479			
	Grand Total Research	4,000,182	3,496,962			
	Unobligated Funds from Previous Years		701,870			
	Part 1 Planning Funds		50,000			
	FY 11 SPR 1½ % Apportionment		2,745,092			
			3,496,962			

FY 2011 SPR Research Work Program by Category

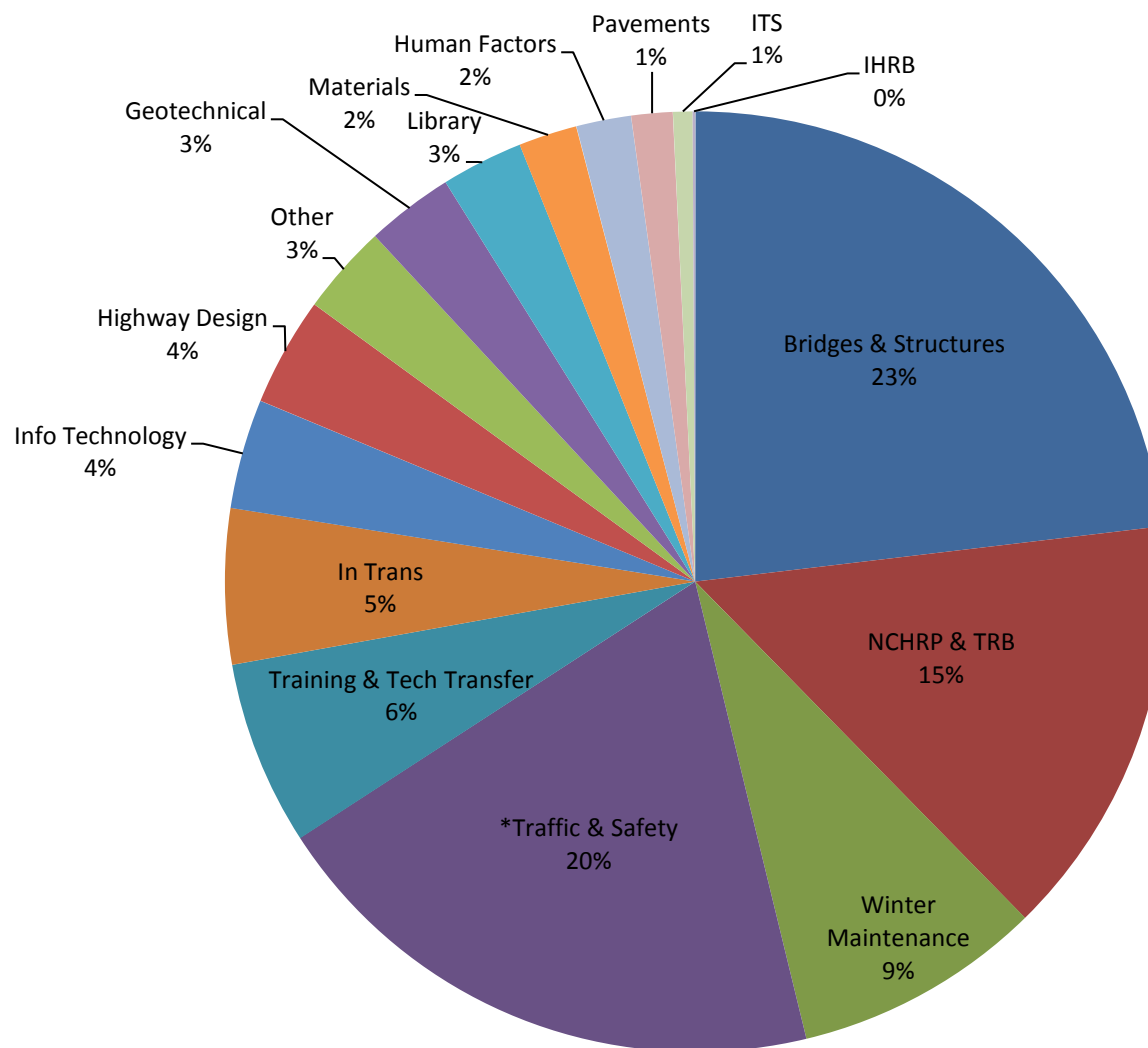


FY 2011 SPR Allocations by Type of Work

	FY 11 \$	% \$	Project #	% #		FY 10 \$
Bridges & Structures	\$ 1,040,000	23	21	37	\$	465,000
NCHRP & TRB	\$ 654,098	15	3	5	\$	618,383
Winter Maintenance	\$ 385,067	9	6	11	\$	73,500
*Traffic & Safety	\$ 883,533	20	10	18	\$	690,000
Training & Tech Transfer	\$ 285,000	6	5	9	\$	150,000
In Trans	\$ 240,000	5	1	2	\$	240,000
Info Technology	\$ 170,000	4	1	2	\$	160,000
Highway Design	\$ 168,275	4	4	7	\$	70,000
Other	\$ 138,999	3	6	11	\$	151,000
Geotechnical	\$ 135,000	3	3	5	\$	135,000
Library	\$ 127,000	3	2	4	\$	127,000
Materials	\$ 90,300	2	7	12	\$	118,700
Human Factors	\$ 85,000	2	3	5	\$	285,000
Pavements	\$ 64,000	1	5	9	\$	122,000
ITS	\$ 30,000	1	1	2	\$	30,000
IHRB	\$ 3,900	0	1	2	\$	250,000
	<u>\$ 4,500,172</u>	<u>100</u>	<u>57</u>	<u>100</u>	<u>\$</u>	<u>3,185,583</u>

*Includes Traffic Safety Improvement Program Research Projects

FY 2011 SPR Allocations by Type of Work



*Includes Traffic Safety Improvement Program Research Projects

**FY 2011 Traffic Safety Improvement Program
Research Projects**

Attachment 6

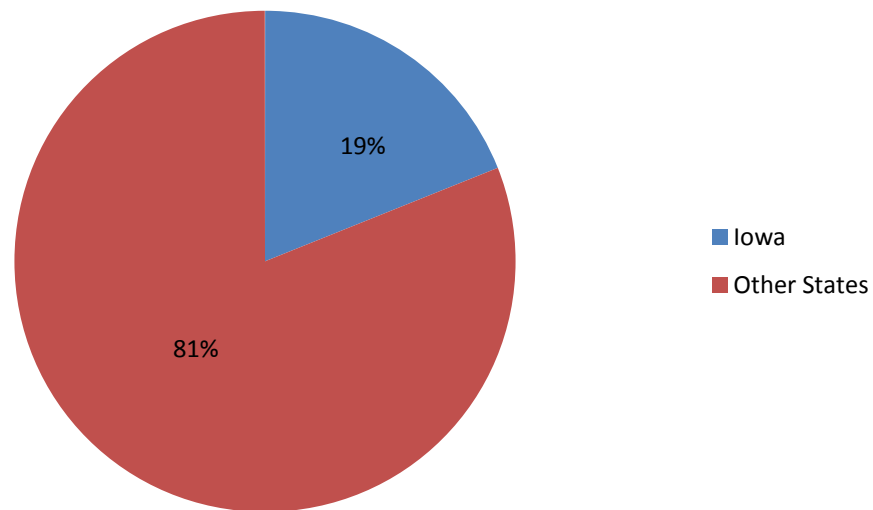
Title	Amount
Iowa Traffic Safety Data Service (ITSDS)	20,000
Intersection Magic/Diagram Magic Statewide License Renewal	13,000
Work Zone Safety Training	45,000
Traffic Safety Liaison Program	50,000
Evaluation of Dynamic Warning Signs at High Crash Rural Curves, Phase II	40,000
Study Yield Signs at RR Crossings Impact	10,000
Evaluating Red Light Running Camera Enforcement (RLRCE) and Developing Guidelines for Use of RLRCE	15,000
Guidance for Effective Traffic Calming and Traffic Control in Small Rural Communities	35,000
Identifying High Crash Curves - Phase II	25,000
Winter Crash Analysis and Safety Audit	15,000
Safety Circuit Rider Support	20,000
Traffic and Safety Engineering Forum, Training and Peer Exchange	20,000
OWI Recidivism Study	20,000
Traffic Data Collection & Reduction Using Video Detection Equipment	28,500
Iowa Traffic Safety Alliance "Change the Culture"	50,000
Systematic Identification of Optimal Roundabout Sites	35,000
Comprehensive Highway Safety Plan Implementation	8,500
Development of Geometric Design Guides for Roundabouts	50,000
Total	500,000

Attachment 7

2011 In-State Technical Training Requests							Rev #6	4/15/2011
Attachment to FY 11 State Planning & Research Plan								
Requester	Course Name & NHI #	# Att	@ Cost	Class Cost	Room	Total		
NHI Courses								
Todsen	Bridge Inspection Refresher Training #130053	24	520	12,480	250	12,920		
Todsen	Safety inspection of in-service bridges #130055	2	1,500	3,000	0	1,400		
Nielsen	Drilled Shafts #132014	29	520	15,080	500	18,200		
Claman	Surface Water Modeling System with Flo2DH and SMS #135071	26	650	16,900	1,000	12,350		
Nielsen	Load and Resistance Factor Rating for Highway Bridges #130092A	20	700	14,000	500	13,300		
Nielsen	Bridge Evaluation for Rehabilitation Design Consideration #134062	25	620	15,500	1,000	16,250		
Ohman	Urban Drainage Design #135027	30	750	22,500	1,500	18,600		
Kasper	Contract Administration Core Curriculum #134077	20		3,500	500	4,000		
				Total NHI		97,020		
Non – NHI Courses								
	Federal Aid Highways 101 2 days	100		12,500	1,500	14,000		
Schram	Advanced Mix Design (HMA) 3 days	3	600	1,800	0	1,800		
Meyer	Bridge Girder Erection 1 day	16	120	1,920	0	1,920		
Buchwald	Americans with Disabilities Act			30,000	0	30,000		
Engle	Fundamentals of Railroad Engineering 2 days	35		35,000	0	20,000		
				Total Non-NHI		67,720		

**FY 2011 Committed Research Funds Leveraged
Through Iowa-Led Pooled Fund Projects**

Project #	Pooled Fund	Iowa	Other States	Total	% Iowa
SPR-3(042)	Aurora	\$ 25,000	\$ 325,000	\$ 350,000	7
TPF-5(081)	Smart Work Zone	\$ 45,000	\$ 150,000	\$ 195,000	23
TPF-5(159)	TTCC	\$ 7,000	\$ 106,000	\$ 113,000	6
TPF-5(169)	Curved Girder Bridges	\$ 50,000	\$ 22,500	\$ 72,500	69
TPF-5(183)	Foundations for Concrete Pvmnt	\$ 35,000	\$ 140,000	\$ 175,000	20
TPF-5(205)	Mix Design & Analysis	\$ 25,000	\$ 100,000	\$ 125,000	20
TPF-5(207)	Novice Drivers	\$ 20,000	\$ 25,000	\$ 45,000	44
TPF-5(219)	Structural Health Monitoring	\$ 50,000	\$ 170,000	\$ 220,000	23
TPF-5(224)	Joint Deterioration	\$ 15,000	\$ 90,000	\$ 105,000	14
TPF-5(233)	Tech Transfer Intelligent Compaction	\$ 9,000	\$ 76,000	\$ 85,000	11
Total		\$ 281,000	\$ 1,204,500	\$ 1,485,500	19





ANNUAL REPORT

of

Iowa Highway Research Board Research and Development Activities FY 2011

Attachment to
FY 2011 Annual Report
Research, Intelligent Transportation Systems, and
Technology Transfer Activities

DECEMBER 2011



**ANNUAL REPORT
OF
IOWA HIGHWAY RESEARCH BOARD
RESEARCH AND DEVELOPMENT ACTIVITIES**

**FOR THE
FISCAL YEAR ENDING JUNE 30, 2011**

RESEARCH AND TECHNOLOGY BUREAU
OPERATIONS RESEARCH
(515) 239-1447
www.iowadot.gov/operationsresearch

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2011

TABLE OF CONTENTS

	Page
Research and Development	1
Iowa Highway Research Board	1
Table I - Iowa Highway Research Board Members.....	2
Research and Development Projects	4
In-House Research and Development	4
National Cooperative Highway Research Program	4
Secondary Road Traffic Count Program	5
Secondary Road Research Fund	5
Street Research Fund.....	6
Primary Road Research Fund	6
Projects Initiated During FY 2011	7
Projects Completed During FY 2011	8
Table II - Financial Summary of Research and Development Project Expenditures	9
Research Project Descriptions	11

LIST OF ACRONYMS

AASHTO - American Association of State Highway and
APWA - American Public Works Association
ASCE - American Society of Civil Engineers
DOT - Department of Transportation
FHWA - Federal Highway Administration
GIS - Geographic Information System
HMA - Hot Mix Asphalt
IHRB - Iowa Highway Research Board
ISU - Iowa State University
LRFD - Load and Resistance Factor Design
LTAP - Local Technical Assistance Program
LVR - Low Volume Road
MOVITE - Missouri Valley Section of the Institute of Transportation Engineers
NCHRP - National Cooperative Highway Research Program
QA - Quality Assurance
QC - Quality Control
SUDAS - Statewide Urban Designs and Specifications
TAC - Technical Advisory Committee
TRB - Transportation Research Board
UHPC - Ultra High Performance Concrete
USGS - United States Geological Survey

RESEARCH AND DEVELOPMENT

The Highway Division of the Iowa DOT engages in research and development for two reasons: first, to find workable solutions to the many problems that require more than ordinary, routine investigation; and second, to identify and implement improved engineering and management practices.

