



FY 2009 ANNUAL REPORT

Research, Intelligent Transportation Systems, and Technology Transfer Activities



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 2009, Iowa led seventeen pooled fund studies and participated in sixteen others.

In 2009, research efforts again focused on six primary areas:

- **Safety** – The centerpiece of safety research is the annual Transportation Safety Improvement Program. In addition, Iowa DOT leads four national pooled fund traffic safety projects and administers other widely varied safety projects such as a “GO Team” study of teen crash fatalities, evaluation of Iowa’s Driver Improvement Program, evaluation of dynamic warning signs at high crash curves, countermeasures to prevent lane departures, and tests of wet reflective pavement markings.
- **Winter Maintenance** – Iowa hosted the American Public Works Association Snow Conference in April 2009, 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 included testing an automated deicer blending system, thermal mapping, and a combination snow fence/deer fence. The Office of Maintenance also conducts a variety of research initiatives every winter, testing new equipment and processes with operation forces and budget. A multiple-blade plow designed to clear roadways of more snow and ice per pass is a new promising initiative.
- **Pavements** – With assistance from the Concrete Pavement Technology (CPT) Center at Iowa State University, the Iowa DOT leads seven 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 two 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. In 2009 the Iowa DOT opened a Statewide Emergency Operations Support Center (SEOP Center) in Ames along with development of Statewide ITS Management Software (SIMS) project that will enable DOT personnel and partner agency staff to control and configure existing and future deployments of ITS devices statewide. 2009 also saw the launch of Iowa’s Real Time Kinetic Global Positioning System (RTK/GPS), a network comprised 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.
- **Geotechnical** – The Partnership for Geotechnical Advancement (PGA) mission has been expanded into the new Earthworks Engineering Research Center (EERC) at Iowa State University. According to the EERC: *Smart infrastructure solutions start at the bottom, with the foundations that support and significantly determine the performance of every structure. Investing in soil engineering and technology improvements that result in faster, cheaper, and longer-lasting foundations offers disproportionately large returns.* In April 2009, the Iowa DOT hosted a workshop on Intelligent Compaction with over 85 participants from states, FHWA, and industry. Iowa also leads a new pooled fund study: Improving the Foundation Layers for Concrete Pavements.

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

	Page
Introduction	
I. Research & Technology Bureau Programs	
A. State Planning & Research (SPR) Program	1
B. Iowa Highway Research Board	19
C. Intelligent Transportation Systems (ITS) Projects	20
D. Primary Road Research	25
E. Technology Transfer	26
II. Other Research, Development and Technology Transfer Activities	
A. Traffic & Safety Research	28
B. Maintenance Research	29
C. Bridges & Structures Research	32
D. Living Roadway Trust Fund Research	33
III. Transportation Research Board	34
IV. University Research Coordination	
A. Iowa Transportation Research Collaboration	36
B. Institute for Transportation (InTrans)	37
Attachments	
1. SPR Research Programmed Funds 1993-2009	39
2. FY 2009 Research Work Program Summary	40
3. FY 2009 SPR Research Work Program by Category	44
4. FY 2009 SPR Approved Training Requests	45
5. FY 2009 SPR Allocations by Type of Work (Table)	46
6. FY 2009 SPR Allocations by Type of Work (Chart)	47
7. FY 2009 Research Funds Leveraged Through Pooled Fund Projects (Table)	48
8. FY 2009 All DOT Research Funding Sources	49
9. FY 2009 Traffic Safety Improvement Program – Research Projects	50
10. Annual Report of Iowa Highway Research Board Research and Development Activities FY 2009	52

Introduction

The purpose of this report is to provide an overview of research, Intelligent Transportation Systems (ITS), and technology transfer activities carried on throughout the Iowa Department of Transportation (DOT).

The Research and Technology Bureau (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).
- 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.
- Assist and lead department to 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 these other divisions and offices of the Department:

- 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.
- 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.

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 09 the total was \$2,961,006.

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 09 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.

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.

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.

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

IOWA STATE UNIVERSITY
Institute for Transportation

AASHTO Partnerships

Iowa DOT supports five 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

Geotechnical Research and Development – 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 is Resource Management System (RMS), Daily Log phase. RMS will be used by maintenance staff for managing both human and physical resources. A future application to be developed is the Laboratory Information Management System (LIMS) for the Office of Materials.

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

LRFD Development

The Office of Bridges & Structures is implementing LRFD specifications developed under a pooled fund study TPF-5(068). Manuals and design software have been purchased and training presented.

★ **Result:** Ability to stay current with national LRFD standards of bridge design

Electronic Construction Collaboration System

Bridge construction projects are becoming increasingly complex as the demand for context sensitive solutions, aesthetic designs and accelerated bridge construction becomes more prevalent. In addition, the Iowa DOT is entering a phase of design and construction of large border bridges such as the I-80 (Let 2008 for \$56 Million) and U.S. 34 bridges over the Missouri River and I-74 over the Mississippi River. Researchers will investigate Iowa DOT requirements for a web-based construction project management and collaboration tool, review industry "best-practices," review commercially available software options, and make a recommendation for implementation or development of a software tool and conduct a pilot project.

★ **Result:** The successful implementation, or development of software, could speed construction submittal review time, reduce incidence of delay claims and free up DOT staff from project management administrative tasks.

Sign Management System, Phase III

The Sign Management System is helping Iowa DOT develop a statewide inventory and management tool for roadway signs. Phase III is the Implementation & Operations Plan for the system.

★ **Result:** More effective road sign management



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

Investigate Defects in Existing Concrete Railing