This report, entitled “Iowa Highway Research Board Research and Development Activities FY2011” is submitted in compliance with Sections 310.36 and 312.3A, Code of Iowa, which direct the submission of a report of the Secondary Road Research Fund and the Street Research Fund, respectively. It is a report of the status of research and development projects in progress on June 30, 2011. It is also a report on projects completed during the fiscal year beginning July 1, 2010 and ending June 30, 2011. Detailed information on each of the research and development projects mentioned in this report is available from the Research and Technology Bureau, Highway Division, Iowa Department of Transportation. All approved reports are also online for viewing at: www.iowadot.gov/operationsresearch/reports.aspx.

THE IOWA HIGHWAY RESEARCH BOARD

In developing a progressive, continuing and coordinated program of research and development, the Highway Division is assisted by the IHRB. This advisory group was established in 1949 by the Iowa State Highway Commission to respond to the research denoted in Sections 310.36 and 312.3A of the Code of Iowa.

The Research Board consists of 15 regular members: seven Iowa county engineers, four Iowa DOT engineers, one representative from Iowa State University, one from The University of Iowa, and two engineers employed by Iowa municipalities. Each regular member may have an alternate who will serve at the request of the regular member. The regular members and their alternates are appointed for a three year term. The membership of the Research Board as of June 30, 2011, is listed in Table I.

The Research Board held seven regular meetings during the period from July 1, 2010, through June 30, 2011. Suggestions for research and development were reviewed at these meetings and recommendations were made by the Board.



Members of the IHRB are serious about the future of transportation. Understanding that every research project has the potential to strengthen the infrastructure, save lives, time and precious resources, they work hard to make sure new methods, technologies and materials are developed efficiently and economically for application in the real world. **The IHRB has received national attention as a leader in transportation research implementation.**

TABLE I

2011 IOWA HIGHWAY RESEARCH BOARD**July 1, 2011**

<u>Member</u>	<u>Term Expires</u>	<u>Alternate</u>
Ahmad Abu-Hawash Chief Structural Engineer Iowa DOT - Bridges and Structures 800 Lincoln Way Ames, IA 50010	12-31-12	Deanna Maifield Methods Engineer Iowa DOT – Office of Design 800 Lincoln Way Ames, IA 50010
Robert Younie Director Office of Maintenance 800 Lincoln Way Ames, IA 50010	12-31-11	Kent Nicholson Assistant Road Design Engineer Road Design 800 Lincoln Way Ames, IA 50010
James Alleman Dept. of CCE Engineering Iowa State University 390 Town Engineering Bldg. Ames, IA 50011	12-31-11	
Wade Weiss Greene County Engineer 114 N. Chestnut Jefferson, IA 50129	12-31-11 District 1	Robert Kieffer Boone County Engineers Office 201 State Street Boone, IA 50036-3988
Vicki Dumdei District Engineer Hwy Div- District 2 1420 Fourth St. S.E. Mason City, IA 50401-4438	12-31-13	David Little Assistant District Engineer Highway District 2 512000 - Hwy Div District 2 Office Mason City, IA 50401
Douglas Schnoebelen, Chair The University of Iowa – IIHR 323A SHL 300 South Riverside Drive Iowa City, Iowa 52242-1585	12-31-13	
J.D. King Fayette County Engineer 114 N. Vine St., PO Box 269 West Union, IA 52175	12-31-13 District 2	Doug Miller Kossuth County Secondary Road Department 114 W State Algona, IA, 50511

<u>Member</u>	<u>Term Expires</u>	<u>Alternate</u>
Jack Moellering Pocahontas County Engineer 99 Court Square – Ste. 4 Pocahontas, IA 50574-1629 712-335-3252 SS-076	12-31-12 District 3	Ron Haden Calhoun and Sac Counties' Engineer 416 4th Street Rockwell City, IA, 50579 (712) 297-8322 Calhoun SS-013 or SAC-081
James Berger Director of Materials Iowa DOT 800 Lincoln Way Ames, IA 50010	12-31-12	
John Joiner, Vice Chair Public Works Director 515 Clark Avenue P.O. Box 811 Ames, IA 50010	12-31-11	Jeff May Public Works Director 305 S. 3rd Knoxville, Iowa 50138
Ronald Knoche City Engineer 410 E. Washington Street Iowa City, IA 52240-1825	12-31-12	Bruce Braun Street Maintenance Administrator 216 SE 5 th Street Des Moines, IA 50309
Mark Nahra Woodbury County Engineer 759 E. Frontage Road Movile, Iowa 51039	-	
Daniel Ahart Shelby County Engineer 1313 Industrial Parkway Harlan, IA 51537	12-31-11 District 4	Kevin Mayberry Mills County Engineers Office 403 Railroad Avenue Glenwood, IA, 51534
Ernie Steffensmeier Lee County Engineer 933 Avenue H Fort Madison, IA, 52627	12-31-13 District 5	Larry Roehl Louisa County Engineer 8313 K. Avenue Wapello, IA, 52653-9279
Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060	12-31-12 District 6	Robert Fangmann Cedar County Engineer 400 Cedar Street Tipton, IA 52772

RESEARCH AND DEVELOPMENT PROJECTS

Proposals for research and development are reviewed by the Iowa Highway Research Board. The Board's recommendations are transmitted to the director of the Highway Division of the Iowa Department of Transportation. Expenditure of research and development funds is then authorized on an individual project basis.

These expenditures may be charged to the Primary Road Research Fund, Secondary Road Research Fund or the Street Research Fund, depending on which road system will benefit from the project. If more than one jurisdiction's roads share in benefits, the costs are shared.

Table II is a record of expenditures for research and development made during the fiscal year ending June 30, 2011. Total expenditure was \$2,439,161.10.

IN-HOUSE RESEARCH AND DEVELOPMENT

Research and development projects performed by Iowa DOT personnel are termed "in-house" projects. These projects may involve other departmental and field personnel in addition to personnel from the Research and Technology Bureau, Operations Research Section. In many instances, personnel from other offices are designated as a project principal investigator, which means that they have a major role in the planning, performance and analysis of the research.

Contract research funds may be used for material and equipment costs for in-house research, but cannot be used for salary or personal expenses of the participating personnel. Consequently, the contract amounts for in-house projects are relatively small. The Research and Technology Bureau, Operations Research Section, wishes to express its appreciation to other offices for their assistance.

NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

The NCHRP was organized by the American Association of State Highway Officials (now the American Association of State Highway and Transportation Officials—AASHTO). The program is administered by the TRB, a branch of the National Academy of Sciences.

The purpose of NCHRP is to provide the funds and direction for research in highway matters of national concern. The program is funded annually by all fifty states in an amount equal to 5.5% of the federal aid allocated to the states for statewide planning and research (SPR). Iowa's obligation and actual expenditure for NCHRP varies and may be influenced by billing practices.

SECONDARY ROAD TRAFFIC COUNT PROGRAM

Secondary road traffic counts are conducted annually and funded from the Secondary Road Research Fund as Non Contract Engineering Studies. The Office of Transportation Data conducted traffic counts in 25 counties during fiscal year 2012 as part of the Annual Traffic Count Program. This activity consisted of 5400 portable recorder classification counts and 100 portable recorder volume counts. Traffic volumes from these counts are used to develop Motor Vehicle Traffic Flow Maps for each county showing the Annual Average Daily Traffic (AADT) on specific road sections within each county.

Secondary roads geometrics and current condition inventories were requested from all 99 counties and 92 of those submitted information. This data provides county engineers, highway engineers, planners and administrators with essential information needed to determine design standards, to systematically classify highways, and to develop programs for improvement in maintenance of secondary roads.

SECONDARY ROAD RESEARCH FUND

Section 310.34 of the Iowa Code authorizes the Iowa Department of Transportation to set aside each year an amount not to exceed 1½% of the receipts to the Farm-to-Market Fund in a fund to be known as the Secondary Road Research Fund. This authorization was first made in 1949; it was repealed in 1963, and reinstated in 1965. When the fund was reinstated, the fund was designated to finance engineering studies and research projects. The Iowa Department of Transportation accounting procedure for the Secondary Road Research Fund is based on obligations for expenditures on research projects and not the actual expenditures.

The fiscal year 2011 financial summary is:

Beginning Balance 7-1-10		\$ 840,103.24
Receipts		
State Road Use Tax Fund		
(1½% of receipts)	\$1,219,807.39	
Federal Aid Secondary		
(1½% of receipts)	0.00	
Research Income	<u>0.00</u>	
Sub-Total		<u>\$1,219,807.39</u>
Total Funds Available		\$2,059,910.62
Obligation for Expenditures		
Obligated for		
Contract Research	\$1,021,450.86	
Non-Contract		
Engineering Studies	<u>\$87,977.00</u>	
Total Expenditures		<u>\$1,109,427.86</u>
Ending Balance 6-30-11		\$950,482.76

STREET RESEARCH FUND

The Street Research Fund was established in 1989 under Section 312.3A of the Iowa Code. Each year \$200,000 is set aside from the street construction fund for the sole purpose of financing engineering studies and research projects. The objective of these projects is more efficient use of funds and materials available for construction and maintenance of city streets. The Iowa Department of Transportation accounting procedure for the Street Research Fund is based on obligations for expenditures on research projects and not the actual expenditures. The fiscal year 2011 financial summary is:

Beginning Balance (7-1-10)	\$ 210,522.86
FY11 Street Research Funding	<u>\$200,000.00</u>
Total Funds Available for Street Research	\$410,522.86
Total Obligated for Expenditure FY11	<u>\$190,206.00</u>
Ending Unobligated Balance 6-30-11	\$220,316.86

PRIMARY ROAD RESEARCH FUND

The Primary Road Research Fund is sourced from non-obligated funds of the Primary Road Fund. These funds can only be expended on Iowa DOT projects for which the funds were reserved, such as contracted research and project-specific research supplies or equipment. An estimate of Primary Road Research Fund expenditures is made prior to the beginning of each fiscal year. The amount expended for contract research from the Primary Road Research Fund for FY11 was \$784,352.23 and the estimate for FY12 is \$750,000.

PROJECTS INITIATED DURING FY 2011

- HR-140 (140H) Collection and Analysis of Streamflow Data
- HR-296 Iowa State University Local Technical Assistance Program (LTAP)
- TR-625 Improving Accuracy of Deflection & Camber Predictions for Pre-stressed Concrete Bridge Girders
- TR-626 Optimization of Snow Drifting Mitigation & Control Methods for Iowa Conditions
- TR-627 Risk Mitigation Strategies for Operations and Maintenance Activities
- TR-628 Alkali Content in Fly Ash Measuring & Testing Strategies for Evaluating Compliance
- TR-629 Revision to the SUDAS Traffic signal Standards Phase II
- TR-630 Evaluation and Guidance on Effective Traffic Calming for Small Communities
- TR-631 Automation of DEM Cutting for Hydrologic/Hydraulic Modeling
- TR-632 Low Cost Rural Road Surface Alternatives
- TR-633 Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays
- TR-634 Pilot Construction for Granular Shoulder Stabilization
- TR-635 Warm Mix Asphalt Phase II: Evaluation of WMA Quality Assurance Testing Protocols

13 Projects Initiated

PROJECTS COMPLETED DURING FY 2011

The following projects were completed during FY 2011 and project Final Reports were approved by the Iowa Highway Research Board:

- TR-548 Investigation of the Impact of Rural Development on Secondary Road Systems
- TR-551 Local Agency Pavement Marking Plan
- TR-564 Adding Scour Estimation to the Iowa Bridge Backwater Software
- TR-566 Investigation of Utility Cut Repair Techniques to Reduce Settlement in Repair Areas
- TR-567 Development of Stage-Discharge Relations for Ungaged Bridge Waterways
- TR-570 Identification of Practices, Design, Construction and Repair Using Trenchless Technology
- TR-574 Structural Design Construction & Evaluation of a Pre-stressed Concrete Bridge Using Ultra High Performance Concrete Pi Girders
- TR-575 Embedded (MEMS) Micro-Electromechanical Sensors & Systems for Monitoring Highway Structures & for Infrastructure Management
- TR-580 Pavement Markings and Safety
- TR-591 Stabilization Procedures to Mitigate Edge Rutting for Granular Shoulders
- TR-594 Development of Non-Petroleum Based Binders for Use in Flexible Pavements
- TR-598 Development of Updated Specifications for Roadway Rehabilitation Techniques
- TR-599 Investigation of Warm Mix Asphalt Using Iowa Aggregates
- TR-607 Review of Inconsistencies Between SUDAS & Iowa DOT Specifications
- TR-610 On-The-Spot Damage Detection Methodology for Hwy Bridges During Natural Crisis
- TR-611 Wireless Sensor Networks for Infrastructure Monitoring

16 Projects Completed and Approved

Table II
FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES
July 1, 2010 to June 30, 2011
(Active projects with no current fiscal year expenditures are not included)

Project	Project Title	Primary Road	Secondary Road	Street	Total
		Research Fund	Research Fund	Research Fund	
		<u>Expenditures</u>	<u>Expenditures</u>	<u>Expenditures</u>	<u>Expenditures</u>
140	Collection and Analysis of Stream Flow Data	168,824.50	124,825.00	48,908.00	342,557.50
296	ISU Local Technical Assistance Program (LTAP)	86,343.02	44,610.28	13,000.00	143,953.30
375	Transportation Research Board Education for County Engineers		5,577.39		5,577.39
519	Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa		37,333.93		37,333.93
551	Local Agency Pavement Marking Plan	1,930.99			1,930.99
563	The Effects of Implements of Husbandry Farm Equipment on Pavement Performance	35,000.00			35,000.00
564	Scour Estimation for the Iowa Bridge Backwater Software	456.00	2,056.00	486.00	2,998.00
567	Stage-Discharge Relations for Ungaged Bridge Waterways	563.59			563.59
568	Modified Sheet Pile Abutments for Low Volume Bridges	7,231.23	88,164.06		95,395.29
573	Development of LRFD Design Procedures for Bridge Piles	47,666.83	8,247.48		55,914.31
574	Structural Design Construction & Evaluation of a Pre-stressed Concrete Bridge Using UHPC Pi Girders	23,177.41	15,318.94		38,496.35
575	Embedded (MEMS) Micro-Electromechanical Sensors & Systems for Infrastructure Management	31,930.76	35,952.40		67,883.16
579	Strategies to Reduce Speed and Crashes on Curves	8,908.10	21,015.83		29,923.93
580	Pavement Markings and Safety	10,029.95			10,029.95
581	Development of an Agricultural-Based Deicing Product	388.08			388.08
582	Ethanol By-Product Geo-Material Stabilization	7,812.19			7,812.19
583	Field Testing of Piles & Development of a Wave Equation Method for Pile Design in IA	81,959.32	30,209.36	4,810.59	116,979.27
584	Establishing a Dynamic Formula for Pile Design & Construction Control of Pile Driving	5,041.45			5,041.45
591	Stabilization to Mitigate Edge Rutting for Granular Shoulders	6,685.29			6,685.29
593	Infrastructure Impacts on Iowa's Changing Economy	2,827.75			2,827.75
594	Development of Non-Petroleum Based Binders for Use in Flexible Pavements	2,666.89			2,666.89
597	Wet Reflective Pavement Marking Demonstration Project	38,227.33	12,079.90		50,307.23
598	Development of Updated Specifications for Roadway Rehabilitation Techniques		1,423.79	131.04	1,554.83
599	Investigation of Warm Mix Asphalt Using Iowa Aggregates	30,557.35			30,557.35
600	Improving Concrete Overlay Construction	2,672.41			2,672.41
601	Roadway Lighting and Safety: Phase II (TR-540) Monitoring, Quality, Durability and Efficiency	2,824.48	31,816.99	2,135.56	36,777.03

Project	Project Title	Primary Road	Secondary Road	Street	Total
		Research Fund	Research Fund	Research Fund	
		Expenditures	Expenditures	Expenditures	
604	Field Testing and Evaluation of a Demonstration Timber Bridge		11,739.08		11,739.08
605	Evaluation of the Buena Vista IBRD Bridge: A Furthering of Accelerated Bridge Construction in Iowa		29,539.09	1,622.98	31,162.07
606	Iowa Public Employees Leadership Academy (LTAP)		10,583.07	25,850.35	36,433.42
607	Inconsistencies Between SUDAS & Iowa DOT Specifications	5,760.29			5,760.29
608	Assessment of Iowa County Roadway Financing Needs	21,489.22	32,020.54		53,509.76
609	Curing Criteria for Cold In-Place Recycling Phase III	15,309.35	3,313.08	1,776.18	20,398.61
610	On-The-Spot Damage Detection Methodology for Hwy Bridges During Natural Crisis	23,497.15			23,497.15
611	Wireless Sensor Networks for Infrastructure Monitoring	29,936.00	27,761.09	3,062.59	60,759.68
613	Impacts of Implements of Husbandry on Iowa Bridges	20,133.73	70,317.26	6,849.12	97,300.11
614	Structural Characterization of a UHPC Waffle Bridge Deck and its Connections	9,425.26		355.28	9,780.54
615	Connection Details and Field Implementation of UHPC Piles	670.67	24,430.06	14,232.70	39,333.43
616	Timber Abutment Piling and Back Wall Rehabilitation and Repair		26,353.78		26,353.78
617	An Adaptive Field Detection Method for Bridge Scour Monitoring Using Motion-Sensing Radio Transponders (RFIDs)		21,459.68	12,960.37	34,420.05
618	Parallel Wing Headwalls for Single RCBs (LRFD)		85,339.24		85,339.24
619	Development of Self-Cleaning Box Culvert Design - Phase II - additional funding for field test approved 6/25/10 \$9679	4,463.28	53,234.53	8,491.99	66,189.80
620	Update of RCB Culvert Standards to LRFD Specifications	47,486.94	159,141.42	30,185.69	236,814.05
621	Geosynthetic Reinforced Soil for Low Volume Bridge Abutments	1,219.46	39,101.94	8,108.48	48,429.88
622	Maintenance and Design of Steel Abutment Piles in Bridges		24,483.45	19,953.22	44,436.67
623	Quality Control/Quality Assurance Testing for Joint Density and Segregation of Asphalt Mixtures		29,148.84	10,172.13	39,320.97
624	Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures		33,798.41	13,485.63	47,284.04
625	Improving Accuracy of Deflection & Camber Predictions for Prestressed Concrete Bridge Girders	255.02	5,117.78		5,372.80
626	Optimization of Snow Drifting Mitigation & Control Methods for Iowa Conditions	160.56	43,616.59	7,617.22	51,394.37
627	Risk Mitigation Strategies for Operations and Maintenance Activities		24,177.65	2,383.01	26,560.66
629	Revision to the SUDAS Traffic signal Standards Phase II	820.38	2,879.80	2,526.28	6,226.46
630	Evaluation and Guidance on Effective Traffic Calming for Small Communities			213.72	213.72
635	Warm Mix Asphalt Phase II: Evaluation of WMA Quality Assurance Testing Protocols			1,210.75	1,210.75
1027	Secondary Road Research Coordinator		50,449.26		50,449.26
	Contract Research Subtotal	784,352.23	1,266,636.99	240,528.88	2,291,518.10
SPR-PL-1(47)	FY 2011 Transportation Inventory Engineering Studies		147,643.00		147,643.00
	Total of Expenditures	784,352.23	1,414,279.99	240,528.88	2,439,161.10

HR-140

Agency:
United States
Geological Survey

Principal Investigator:
Rob Middlemis-
Brown

Research Period:
July 1, 1967 to
September 30, 2012
Annual Renewal

Research Board Funding:
\$238,650

Funding Source:
45% Federal funds,
55% State –
40% Primary funds
50% Secondary funds
10% Street funds

Collection and Analysis of Stream Flow Data

Objective: Collect the data necessary for analytical studies (including flood-frequency discharge estimation) and to define, for any location, the statistical properties and trends in discharge or elevation of streams, lakes, and reservoirs; Define the water-surface-elevation profiles and corresponding discharges along streams in basins with at least 100 mi² of drainage area for selected floods and evaluate the flood characteristics and hydraulics at existing and proposed flow structures in basins of all sizes when requested.

Progress: Data collection and annual reporting of stream flow data is ongoing annually.

Reports: Annual Report, Flood Event Reports

Implementation: Flood frequency and discharge data is used for sizing hydraulic structures in Iowa. Structure design agencies use this data for their designs.



U.S. Geological Survey measures the high water mark on the Cedar River at the Janesville stream gage on June 10, 2008. The record discharge for this site was set that day with streamflow measured at 53,400 cfs.

Photo: U.S. Geological Survey

HR-296

Agency:

Iowa State University

Principal Investigator:

Keith Knapp

Research Period:

October 1, 1986 to
December 31, 2012

Research Board Funding:

\$145,000

Funding Source:

Federal funds, 15.4%
Safety funds, State
Funds, Workshop
income funds

State –

40% Primary funds

50% Secondary funds

10% Street funds

*promote research -
encourage implementation -
distribute research data*

Iowa State University Local Technical Assistance Program (LTAP)

Objective: Assist Iowa's local governments with growing demands on local roads, streets, bridges, and public transportation. The center provides technical and managerial assistance to Iowa's local transportation officials through a variety of programs.

Progress:

- Publish *Technology News* newsletters
- Conduct training courses and workshops
- Distribute publications
- Provide service and information to users
- Present transportation safety information to rural communities by employing a Transportation Safety Circuit Rider

Reports: Newsletters, Annual Report

Implementation: Implementation of research findings and the proper training of state and county employees will improve the quality and reduce the cost of road construction and maintenance.

HR-375

Agency:

Iowa Department of
Transportation,
Highway Division

**Principal
Investigator:**

Mark Dunn

Research Period:

November 1, 1994 to
on-going

**Research Board
Funding:**

\$37,400

Funding Source:

100% State -
100% Secondary
funds

Transportation Research Board Education for County Engineers

Objective: Annually send county engineers to the TRB Annual Meeting in Washington, D.C., for research education. County engineers selected are generally those starting their term as regular members of the IHRB. Attendance at the TRB Annual Meeting gives county engineers serving on the IHRB a better understanding of research at a national and international level. Additional benefits may be gained as the county engineers begin to develop ideas for research from their experience at the TRB meeting.

Progress: Between 1995-2011, 25 county engineers have received funding through IHRB to attend the Annual TRB meeting in Washington, D.C.

Reports: None

Implementation: County engineers who have attended the conference say it was a very good educational experience and that it educates and encourages them to better serve their counties and the IHRB.



Dr. Martin Wachs, Director, Transportation, Space and Technology Program, Rand Corporation, delivers the Thomas B. Deen Distinguished Lecture during TRBs 88th Annual meeting in Washington, D.C. on January 11, 2010.

Photo: Cable Risdon, Transportation Research Board

TR-519 Phase II

Agency:

United States
Geological Survey
(USGS)

**Principal
Investigator:**

David Eash

Research Period:

June 1, 2004 to
March 31, 2013

**Research Board
Funding:**

\$464,777

Funding Source:

44.3% Federal funds
and 55.7% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Implementing a StreamStats Web Site for Iowa and Developing Flood-Estimation Equations for Small and Large Drainage Basins

Objective: Develop a comprehensive flood-estimation method for unregulated, rural streams in Iowa. Specifically:

- Implement an interactive StreamStats Web site for all of Iowa that allows users to easily select stream sites and estimate flood-frequency discharges by automating the measurement of basin characteristics and calculation of regression estimates
- Develop two sets of regional regression equations to estimate 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year flood-frequency discharges
- Develop the smallest drainage-area range for a transition zone as possible for Iowa to prevent the possibility of small-basin regression estimates exceeding large-basin regression estimates

Progress: The skew study for Iowa was contracted to Cornell University. Cornell University was not able to start work on the Iowa skew study until about July 2010, about a nine-month delay. Then in September 2010, Cornell University found an error in the new EMA (expected moments algorithm) flood-frequency analysis program for low-outlier calculations and the EMA code was not revised by the USGS until April 2011, about a eight-month delay.

OSW recently reported that the skew study will be completed by November 1, 2011. The IA WSC has prioritized work for the remaining study tasks (update 517 streamgages with new skew values using EMA through the 2009 water year, perform regression analyses to develop new peak-flow estimation equations for both small- and large-sized drainage areas, prepare report, obtain USGS reviews for report and publish report, and implement GIS data and new regression equations into StreamStats). The IA WSC now estimates the study can be completed by March 2013.

Reports: None

TR-551

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
January 1, 2006 to
July 30, 2010

Research Board Funding:
\$157,081

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Local Agency Pavement Marking Plan

Objective: Produce a Reflectivity Guideline to assist local agencies in identifying application of pavement marking needs due to wear or marking damage over the winter and in developing marking needs and priorities each spring. This research will also:

- Develop a county and city pavement marking application matrix which will provide guidance on the selection of marking materials based on roadway type, pavement service life, user needs, and other factors specific to local agency conditions
- Address quality control issues for cities and counties to improve efficiency and effectiveness of pavement markings on all marked public roadways

Reports: Final Report, July 2010

Implementation: These guidelines will be incorporated into a pavement marking design section within the Iowa SUDAS manual. Research findings will be shared through presentations at the County Engineer Conference, the ASCE Transportation Conference, the APWA Conference, and through a variety of other professional, municipal, and national group presentations.



One goal of this project was to find new products and methods for improving both durability and retro-reflectivity of centerline markings.

Photo: Neal Hawkins, Iowa State University/CCEE

TR-563 TPF-5(148)

Agency:
Minnesota
Department of
Transportation

Principal Investigator:
Tim Clyne
(Minnesota
Department of
Transportation)

Research Period:
July 2006 to
September 30, 2011

Research Board Funding:
\$105,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

The Effects of Implements of Husbandry Farm Equipment on Pavement Performance (MnROAD Study)

Objective: Determine pavement response under various types of agricultural equipment (including impacts of different tires and additional axles) and compare this response to the impact of a typical five-axle semi tractor-trailer. This may be accomplished by constructing new instrumented test sections at MnROAD and/or to retrofit instrumentation into the existing test sections. The final scope and work plan for the study will be developed by the participating agencies.

Progress: The final testing occurred at the end of August 2011. The Final Report is expected to be complete in December 2011.

Reports: None

Implementation: This research will help with policy and design decision making, providing direct experimental results to support those decisions rather than using just models. When models are used they cannot be calibrated for the types of loadings and tire configurations for a variety of agricultural equipment.



Large manure hauling tank on the MnROAD test track; fully loaded it weighs more than 134,000 lbs (distributed over four axles - not including the tractor).
Photo: Shongtao Dai, Research Operations Engineer, Minnesota DOT

TR-564

Agency:
Digital Control, Inc.

Principal Investigator:
LaDon Jones

Research Period:
September 1, 2006 to
September 24, 2010

Research Board Funding:
\$52,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Adding Scour Estimation to the Iowa Bridge Backwater Software

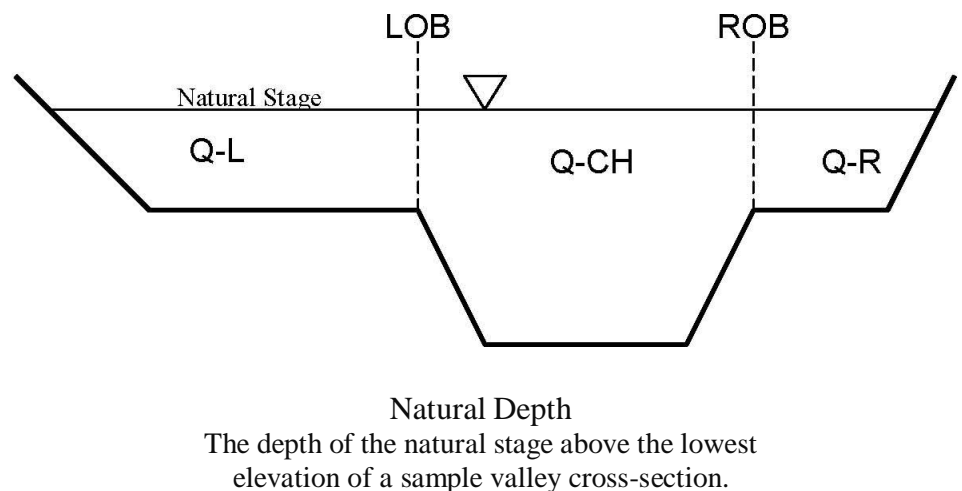
Objective: Add a new major component to the Iowa Bridge Backwater software (published in 2003), *The Estimation of Scour at Bridges*. Adding scour estimation will be the most significant portion of this project and provide a valuable time saving tool for city, county and state engineers.

In addition to scour, the following items will also be completed as part of Version II of the software as suggested by users of the current software:

- Improved convergence and iteration on backwater with overtopping
- Improved label scaling on plots and graphs
- Design flow rate copying
- Updated User Manual
- Online Help

Reports: Final Report, September 2010

Implementation: The Iowa Bridge Backwater Version 2 software will be utilized by city and county engineers, Iowa DOT staff and consultants for the design of bridges along the State's primary and secondary road system. One copy of the program will be provided to each county engineering office in Iowa.



TR-567

Agency:

The University of Iowa

Principal Investigator:

Thanos Papanicolaou

Research Period:

August 1, 2006 to September 30, 2010

Research Board Funding:

\$157,030

Hungry Canyons Alliance Funding:

\$105,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary funds and
10 % Street funds

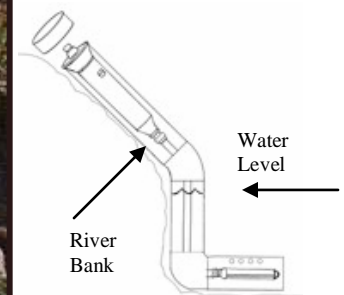
Development of Stage Discharge Relations for Ungaged Bridge Waterways in Western Iowa

Objective: Establish stage-discharge relationships for ten ungaged streams in western Iowa through implementation of a semi-automatic sensor network. This project seeks to describe and document knickpoint propagation and identify and prioritize at-risk sites, thereby avoiding potential safety and asset risks due to knickpoint propagation and channel vertical shift.

Reports: Final Report, October 2010

Implementation: This research will provide stage-discharge relations for small-to-medium size ungaged streams in western Iowa and comparisons with other ongoing studies; a tool for predicting river response based on discharge data; explain scour and erosion processes at bridge waterways while indicating how past, present, and possible future changes in river or stream dynamics may affect bridge waterway stability as a function of discharge.

Description and documentation of knickpoint propagation in the Hungry Canyons Alliance (HCA) region will aid in identifying and prioritizing at-risk sites, thereby avoiding or lessening potential safety and asset risks. Results will be presented at conferences and information made available to interested agencies.



Installation of Water Level Loggers (left) and drawing (right) of Logger Placement

Photo and Illustration: Dr. Thanos Papanicolaou, The University of Iowa/IIHR

TR-568

Agency:
Iowa State University

Principal Investigator:
David J. White

Research Period:
January 1, 2007 to
December 31, 2011

Research Board Funding:
\$365,912

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Modified Sheet Pile Abutments for Low Volume Bridges

Objective: Develop a design approach for sheet pile bridge abutments for short span, low-volume bridges, including calculation of lateral stresses from retained soil and bearing support for superstructures; formulate an instrumentation and monitoring plan to evaluate performance of sheet pile abutment systems including evaluation of lateral structural forces and bending stresses in sheet pile sections.

Also, evaluate and understand the costs and construction efforts associated with building a sheet pile bridge abutment demonstration project and materials; provide recommendations for use and potential limitations of sheet pile bridge abutment systems.

Progress: Testing is complete and the final report is currently being written. The report will be presented at the January 2012 IHRB meeting.

Reports: None

Implementation: The Final Report will provide recommendations for site investigation and design of sheet pile bridge abutments for LVRs. A summary sheet will be made available at appropriate local and regional conferences.

The observations and conclusions from this study provide recommendations for use of sheet pile abutments in bridges on low volume roads and in-situ soil testing. County engineers (responsible for 80% of Iowa's low volume roads) can implement recommendations for use of an alternative abutment system.

TR-573

Agency:

Iowa State University

Principal Investigator:

Sri Sritharan

Research Period:

July 1, 2007 to
June 25, 2010

Research Board Funding:

\$250,000

Funding Source:

100 % State -
45 % Primary funds,
55 % Secondary
funds

Development of LRFD Design Procedures for Bridge Piles in Iowa

Objective: Examine current pile design and construction procedures used by the Iowa DOT and recommend changes and improvements to those that are consistent with available pile load test data, soils information and bridge design practice recommended by LRFD. It is a priority to work towards recommended changes that do not significantly increase design and construction costs.

Reports: Final Report, June 2010

Implementation: This research will provide direct benefits to bridge infrastructure in Iowa, including the development and implementation of LRFD design procedures for bridge piles in Iowa to ensure the uniform reliability of bridges while providing cost-effective solutions to foundation designs in accordance with the LRFD specifications and local soil conditions.

A training course will be designed for engineers at the Iowa DOT, emphasizing the importance of collaboration between structural, geotechnical and construction engineers. Other participants from transportation agencies will also be attending.

TR-574

Agency:

Iowa State University

Principal Investigator:

Terry Wipf

Research Period:

April 1, 2007 to
September 30, 2010

Research Board Funding:

\$79,933

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Structural Design, Construction and Evaluation of a Pre-stressed Concrete Bridge Using Ultra High-Performance Concrete Pi Girders

Objective: Optimize the design and use of Pi girders while advancing the state-of-the-art in bridge concrete construction technology. In addition, this research continues to foster an important partnership with FHWA and industry that is contributing to the standardization and use of the next generation of high performance materials.

Reports: Final Report, February 2011

Implementation: The successful application of UHPC will further advance development of cost-effective use for implementation by all jurisdictions within Iowa as ultimately costs are reduced through:

- Taking advantage of a higher strength material
- Taking advantage of a material with almost zero permeability which could essentially eliminate deterioration of bridge decks
- The optimization, validation, and acceptance of the proposed girder cross section represent a significant step in more widespread adoption

Benefits associated with this work will be a reduction in costs associated with bridge construction and, more significantly, in costs associated with bridge maintenance. Further advances with UHPC may yield bridge designs in which the deck and superstructure last for the same duration, thus eliminating the need for intermittent and costly deck replacement. These benefits will be easily quantified at that time by a significant reduction in life-cycle costs associated with bridge ownership.

TR-579

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark

Research Period:
November 1, 2007 –
December 31, 2011

Research Board Funding:
\$80,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Low Cost Strategies to Reduce Speed and Crashes on Curves

Objective: Evaluate the effectiveness of dynamic speed feedback signs and other low-cost strategies to reduce speeds and crashes on curves. Research results will provide traffic safety and county engineers and other professionals with additional tools to more effectively manage speeds and decrease crashes on horizontal curves on rural roadways.

Progress: 24-month data have been collected and reduced for all speed feedback signs. Before and after crash data were extracted for the curves where speed feedback signs were located. Low-cost reflective treatments were placed on IA 141 which was the last location to receive treatments. Data have been collected on schedule for the other sites. Lateral position and speed data have been collected.

Reports: None

Implementation: Iowa counties will benefit from this research (among others) by obtaining another tool for improving safety on rural curves. A number of treatments have been used but their effectiveness is not known. Additionally, use of the project as matching funds to the FHWA project allows us to leverage federal funding to evaluate treatments in Iowa and to be able to compare those results to other sites nationally.



Two strategies being evaluated in this research:

A dynamic sign triggered by speeds above a safe threshold.



A static, painted warning sign.



TR-580

Agency:

Iowa State University

Principal Investigator:

Omar Smadi

Research Period:

January 1, 2008 –
July 30, 2010

Research Board Funding:

\$96,113

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Pavement Markings and Safety

Objective: Use Iowa DOT data under nighttime conditions to achieve the following:

- Capitalize on current research efforts and develop a systematic method to compare pavement marking and crash data for a given roadway segment
- Investigate the impact that varying levels of pavement marking retroreflectivity have on crash performance
- Use findings to develop strategies for agencies in determining the level of investment needed for pavement markings

Reports: Final Report, December 2010

Implementation: This research will assist technical and non-technical staff in assessing pavement marking needs and the impact on safety. These results will be incorporated into the ongoing efforts of the Iowa DOT Pavement Marking Task Force, and will also benefit the Iowa Highway Research Board Local Agency Pavement Marking Plan research efforts and technology outreach.



A pavement marking test deck in Dallas County, evaluating experimental centerline markings placed within a groove.

Photo: Neal Hawkins, Iowa State University/CCEE

TR-581

Agency:

Iowa State University

Principal**Investigator:**

John Verkade &
Peter Taylor

Research Period:

November 15, 2007 –
February 14, 2010

**Research Board
Funding:**

\$100,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of an Improved Agricultural-Based Deicing Product

Objective: Seek agricultural based products suitable for use as deicing materials that are suitably cost effective, environmentally acceptable and technically functional.

Reports: A draft final report has been submitted and is currently being reviewed.

Implementation: If a suitable compound can be found the Iowa DOT will be able to reduce costs associated with deicing and ant-icing, either by the use of a cheaper material, more efficient use of materials, reduced maintenance costs, reduced environmental impact, or some combination of these benefits.

TR-582

Agency:

Iowa State University

Principal**Investigator:**

Halil Ceylan

Research Period:

March 1, 2008 –
April 30, 2010

**Research Board
Funding:**

\$50,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Ethanol By-Product Geo-Material Stabilization

Objective: Investigate the utilization of processed corn stover or corn grain fermentation by-product in pavement base/subbase soil stabilization. Specifically:

- Demonstrates the ability of lignin as an effective soil stabilizing agent for lignins that are currently available or are anticipated to become available in the future in abundant supply.
- Evaluates the effect of lignin on the engineering properties of soil-lignin mixtures for Iowa conditions. It is anticipated that this research will lead to extended and rigorous evaluation of this concept both in the lab and in terms of field performance.

Reports: Final Report, April 2010

Implementation: The usefulness of industrial lignins has been demonstrated by profitability of the lignin chemicals industry operated worldwide. Lignin is also a by-product of ethanol plant production. With the increase in soy/corn based ethanol plant production, new uses of lignin are being developed to provide additional revenue streams to improve the economics of the biorefineries.

Modified lignins have already been successfully used as concrete admixtures and as dust suppressants in unpaved roads. Currently, they are being evaluated as anti-oxidants in asphalt. Considering the wide range of pavement-related applications in which agricultural derived lignin could be used, this research could result in substantial economic savings for Iowa.

TR-583

Agency:

Iowa State University

Principal Investigator:

Sri Sritharan

Research Period:

January 1, 2008 –
February 28, 2011

Research Board Funding:

\$380,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Field Testing of Piles and Development of a Wave Equation Method for Pile Design in Iowa

Objective:

- Install and load test piles in the field
- Collect complete data including driving data
- Improve design of piles in accordance with LRFD specifications
- Develop a suitable dynamic analysis method for pile design
- Disseminate research outcomes to bridge designers in Iowa and elsewhere

Reports: Final Report, September 2011.

Implementation: The project team will organize and deliver a training course to supplement the Final Report and expedite implementation of project results into actual design and field practice. Designed for engineers in the office of Bridges and Structures, Soils Design Section, and the Construction Office at the Iowa DOT, the course will be delivered over a period of one to three days and clearly emphasize the importance of collaboration between structural, geotechnical, and construction engineers.

Other interested participants from county and city transportation agencies will also be invited. Depending on need, FHWA experts on LRFD may contribute to the course by providing an overall perspective on the implementation of project outcomes based on their experience with other bridge design agencies.

TR-584

Agency:

Iowa State University

Principal Investigator:

Sri Sritharan

Research Period:

January 1, 2008 –
August 31, 2010

Research Board Funding:

\$70,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Establishing a Dynamic Formula for Pile Design and Construction Control of Pile Driving

Objective: Consistent with LRFD specifications, develop dynamic formulas to design piles and control their installation in the field, focusing on methods suitable for Iowa soil conditions.

Progress: The draft final report is complete and training materials are currently being developed for submittal in February 2012.

Reports: None

Implementation: A training course to supplement the Final Report and expedite implementation of results into design and practice in the field will be developed. Designed for engineers at the Iowa DOT, the course will be delivered over a period of one to three days and clearly emphasize the importance of collaboration between structural, geotechnical, and construction engineers.

Other interested participants from county and city transportation agencies will also be invited. The training course will largely be delivered by the project team members. Depending on need, FHWA experts on LRFD may contribute to the course by providing an overall perspective on the implementation of project outcomes based on their experience with other bridge design agencies.

TR-589

Agency:
National Weather
Service

**Principal
Investigator:**
National Weather
Service

Research Period:
April 1, 2008 –
September 30, 2012

**Research Board
Funding:**
\$137,937

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Updating U.S. Precipitation Frequency Estimates for the Midwestern Region

Objective: Determine annual exceedance probabilities and average recurrence intervals for rainfall durations ranging from five minutes to 60 days and frequencies from 1-500 years. The study results will be a web based publication.

Progress: HDSC completed screening all 15-minute, 1-hour and 1-day stations for (1) duplicate records from different data sources, (2) duplicate records at co-located daily, hourly, and/or 15-minute stations, (3) extending records using data from co-located stations, (4) merging records of nearby stations, and (5) removing shorter, less reliable records in station dense areas. This was a significant accomplishment, since, for instance, 5,792 1-day stations required review. A total of 1,553 pairs of stations were merged or extended during this process.

Reports: None

Implementation: The National Weather Service (NWS) rainfall maps have not been updated for approximately 50 years. This means that the designs of storm sewers, culverts, dams, detention basins, etc. have been performed by engineers using outdated data. This project is part of a national effort to update the rainfall/frequency relationships for the entire United States.

Contour maps and high resolution grids will be available for each combination of rainfall frequency and duration. Charts of seasonal distribution of annual rainfall will be developed and documented.



Implementing updated precipitation frequency estimates as a design tool for future projects will help engineers design bridges, culverts, detention basins, storm sewers and other transportation projects more efficiently.

Photo: NOAA

TR-591

Agency:

Iowa State University

Principal**Investigator:**

Charles Jahren

Research Period:

April 1, 2008 –
September 30, 2010

**Research Board
Funding:**

\$91,638

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Stabilization Procedures to Mitigate Edge Rutting for Granular Shoulders – Phase II

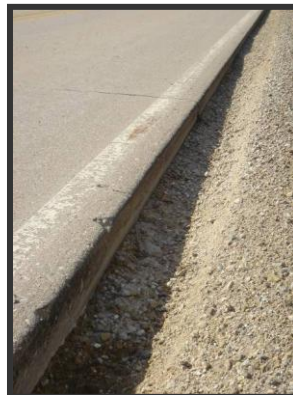
Objective:

- Determine the relative importance of localized, chronic edge rut issues compared to longer reaches of roadway with more general shoulder edge rut maintenance issues.
- Develop strategies for mitigating edge rut problems using various mixtures and gradations of granular materials and stabilization agents.
- Rate the performance of a subset of the above mentioned strategies.
- Recommend strategies based on the results of test section performance, cost and likely future maintenance procedures.
- Assist the Iowa DOT in implementing use of the recommended strategies.

Reports: Final Report, February 2011

Implementation: Results of this study are intended to allow maintenance personnel to improve the performance of granular shoulders with regard to edge ruts with the existing complement of maintenance personnel. If methods can be devised to lessen the number of times that crews must be redirected in order to address acute edge rut problems in localized chronic areas, greater overall maintenance efficiency will be achieved.

It is anticipated that the results of this project will reduce life cycle costs for granular shoulders, increase safety, and improve the procedures currently in use to maintain granular shoulders in Iowa.



An example of granular shoulder edge rutting
Photo: Dr. David White, Iowa State University/InTrans

TR-593

Agency:
Iowa State University

Principal Investigator:
Nadia Gkritza

Research Period:
August 15, 2008 –
April 30, 2010

Research Board Funding:
\$120,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Infrastructure Impacts on Iowa's Changing Economy

Objective: Develop traffic and fiscal assessment tools to understand the impacts of biofuels and wind industries on Iowa's highway transport infrastructure, particularly the secondary road system. Also, to document the current physical and fiscal impacts of Iowa's existing bio-fuels and wind industries; Assess the likely physical and fiscal impacts (and infrastructure needs) of further development of biofuels and wind power industries in Iowa in the next 15-20 years using a multi-county, case study approach; and quantify and visualize the impacts to the extent possible.

Reports: Final Report, April 2010

Implementation: Develop a set of public policy recommendations to support the biofuels and wind industries in Iowa during the next 15-20 years and a Road Map for technology transfer for this issue.



A typical wind turbine blade transport vehicle, often seen traveling on Iowa roads

Photo: Iowa Energy Center

TR-594

Agency:

Iowa State University

Principal**Investigator:**

Chris Williams

Research Period:

August 15, 2008 –
May 31, 2010

**Research Board
Funding:**

\$75,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of Non-Petroleum Based Binders for Use in Flexible Pavements

Objective: Optimize a bio-oil product (production and post-production) for use as a non-petroleum binder. Various bio-oils will be produced and pyrolytic lignins derived for modifying asphalt binders. Liter quantities of bio-oil from five different sources will be obtained and analyzed for their properties such as acidity, char content, and stability.

Reports: Final Report, October 2010

Implementation: The benefits of this research are potentially very substantial. A lower cost binder that performs as well as asphalt binders currently used could be developed.

Further, the bio binder will likely lower hot mix asphalt plant production temperatures, thus reducing plant emissions. Lastly, the bio binder represents the development of renewable green materials/technology, reducing reliance on crude oil.

TR-597

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
August 1, 2008 –
July 31, 2011

Research Board Funding:
\$125,000

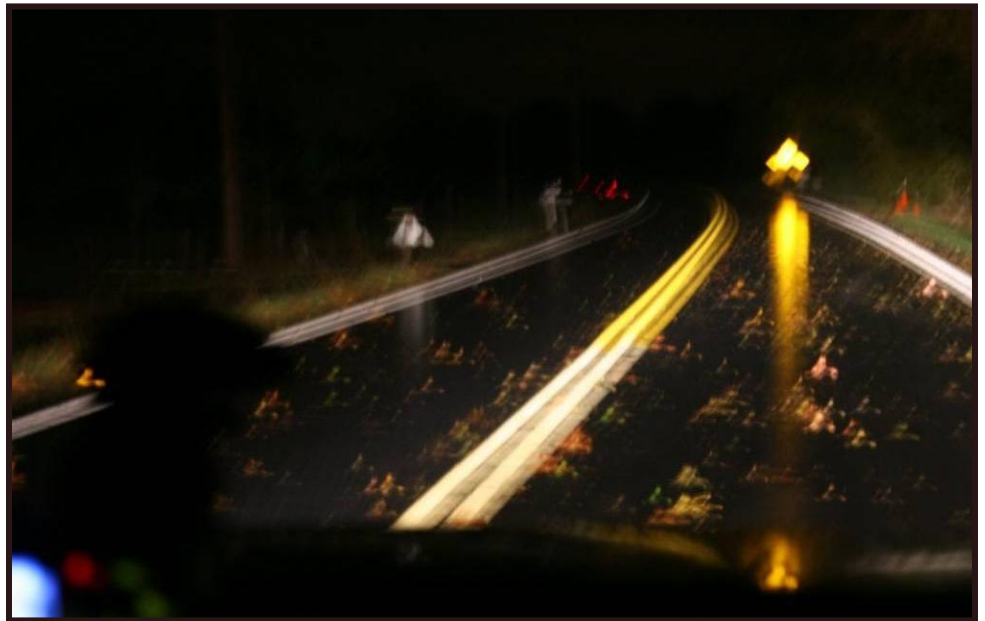
Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Wet Reflective Pavement Marking Demonstration Project

Objective: Develop a two year line-test deck allowing the evaluation and demonstration of a variety of wet reflective pavement marking materials and treatments under wet night conditions.

Reports: Final Report, December 2011

Implementation: Documenting the performance of these various products and treatments will assist the Iowa DOT and local agencies in determining when and where their use might be most effective. Performance parameters will include durability, presence, retro-reflectivity, and wet night visibility.



Wet, dark conditions present special challenges to drivers, such as color variations (shown here between two different centerline pavement marking products used on a rural two-lane roadway). In dry conditions, both products are yellow. However, under wet conditions the nearer product appears white in color (like edge line markings) which is an obvious safety concern.

Photo: Neal Hawkins, Iowa State University/InTrans

TR-598

Agency:
Iowa State University

Principal Investigator:
Charles Jahren

Research Period:
December 1, 2008 –
September 30, 2010

Research Board Funding:
\$60,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of Updated Specifications for Roadway Rehabilitation Techniques

Objective: Create recommendations to improve the SUDAS and Iowa DOT standard specifications, incorporating results of recent research on seal coat, slurry seal, micro-surfacing, and fog sealing; To assess cold in-place recycling and stabilization in the SUDAS manuals and based on input, recommend appropriate additions for cold in-place recycling and modifications to the sections on stabilization.

Reports: Final Report, May 2011

Implementation: The research findings will be reported as Draft and Final documents for inclusion in the SUDAS Standard Specifications, the SUDAS Design Manual, the Iowa DOT Standard Specifications, the Iowa DOT Materials Instructional Memoranda, and other similar documents.

It is expected that the results of this research can be fully implemented within current SUDAS and Iowa DOT staffing, budgets, and procedures.



A chip spreader applies cover aggregate during a seal coat or "chip seal" operation on 74th Street in Cedar Rapids, Iowa, during a road maintenance effort

Photo: Dr. Charles Jahren, Iowa State University/CCEE

TR-599

Agency:

Iowa State University

Principal**Investigator:**

Chris Williams

Research Period:

January 26, 2009 –
December 31, 2010

**Research Board
Funding:**

\$124,997

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Investigation of Warm Mix Asphalt Using Iowa Aggregates

Objective: Identify technologies for producing Warm Mix Asphalt (WMA) and recommend up to three with the greatest potential for success using Iowa aggregates:

- Develop and test selected WMAs in the laboratory for performance (permanent deformation, fatigue and moisture susceptibility), aging characteristics, and laboratory compaction effort
- Document a Draft set of procedures for field implementation
- Construct and monitor field trials and laboratory performance testing
- Compare performance of field produced mixtures with laboratory produced mixtures and standard HMA control mixtures

Reports: Final Report, April 2011

Implementation: This project will provide guidance on the implementation of WMA technology in Iowa. The research team will assist in implementing WMA technology beyond obligations of this research, including evaluation and integration of WMA technology into Iowa.

An additional phase for this project will likely be needed to address the developing technical issues, namely how to integrate warm mix asphalt into Iowa DOT QC/QA specifications.

TR-600

Agency:
Iowa State University

Principal Investigator:
Paul Wiegand

Research Period:
November 3, 2008 –
September 30, 2010

Research Board Funding:
\$250,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Improving Concrete Overlay Construction

Objective: Reduce quantity overrun concerns using project GPS mapping and reduce construction survey time. Evaluate GPS and 3-D construction equipment control (milling machine, slipform paver, cure cart) and develop ways to establish the profile grades and machine control before or immediately after the contract letting by the highway agency so construction is not impacted.

Reports: Final Report, June 2010

Implementation: Findings of the project provide guidance on the implementation of WMA technology in Iowa. The research team continues to assist in WMA technology implementation beyond the obligations of this research.



On County Road V-18 in Poweshiek County, a six-inch concrete overlay is constructed without the use of strings to control the paver. A fabric bond breaker between the new overlay and underlying pavement was used instead of the usual asphalt layer.

Photo: Paul Wiegand, Iowa State University/InTrans

TR-601

Agency:

Iowa State University

Principal Investigator:

Omar Smadi

Research Period:

January 1, 2009 –
September 30, 2011

Research Board Funding:

\$100,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Roadway Lighting and Safety: PHASE II – Monitoring, Quality, Durability and Efficiency

Objective: Address the quality of lighting rather than just the presence of light with respect to safety. ISU staff are teamed with Virginia Tech Transportation Institute (VTTI) through funding from the National Safety Center. VTTI will replicate Phase I, develop roadway illumination monitoring equipment, and work with ISU to complete objectives to analyze data and establish a relationship between crash performance and illumination at rural, unsignalized intersections. Recommendations to address lighting design and maintenance will be developed.

Reports: Final Report, December 2011

Implementation: Findings can be incorporated into Chapter 11 of the SUDAS Roadway Lighting Design Manual and will be included in the SUDAS manuals. Presentations will be given at the County Engineer Conference, ASCE Transportation Conference, APWA conference, and through a variety of other professional, municipal, and national group presentations.



Intersection infrastructure and geometry influence lighting levels and corresponding crash rates. Safety recommendations will be established based specifically on lighting levels and related crash data.

*Photo: Dr. Omar Smadi,
Iowa State University/
InTrans*

TR-604

Agency:
Iowa State University

Principal Investigator:
Travis Hosteng

Research Period:
November 15, 2008 –
December 31, 2011

Research Board Funding:
\$88,336

Funding Source:
100 % State -
100 % Secondary
funds

Field Testing and Evaluation of a Demonstration Timber Bridge

Objective: Perform field testing and evaluation of a glued-laminated timber girder bridge with transverse deck panels and an asphalt wearing surface to assess overall design, construction, and bridge and wearing surface performance. Monitoring systems will be designed and installed on the demonstration field timber bridge to collect overall bridge construction and in-service performance over a period of approximately two years.

Evaluation of performance will be formulated through comparisons with design assumptions, previous research, and existing bridge performance records. The research will be performed through a cooperative effort of researchers at ISU, the United States Department of Agriculture (USDA) Forest Products Laboratory (FPL) and Delaware County Engineering staff.

Progress: The project team has completed all testing and is currently drafting the final report.

Reports: None

Implementation: The successful development and implantation of deck panel joint details for transverse glued-laminated decks will be useful nationwide for management of timber bridges with asphalt wearing surfaces. The systems may be incorporated into typical standard bridge plans and utilized nationwide for bridge projects.



A demonstration timber bridge was completed in the spring of 2009 in Delaware County, Iowa. It features an innovative deck treatment system.

Photo: Iowa State University/InTrans, Bridge Engineering Center

TR-605

Agency:
Iowa State University

Principal Investigator:
Terry Wipf

Research Period:
November 15, 2008 –
December 31, 2011

Research Board Funding:
\$70,044

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Evaluation of the Buena Vista IBRD Bridge: A Furthering of Accelerated Bridge Construction in Iowa

Objective:

- Assist the Iowa DOT and Iowa County Engineers to fully leverage FHWA Innovative Bridge Research Construction Program funding
- Demonstrate benefits of precast post-tensioned bridge components
- Perform testing and evaluation of precast components for the bridge project in Buena Vista County and assess design, construction, and structural performance
- Design and install monitoring systems and perform structural tests over approximately two years
- Formulate evaluation of performance through comparisons with design assumptions, recognized codes and standards

Progress: Testing is complete and the final report is currently being written.

Reports: None

Implementation: The development of precast (and in some cases post-tensioned) bridge components offers the potential to significantly reduce traffic delays and inconvenience to the travelling public, improve safety during construction, resulting in more durable bridges, particularly for low volume roads.



Beam placement during accelerated construction of Buena Vista IBRD bridge
Photo: Dr. F. Wayne Klaiber, Iowa State University/CCEE

TR-606

Agency:

Iowa State University

Principal Investigator:

Duane Smith

Research Period:

February 21, 2009 –
February 29, 2011

Research Board Funding:

\$125,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Iowa Leadership Institute

Objective: The Iowa LTAP, in conjunction with Iowa's public agency representatives, continues developing a training program to create better (or new) leaders and supervisors for Iowa's public agencies. Modules are offered for a fee to support future development and administration of the Academy through the Iowa LTAP. The curriculum and course content for ten core modules includes:

- Supervisory Techniques
- Effective Communication
- Community Service Skills
- Resource Management Skills
- Fundamentals of Government
- Basic Management Skills
- Leadership Skills
- Legal Understanding
- Finance
- Operations and Maintenance

Tasks: Coordinate Planning and Development Activities; Develop Academy Identity or Theme (Branding); Establish A Marketing Plan; Sequence and Schedule Academy Development; Create Module Content; Present Academy Modules; Integrate the Academy into Conferences and Workshops; Identify Measures of Success and Suggest Peer Exchange Format.

Reports: Final Report, September 2011

Implementation: The modules are accessible to anyone with an internet connection at www.ctre.iastate.edu/LTAP. Publicity about the program is being handled through the LTAP program.



Leadership Academy Program Coordinator Bob Sperry records an instructional video with Marion County Engineer Roger Schletzbaum and Lorri Jahner, Marion Deputy County Auditor.
Photo: Iowa State University

TR-607

Agency:
Snyder and
Associates

**Principal
Investigator:**
Steve Klocke

Research Period:
March 9, 2009 –
December 31, 2010

**Research Board
Funding:**
\$111,455

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Review of Inconsistencies Between SUDAS and Iowa DOT Specifications – PHASE III

Objective: Revise sections of SUDAS specifications consistent with the format utilized during the Phase II project and other work completed by SUDAS staff. Sections to be revised:

- **Division 7:** Streets and Related Work
Specifications for Section 7040, Pavement Repair and Rehabilitation specifications
- **Division 9:** Site Work and Landscaping
Specifications for Sections 9020, Sodding; 9030, Plant Material and Planting; 9050, Gabions and Rip Rap; 9060, Fencing; 9070, Retaining Walls; and 9080, Concrete Steps and Handrails
- **Standard Drawings:** SUDAS figures for sections 7010, PCC Pavement; 7020, Hot Mix Asphalt; 7040, Pavement Repair and Rehabilitation; 9030, Plant Material and Planting; 9050, Gabions and Rip Rap; 9060, Fencing; 9070, Retaining Walls; and 9080, Concrete Steps and Handrail

Reports: Final Report, December 2010

Implementation: Revised specifications and figures developed as part of this project will be adopted by SUDAS for inclusion in the SUDAS Specification manual and utilized by agencies and contractors across the State of Iowa. In addition, the Iowa DOT may adopt any portion of the revised specifications.

TR-608

Agency:

Iowa County
Engineer Association
Service Bureau

Principal Investigator:

Steve DeVries

Research Period:

August 1, 2009 –
December 31, 2011

Research Board Funding:

\$154,316

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Assessment of Iowa County Roadway Financing Needs

Objective: Develop a conceptual model to facilitate accurate forecasting simple enough for presentation to the public, also:

- After the conceptual model is defined, physical and financial data will be gathered from public and private sectors and reviewed to identify and quantify interrelationships between the road network, vehicles that operate on it, and land parcels that adjoin it.
- Define a data structure and processing engine that represent road, traffic and land use entities' relationships and affects on each other.

Progress: Computation code has been reviewed and double-checked, so as to be ready to process in FY11 County Engineer Annual Report data as soon as it has been reviewed by the DOT. It is expected to quickly move on to completion of the dynamic modeling part of the project as soon as the new fiscal year is merged.

Reports: None

Implementation: The model will assist agencies with estimating the cost of a service level, find what service level fits a particular revenue stream, and project what improvements are needed to meet traffic levels. It will also facilitate study and discussion of tradeoffs between road costs, vehicle costs and land use costs, and identify the value of commerce supported by secondary roads.

TR-609

Agency:

The University of Iowa

Principal Investigator:

Hosin "David" Lee

Research Period:

July 16, 2009 –
December 31, 2011

Research Board Funding:

\$104,140

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Curing Criteria for Cold In-Place Recycling – PHASE III

Objective: The Objectives of this project are to:

- Measure moisture contents and temperature throughout a CIR layer at six CIR project sites
- Calibrate developed moisture loss indices using field measurements from six CIR project sites
- Develop stiffness/density gain model to supplement (or possibly replace) the moisture criteria

The moisture loss indices will provide data when rationalizing how the quality of CIR layer is inspected for optimum timing of an HMA overlay, and significantly enhance the long-term performance of CIR pavements. In addition, the stiffness of CIR layer measured by the Geo-gage can be used to supplement (or possibly replace) the moisture measurement during a curing period.

Progress: Moisture and stiffness data collection from the additional CIR-foam project sites were completed and they are currently being analyzed to develop a moisture loss index and stiffness gain model.

Reports: None

Implementation: This research will provide a moisture loss index and/or a stiffness/density gain model to monitor the CIR layer for a timely placement of the wearing surface. A set of curing indices and/or a stiffness/density gain model that can determine an optimum timing of an overlay are expected.



Curing process on Iowa county road before overlay

Photo: Dr. Hosin "David" Lee, IIHR, The University of Iowa

TR-610

Agency:

The University of
Iowa

**Principal
Investigator:**

Salam Rahmatalla

Research Period:

August 1, 2009 –
July 31, 2010

**Research Board
Funding:**

\$69,092

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

On-the-Spot Damage Detection Methodology for Highway Bridges during Natural Crises

Objective: Develop and assess effectiveness of an experimental approach to a damage-detection methodology that can be applied to highway bridges in Iowa during natural disasters such as flooding and assist bridge inspectors in assessments. The research will:

- Verify and validate the proposed methodology using structural models in the lab
- Apply the methodology on one of Iowa highway bridges in rural areas, such as Iowa Highway 22
- Visually validate the finding

Reports: Final Report, July 2010

Implementation: This research provides a proof-of-concept report supplemented with a Matlab vibration analysis module based on test results to analyze the effectiveness of experimental damage detection methodologies for bridges during natural crises.



On-the Spot damage detection field testing on County IA-1, South of Iowa City, Iowa, near Gingerich Road

Photo: Dr. Salam Rahmatalla, The University of Iowa

TR-611

Agency:

The University of
Northern Iowa

**Principal
Investigator:**

M.D. Salam

Research Period:

August 1, 2009 –
October 31, 2010

**Research Board
Funding:**

\$74,842

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

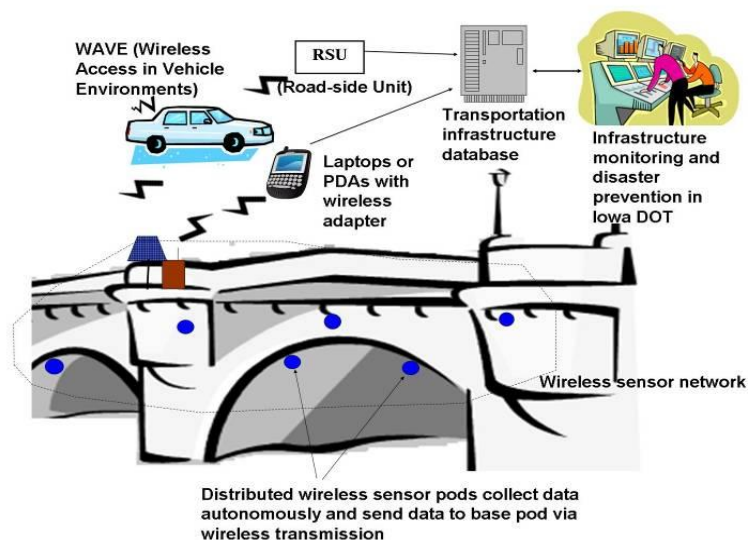
Wireless Sensor Networks for Infrastructure Monitoring

Objective: Evaluate the use of distributed wireless sensor networks instead of PC-based systems for transportation infrastructure monitoring, specifically:

- Establish a list of physical quantities to be monitored and their requirements from the practical, technical and financial aspects
- Investigate sensor and data acquisition technologies salient to these quantities and select likely technologies for field implementation
- Establish the characteristics of mobile computers and wireless communication adapters
- Test available technologies and select the best fit
- Deploy a prototype test-bed unit in the field
- Acquire data under a variety of climatological conditions
- Investigate the feasibility of integrating existing infrastructure monitoring system into the Intelligent Transportation System using WAVE interfaces
- Evaluate the suitability and scalability of these technologies for practical deployment in other bridges and further investigation based on data and observation analysis and direct testing by Iowa transportation professionals

Reports: Final Report, December 2010

Implementation: This project will lead to a working design for application in Iowa. For testing, this project will adopt the technologies most recently commercially available.



Graphic: Dr. M.D. Salim, University of Northern Iowa/IT

TR-613

Agency:
Iowa State University

Principal Investigator:
Terry J. Wipf

Research Period:
January 25, 2010 –
June 30, 2011

Research Board Funding:
\$153,590

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Study of the Impacts of Implements of Husbandry on Iowa Bridges

Objective: The objective of this study is to determine how the implements of husbandry distribute their load within a bridge structural system and to provide recommendations for accurately analyzing bridges for their loading effects. To achieve this objective the distribution of live load and dynamic impact effects for different types of agricultural vehicles will be determined by load testing and evaluating two general types of bridges. The types of equipment studied will include but is not limited to; grain wagons/grain carts, manure tank wagons, agriculture fertilizer applicators, and tractors. Once the effect of these vehicles has been determined, recommendations for the analysis of bridges for these non-traditional vehicles will be developed.

Progress: Bridge load testing is complete for the Iowa bridges. The project team is currently analyzing the vast amounts of data.

Reports: None

Implementation: Engineers involved in the rating/evaluation of bridges for live load performance of bridges will be able to immediately be able to use the resulting information as the results will be given in a format commonly used by practicing engineers. The results of this study will most likely supplement existing standards by providing information/guidance not previously available.

TR-614

Agency:
Iowa State University

Principal Investigator:
Sri Sritharan

Research Period:
November 20, 2009 –
December 31, 2011

Research Board Funding:
\$50,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Structural Characterization of a UHPC Waffle Bridge Deck and its Connections

Objective: The objectives of this proposed research is to perform structural characterization of the UHPC waffle bridge deck panel designed for the bridge in Wapello County and its critical connections, and evaluate the system performance and ride ability of the panel top surface.

Progress: The project team has developed a detailed finite element model (FEM) in ABAQUS, built full-scale test unit consisting of two waffle deck panels and UHPC infill joints and completed all tests outlined in the proposal. These tests included service load testing; fatigue testing consisted of more one million load cycles and ultimate load test on the joint between panels and on the center of a panel. The test results, which agreed with the finite element results, confirmed the designed UHPC panels can be used for field applications. Additionally, ultimate limit state tests and a punching failure test have been completed. Production of UHPC panels for the field implementation is complete and the construction of the bridge was completed in Fall 2011.

Reports: None

Implementation: The research findings of the project will be disseminated to designers and practitioners in the fields of structural and construction engineering.

TR-615

Agency:
Iowa State University

Principal Investigator:
Sri Sritharan

Research Period:
December 17, 2009 –
May 31, 2012

Research Board Funding:
\$210,000

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Connection Details and Field Implementation of UHPC Piles - Phase II: Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications

Objective: The objectives chosen for the next phase of the project are to:
1) establish and test connection details to extend the length of UHPC piles in the field; 2) develop and test suitable details that can be used to connect the UHPC pile to concrete pile cap as well as to bridge abutment; 3) study a UHPC pile behavior as part of a bridge foundation in the field and compare its behavior to that of a steel H pile, and 4) develop a preliminary geotechnical design methodology.

Progress: A summary of the project progress is as follows: 1) Finalized the DOT drawings of the Test-Setup and of the production piles that will be monitored; 2) Completed a tension test on the proposed splice detail; 3) Completed a bending test on the proposed splice detail; 4) Completed a shear test on the proposed splice detail; 5) Calculated the amount of displacement in the lab needed to correspond to 1.0 inches of lateral displacement and 1.55 inches of lateral displacement; 6) Completed the pile-to-abutment connection test for the HP 10 x 57 test pile; 7) Devised an instrumentation plan for field testing and purchased the required instruments; 8) A SPT test was performed at the location of the test piles at the Sac County bridge site; 9) A CPT test was performed at the location of the test piles as well as at the west abutment of the westbound bridge; and 10) Completed the pile-to-abutment connection test for the UHPC test pile.

Reports: None

Implementation: This research will contribute to establishing a cost-effective, durable pile for bridge infrastructure. The proposed laboratory tests will allow UHPC piles to be effectively extended without causing any construction delays, while the connection tests will establish details for anchoring the pile into pile caps and abutments, which may also be used for steel piles. The planned field tests will not only confirm the expected behavior of the UHPC piles under real-world loading conditions, but will also create unique data that will enable preliminary evaluations to be completed on LRFD design of UHPC piles, examination of the effects of setup and understanding the potential benefits of construction control for this pile type.

TR-616

Agency:

Iowa State University

Principal Investigator:

Brent Phares

Research Period:

August 7, 2010 –
January 31, 2012

Research Board Funding:

\$150,846

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Timber Abutment Piling and Back Wall Rehabilitation and Repair

Objective: The objectives of this investigation are to:

- review existing products for timber preservation and repair and to document their effectiveness in extending the life expectancy of various bridge components.
- determine techniques used by county engineers and other engineers to repair and restore load carrying capacity of piling damaged by deterioration and cracking.
- review methods used to repair failed piling.
- determine/develop effective methods for transferring bridge loads through the failed portion of the pile.
- determine that safe load capacity is restored by the repair methods (existing or new) determined to be structurally efficient.

Progress: Flooding issues at the bridge sites has delayed progress, but significant effort was expended to catch up and proceed with testing in fall 2011.

Reports: None

Implementation: The identification of effective existing systems and new systems for the strengthening/rehabilitating timber substructure elements offers significant benefits to the State of Iowa. Close to 25% of the bridges on LVRs are structurally deficient. Many of these have sound superstructure elements and deficient timber substructure elements. By rehabilitating or strengthening the deficient timber substructure elements, one creates a significant cost savings by extending the life of the bridge.

TR-617

Agency:

The University of
Iowa

**Principal
Investigator:**

Thanos Papanicolaou

Research Period:

June 1, 2010 –
May 31, 2012

**Research Board
Funding:**

\$170,866

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

An Adaptive Field Detection Method for Bridge Scour Monitoring Using Motion-Sensing Radio Transponders (RFIDs)

Objective: The objective is to utilize Motion-Sensing Radio

Transponders (RFIDS) on fully adaptive bridge monitoring and residual life prediction to minimize the problems inherent in human inspections of bridges. This will include an integrated condition-based maintenance (CBM) framework integrating RFID sensors and sensing architecture, for in-situ scour monitoring of critically scoured bridge structures. This will provide real-time state awareness datasets that can be used in making decisions on down time, repair cost, and functionality.

Progress: The project is continuing on pace. The PI held a conference call with the TAC on October 18, 2011 to discuss the progress of the study. Key results to date were discussed which included development of the automated RFID bridge scour monitoring system, the user friendly software to monitor the RFID tags, and development of the calibration curves for interpretation of the RFID signals. Movies were provided highlighting the RFID system.

Reports: None

Implementation: The need for maintenance personnel to be present at a bridge site could be removed by automating the collection and transmission of scour data, thereby making the scour-monitoring process safer and more efficient. An RFID system fitted with data telemetry equipment can provide the ability to collect and transmit data to a maintenance office. Remote monitoring could mitigate the inefficiencies and dangers inherent in the current practices, as well as provide early warning of impending bridge failure and the ability to track long-term degradation as a result of scouring.

Additional benefits of remote monitoring include the potential reduction in the labor required to perform monitoring, and the acquisition of real-time data for calibrating scour prediction equations and enhancing the state of knowledge about the scour-monitoring process.

TR-618

Agency:

Shuck Britson

Principal Investigator:

Steve Kunz

Research Period:

August 1, 2010 –
December 31, 2010

Research Board Funding:

\$130,248

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Parallel Wing Headwalls for Single RCBs (LRFD)

Objective: The objective of this proposal is to the develop LRFD English standards for parallel wing headwalls for single box reinforced cast-in-place concrete box culverts.

Reports: Final Standards have been delivered to the Iowa DOT Office of Bridges and Structures and are undergoing final approval.

TR-619

Agency:

The University of
Iowa

**Principal
Investigator:**

Marian Muste

Research Period:

April 1, 2010 –
January 31, 2012

**Research Board
Funding:**

\$107,529

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of Self-Cleaning Box Culvert Design - Phase II

Objective: The overall objective of this project is to identify and/or develop methods for constructing, or retro-fitting, box culverts so that the typical flow through a culvert will clean the culvert's entrance area and the barrels and keep the structure performing well with little or no maintenance. The new phase of the study will include, but not be limited to, preparing the implementation phase for the self-cleaning design at selected sites in Iowa and continue the multi-prong research on self-cleaning designs for other types of culverts, besides the 3-box culvert investigated in TR 545.

Progress: Modeling of the culvert end treatment is complete. A demonstration site has been identified and the site has been cleaned for monitoring. Initial monitoring has taken place. Funding for constructing the demonstration retrofit is currently being sought by the Iowa DOT.

Reports: None

Implementation: The primary products of the project would be a practical report that provides design layouts and guidance for self-cleansing methods for use for new culverts and for retrofitting to existing culverts known to have a sedimentation problem. The report prepared will be formatted in a comprehensive and well-illustrated manner that directly helps engineers to select the self-cleansing method best suited for a culvert site.

TR-620

Agency:

Foth Infrastructure

Research Period:

July 26, 2010 –
August 31, 2011

**Research Board
Funding:**

\$398,032

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Update of RCB Culvert Standards to LRFD Specifications

Objective: The objectives of the project involve developing software that will design the RCB culvert barrel sections. Using the software, the consultant will design and develop RCB culvert standards to LRFD specifications for single, twin and triple box culverts.

Progress: Barrel Standards are complete and have been submitted to the Iowa DOT Office of Bridges and Structures for approval. Headwall standards are currently being designed and detailed. Additional funding has been approved for the addition of a rating component to be added to the design software.

Reports: None

TR-621

Agency:

Iowa State University

Principal Investigator:

David White

Research Period:

July 9, 2010 –
December 31, 2011

Research Board Funding:

\$81,500

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Geo-synthetic Reinforced Soil for Low Volume Bridge Abutments

Objective: The objectives of this project are to:

1. Develop an instrumentation and monitoring plan to evaluate performance of newly constructed GRS bridge abutment systems.
2. Develop a design approach and construction guidelines for GRS bridge abutment systems with shallow spread footings on LVR bridges.
3. Document and evaluate the cost and construction aspects associated with construction of GRS bridge abutment systems from detailed field observations on project sites.
4. Produce a research report and technology transfer materials that provide recommendations for use and potential limitations of GRS bridge abutment systems.

Progress: Field instrumentation data from the on-site data logger is being periodically downloaded at the office by the research team. A field visit was conducted on September 9, 2011 to monitor bridge elevations. An error occurred on the data logger during mid August and data was lost for a short period of time (about 25 days). This error was addressed during the September 9th visit and the data logger is now working again. Another site visit is being planned to conduct load test during early next quarter.

Significant progress has been made on data analysis during this quarter. Earth pressure cell and piezometer data have been plotted. Laboratory tests to determine shear strength properties of the GRS fill material are being conducted.

Research team will focus on completing the remaining laboratory tests and finish data analysis and the final report during the next quarter.

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations for use of sheet pile abutments in LVRs and in-situ soil testing. County engineers can implement the recommendations for use of an alternative abutment system.

TR-622

Agency:

Wiss, Janey, Elstner
and Associates

**Principal
Investigator:**

Wade Clarke

Research Period:

August 1, 2010 –
July 31, 2012

**Research Board
Funding:**

\$123,426

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Maintenance and Design of Steel Abutment Piles in Iowa Bridges

Objective: The desired outcome of this research will yield

1. Methods for addressing the problem of pile corrosion in existing bridges, and
2. A cost effective design methodology to prevent steel pile corrosion from occurring in new bridges in the future.

In addressing cost effective methods to prevent steel pile corrosion in new bridges, corrosion protection strategies will be developed that can be readily incorporated into contract specifications. These methods can be used and evaluated on upcoming bridge construction projects where steel pile corrosion is a concern.

Progress: WJE has constructed the laboratory test setups, prepared the test specimens, and is currently performing the laboratory testing phase of this project. Preliminary results from these laboratory tests will be used to select several coatings for field tests on existing piles and to develop system requirements for a trial cathodic protection system field test. The field testing phase of this project is anticipated to begin in May of 2012.

Reports: None

Implementation: The project recommendations can be immediately implemented as changes to bridge construction specifications and specifications in maintenance contracts for existing structure repairs or preventive maintenance. Further, the work will provide a basis to develop recommendations to Iowa DOT maintenance staff to assist with optimizing the maintenance of bridge foundations.

TR-623

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
August 1, 2010 –
July 31, 2012

Research Board Funding:
\$150,742

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Quality Control/Quality Assurance Testing for Joint Density and Segregation of Asphalt Mixtures

Objective: The objectives for this project are to identify best practices for joint geometry, joint construction, and for minimizing segregation. Field testing of asphalt pavements during construction as well as existing pavement sections exhibiting open longitudinal joints will be investigated. The project will concurrently compare and evaluate destructive and non-destructive testing methods for identifying segregation and quality control/quality assurance of centerline joints. Testing criteria will then be developed for the most suitable method.” Additionally, a test method that can be used to evaluate the permeability of mixtures during the mix design phase will be included.

Progress: Field testing and subsequent coring were done on three projects: 1. 12.5mm nominal maximum aggregate size (NMAS) that utilized a butt joint, 12.5mm NMAS that used a joint heater, 12.5mm NMAS that consisted on a non-traditional joint construction method.

The non-traditional method involved milling the driving lane and placement of the new mix to the adjoining old mix in the passing lane and then milling the passing lane and placing new mix next to the previously place new mix in the driving lane- thus always maintaining a confined joint. Field testing consisted on using a non-nuclear gauge to record "density", followed by permeability testing and subsequent coring.

Reports: None

Implementation: The implementation and technology transfer aspects of the project will include the specific items stated in the products above and in particular: (1) The development of draft test methods for laboratory and field permeability testing. (2) Development of draft permeability quality assurance criteria for inclusion in percent within limit specifications.

TR-624

Agency:

The University of
Iowa

**Principal
Investigator:**

David Lee

Research Period:

August 1, 2010 –
July 31, 2012

**Research Board
Funding:**

\$150,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of Quality Standards for Inclusion of High Recycled Asphalt Pavement Content in Asphalt Mixtures

Objective: The objective of this project is to develop quality standards for inclusion of high RAP content in asphalt mixtures. Performance testing and asphalt binder testing will be performed at all temperature regimes to characterize the binder contained in RAP and whether or not results are source dependent. Both laboratory and plant produced mixtures will be examined, which would help answer the question that how much blending occurs between the binder in RAP and virgin binder. In addition, this study will explore the possible role that fractionation may take in increasing RAP usage.

Progress: Mix design was performed on the mixtures with varying RAP contents. Typical, fractionated and optimum gradation has been evaluated. Test sections with High RAP will be constructed during the spring of 2012.

Reports: None

Implementation: The implementation outlook for this research effort is very realistic given an increasing number of construction projects of asphalt pavements with RAP in Iowa. The results of this study shall provide a new mix design process with high RAP/FRAP contents.

TR-625

Agency:

Iowa State University

Principal Investigator:

Sri Sritharan

Research Period:

November 1, 2010 –
October 31, 2012

Research Board Funding:

\$250,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Improving Accuracy of Deflection & Camber Predictions for Pre-stressed Concrete Bridge Girders

Objective: The primary objective of the proposed research is to provide accurate methods for predicting short-term and time dependent camber during design and, if desired, means of increasing camber for prestressed beams fabricated for Iowa bridges. The approach will be to evaluate existing data and models as well as to systematically understand instantaneous and time dependent components of camber from casting of the PPCBs to construction of the actual bridge and beyond by quantifying the most significant parameters affecting camber of beams used in Iowa.

A set of prestressed beams will be identified and monitored from fabrication through final erection. Samples of the concrete used in these beams from different precast plants will be tested for strength gain, progressive change of modulus of elasticity, creep and shrinkage behavior in the laboratory. Through this systematic evaluation and measurement of camber immediately after fabrication and continuing through construction, recommendations will be made in a final

Progress: A review of literature has focused on creep and shrinkage of concrete and prediction of camber using methods recommended for design practice. Gathering of data has focused on historical information collected by precast plants and district engineers. several camber measurements techniques have been studied and it has been decided that a tape measure, a digital level, and a string potentiometer measurement system will be deployed to accurately capture the camber at precast plants. It has also been decided to collect data from three precast plants (i.e., Andrews Precast, Coreslab-Omaha and IPC Precast) and initial interviews have been completed at two of the three precast plants.

Reports: None

Implementation: Better understanding of camber behavior and improved predictive tools will facilitate smooth construction, avoid difficult field problems for which there may be no good solution, ensure better service performance, and ultimately reduce life-cycle costs for Iowa's prestressed bridge inventory.

TR-626

Agency:

The University of
Iowa

**Principal
Investigator:**

George
Constantinescu

Research Period:

October 15, 2010 –
June 30, 2012

**Research Board
Funding:**

\$151,430

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Optimization of Snow Drifting Mitigation & Control Methods for Iowa Conditions

Objective: The overarching goal of the present proposal is to optimize the design of passive snow-control measures for Iowa roadways such that the impact of drifting on the roads is minimized or eliminated. The focus of the research will be on providing optimized solutions for limited-area right of ways and topographies which are favoring snow drifting on roadways. This design optimization should result in cost-effective solutions to the snow drift problem that can be tailored for weather and road conditions that are the most common for the Iowa environment.

Progress: Two main sites were chosen (Anamosa and Williams). A meeting with TAC focused on results of the field study during the winter of 2010 and proof of concept of the numerical tool that will be used to develop recommendations in terms of optimum design of snow fences. It was also decided to focus on the Williams site where three different designs can be tested at the same time under similar wind conditions. This is critical for development and calibration of numerical methodology.

Based on 23 design modifications considered in the parametric study of classical snow fences, two new designs were selected for testing in the field. After consultation with the TAC, some of the parameters for these two new designs were adjusted. These new fences are being installed in the field.

Reports: None

Implementation: A series of practical recommendations will be compiled by the project team to include the findings of the study in the Iowa snow fence design guidelines and illustrate the lifecycle cost benefits resulting from the new design implementation. The test cases and set up of the numerical model will be made available to IDOT for future use in new situations where the space constraints and local topography are of concern for the design of snow fences.

TR-627

Agency:

Iowa State University

Principal Investigator:

Kelly Strong

Research Period:

November 1, 2011 –
May 31, 2012

Research Board Funding:

\$79,826

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Risk Mitigation Strategies for Operations and Maintenance Activities

Objective: The objective of this research is to investigate the application of integrated risk modeling to O/M activities, specifically moving operations such as pavement testing, pavement marking, painting, snow removal, shoulder work, mowing, etc. The ultimate goal is to reduce frequency and intensity of loss events (property damage, personal injury, and fatality) during operations and maintenance activities.

After potential risk factors have been identified and loss severity has been evaluated, the research team will identify risk mitigation strategies that can be used within integrated teams to reduce the frequency and/or severity of losses during O/M activities.

Progress: Draft final report is written and is being finalized by publications staff at InTrans.

Reports: None

Implementation: The general form of the research findings will be a process map or guidebook for use by the Iowa DOT, Iowa County Engineers, and municipal transportation agencies to assess the risk potential of various operations and maintenance activities and develop team-based risk mitigation strategies.

TR-629

Agency:

Iowa State University

Principal Investigator:

Neal Hawkins

Research Period:

March 1, 2011 –
August 31, 2012

Research Board Funding:

\$75,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Revision to the SUDAS Traffic signal Standards Phase II

Objective: The objectives of this project are:

1. Update all of the existing SUDAS traffic signal specifications figures
2. Conduct a structural review of footing steel and concrete capacities and standards and incorporate this information into the SUDAS Design Manual
3. Develop and include non-proprietary, performance based NEMA and Type 170 controller and cabinet specifications
4. Develop and include non-proprietary fiber optic cable, modem, and communications specifications
5. Develop and include non-proprietary video monitoring/camera specifications

Progress: A Traffic Signal Committee meeting was held in November to discuss these revised figures. The subcontractor conducted structural review of footing depth, reinforcing steel, and concrete capacities in contrast to existing design standards in Iowa. A table will be added to the SUDAS Design Manual to help designers determine the type of footing to specify for a mast arm pole based on loading and mast arm length. Non-proprietary fiber optic cable, modem, and related communications hardware specifications were developed to be used for traffic signal communications. These draft specs were reviewed by the TAC and revisions were made accordingly. The final drafts will be reviewed by the Traffic Signal Committee in November.

Reports: None

Implementation: The findings of this research will be shared through incorporation into the SUDAS manuals as well as through presentations at the Iowa county engineer's conference, MOVITE Traffic Engineering Conference, ASCE Transportation Conference, Iowa Chapter APWA conference, and through a variety of other professional, municipal, and national group presentations. This information will be disseminated and available for use by all agencies that use the SUDAS manuals.

TR-630

Agency:

Iowa State University

Principal Investigator:

Shauna Hallmark

Research Period:

January 15, 2011 –
December 31, 2012

Research Board Funding:

\$55,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Evaluation and Guidance on Effective Traffic Calming for Small Communities

Objective: The objectives of this study are:

- Summarize information about effective transition zone planning and design practice
- Identify and summarize techniques used to manage speeds in transition zones
- Demonstrate the effectiveness of techniques that are practical for high- to low-speed transition zones
- Acquire additional information about techniques that may show promise but lack sufficient evidence of effectiveness
- Develop an application toolbox to assist small communities in selecting appropriate transition zones and selecting effective techniques for transitioning from high-speed to low-speed roadways

Progress: A total of 16 sites were received and reviewed. The team worked with two counties and obtained 10 sites in 5 communities which will be included in the analysis. The team requested and just received approval from the MUTCD experimentation group for several of the treatments.

The treatments were ordered after obtaining permission from the MUTCD group. The treatments are here and installation was scheduled for Late Oct. After several group discussions, the team decided to wait on installation until spring 2012 and subsequently will need a project extension. Although they could have been installed this fall it was decided that it did not make sense to lay down new pavement marking treatments which would then be subjected to snowplows and winter conditions.

Reports: None

Implementation: The findings from this research will enable practitioners to better design speed transition areas from high- to low-speed roadways, determine when speed management is necessary, and then select and monitor appropriate techniques. This capability is expected to have an impact at the national, state, and local level.

TR-631

Agency:

Iowa State University

Principal Investigator:

Brian Gelder

Research Period:

April 1, 2011 –
January 31, 2014

Research Board Funding:

\$73,873

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Automation of DEM Cutting for Hydrologic/Hydraulic Modeling

Objective: The primary objectives for this project are:

- Develop and program algorithms to enforce fine scale drainage on LiDAR DEMs for the state
- Accurately enforce drainage on catchments larger than 24 acres in conjunction with the Iowa DNR and IIHR

Progress: The IHRB portion of this project has just begun although completion of the Iowa DNR portion of the project, enforcement of channelized streams, is not entirely complete. The DNR portion of the project is within one month of completion at this time.

Reports: None

Implementation: These DEMs will be used by bridge and culvert engineers during initial design as well as by city and county engineers to correctly contributing area and the hydrologic characteristics of the contributing area as they design water conveyance structures. The actual algorithms for DEM enforcement are not likely to be used by the practicing engineer or administrator but will likely be used by DOT GIS professionals to support LiDAR database maintenance.

TR-632

Agency:

Iowa State University

Principal Investigator:

David White

Research Period:

July 1, 2011 –
June 30, 2012

Research Board Funding:

\$50,000

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Low Cost Rural Road Surface Alternatives

Objective: The proposed objectives of this research project are to:

- (a) Conduct a comprehensive literature survey of the state of practice for granular surface road construction with respect to freeze/thaw damage resistance
- (b) Develop recommendations with respect to conducting a phase 2 study to demonstrate various technologies.

Progress: The research team met with Hamilton County Engineer on June 6, 2011 to discuss their local practices on stabilization of gravel roads. A 3.5 mile segment of gravel road on Vail Avenue (North of Hwy 175) was identified as a candidate demonstration site for further evaluation and long-term monitoring.

The research team also met with Pottawattamie County engineer to discuss their local practices on stabilization of gravel roads. Pottawattamie County has some segments of gravel roads that are stabilized with emulsified asphalt stabilized bases (~ 6 inches) surfaced with chip seal coat and desires a better understanding of the seasonal performance of these type roads using a DCP to measure strength capacities so to make better decisions about roadway management.

Buchanan and Hamilton county engineers have expressed interest in further evaluation of some mechanical and chemical stabilization techniques as part of future demonstrations.

Reports: None

Implementation: The benefits from this project will be to provide improved knowledge in the state-of-the practice for granular surface stabilization. The project will result in improved decision making and investment.

TR-633

Agency:
Iowa State University

Principal Investigator:
Kejin Wang

Research Period:
August 1, 2011 –
January 31, 2013

Research Board Funding:
\$124,996

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Investigation into Shrinkage of High Performance Concrete Used for Iowa Bridge Decks and Overlays

Objective: The main objective of the proposed study is to investigate the shrinkage behavior of HPC used for Iowa bridge decks and bridge deck overlays. The specific objectives of this investigation include:

- (1) To identify major components of shrinkages (chemical, autogenous, and drying shrinkages) in Iowa concretes;
- (2) To evaluate the influence of various constituent materials, such as types and contents of cementitious material and aggregate, and admixtures, on these shrinkages; and
- (3) To provide recommendations for improving Iowa HPC mix design and construction practice so as to reduce the concrete shrinkage cracking potential.

Progress: The literature review was focused on the test methods for different types of shrinkage. The factors that affect concrete shrinkage have also been studied. The material collection for this project started in July 2011. With help from IADOT/TAC, all cementitious materials needed for this project were collected. All aggregates were purchased, and chemical admixtures were collected from the suppliers.

Aggregate properties (specific gravity, absorption, and gradation) were measured and the dosages of chemical admixtures (e. g. air entraining agent) were determined. Chemical shrinkage tests – Paste samples for all proposed 11 mixes were cast, and their chemical shrinkage measurements are in progress.

Setting times of mortar samples made with all 11 mixes were determined. Mortar samples made with mixes 1, 5, 7, 10, and 11 were cast for the AutoShrink measurement. Concrete samples made with mixes 1, 2, and 4 were cast for ASTM C157 tests. The shrinkage measurements are in progress.

Reports: None

Implementation: Early age cracking in concrete due to excessive shrinkage is often reported by state DOTs, and the problem is a special concern for HPC used for bridge deck and bridge deck overlays. The most effective way to solve this problem is to select proper concrete materials and mix proportions so that the concrete will have a low tendency to shrink and/or to crack. The observations and conclusions from this proposed study will lead to valuable recommendations on HPC material selection and mix design to reduce the concrete shrinkage cracking potential.

TR-634

Agency:

Iowa State University

Principal Investigator:

Chuck Jahren

Research Period:

July 1, 2011 –
June 30, 2012

Research Board Funding:

\$85,820

Funding Source:

100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Pilot Construction for Granular Shoulder Stabilization

Objective: The objective of the proposed research project is to assist Iowa DOT in cost effectively mitigating edge ruts on granular shoulders by pilot testing the use of DUSTLOCK in a full scale maintenance setting and continuing to explore other alternatives such as developing standard specifications for a class of products that might have similar effectiveness and using other stabilizing strategies or paving short sections of shoulders.

Progress: The project team received price quotes for the use of DUSTLOCK in the summer of 2011 and conducted a literature review. Soy soapstock was applied at various locations at Algona, Garner, Allison, Waverly, Elkader and West Union Garages. Preconstruction observations and one set of post construction observations were taken. Analysis of results of testing will continue during the winter.

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations on products and procedures available to mitigate edge rut problems for granular shoulders. In particular the use of DUSTLOCK will be investigated as a pilot construction project. State, county, and city transportation agencies/ jurisdictions can implement these recommendations. The results of this research could improve the behavior of granular shoulders, and reduce its maintenance cost.

Full implementation of possible recommendations may require the purchase of new equipment in order to perform the stabilization process. Alternatively, it may be possible to rent equipment or contract out certain operations. Changes for stabilization agent purchasing processes may be necessary to properly specify stabilization agents or to purchase proprietary materials. It is expected that researchers will be able to assist the Iowa DOT with these issues within the scope of this proposal.

TR-635

Agency:

Iowa State University

Principal Investigator:
Chris Williams

Research Period:
June 1, 2011 –
May 31, 2013

Research Board Funding:
\$174,991

Funding Source:
100 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Warm Mix Asphalt Phase II: Evaluation of WMA Quality Assurance Testing Protocols

Objective: Phase II of this study will evaluate the performance of plant-produced WMA mixtures as compared to HMA using NCHRP 9-43 recommendations. Other objectives involving curing behavior, quality assurance testing, and hybrid technologies are outlined as follows:

1. Compare the predicted and observed field performance of existing WMA trials produced in the previous Phase I study to that of HMA control sections to determine if Phase I conclusions are translating to the field.
2. Identify any curing effect (and timing of the effect) of WMA mixtures and binders in the field. Determine how the field compacted mixture properties and recovered binder properties of WMA compares to those of HMA over time for technologies common to Iowa.
3. Identify protocols for WMA sample preparation for volumetric and performance testing which best simulate field conditions.

Progress: The research team has developed a proposed experimental plan. Field condition surveys of the pavement sections have been done as well as coring of the all but one of the project locations. Personnel have undergone lab safety training and are being trained on performing extractions utilizing a blend of toluene and ethanol and the recoveries purging nitrogen over the chemical-asphalt binder blend to minimize oxidation aging during the recovery process.

Phase I E* data was used in the M-EPDG to assess the effects of WMA on pavement life with subsequent analysis and development of a draft paper that will be available for the TAC to review. Samples were procured for subsequent moisture sensitivity testing using two varieties of Evotherm with 0%, 0.5%, and 1.0% by weight of the binder as well as samples for testing by Meadwesvaco for compactibility. Frequency sweep testing of binders using Evotherm and Sasobit with polymer modified asphalt was done to evaluate the effects of the polymer-warm mix technology interaction.

Reports: None

HR-1027

Agency:

Iowa Department of
Transportation

**Principal
Investigator:**

Vanessa A. Goetz

Research Period:

March 1980 –
on-going

**Research Board
Funding:**

\$85,000/year (covers
salary and state share
of costs for FICA,
IPERS, health
insurance, vehicle
costs and expenses)

Funding Source:

100% State -
100% Secondary
funds

Secondary Road Research Coordinator

Objective: This is a full-time position at the Iowa DOT. The coordinator's jobs are to act as a research liaison with all of the county engineers and solicit new, innovative and progressive ideas. He or she also actively promotes research for solutions to problems and ideas that will improve quality and reduce costs on the secondary road system.

Progress: Vanessa Goetz continues communications with county engineers to discuss problems encountered by secondary road departments and to discuss current research projects throughout the year.

At any one time as much as 50 percent of IHRB projects involve the secondary road system, including secondary projects with consultants. The coordinator assists these counties with special testing, evaluation and writing of reports necessary to the research and keeps county engineers updated on the latest important research results.

Reports: None

Implementation: There are many problems that are unique to the secondary road system in Iowa. These problems are often common to several counties. Coordination between counties is necessary for understanding the problems and formulating solutions. Proper documentation and dissemination of research results allows for timely technology transfer to and between the counties.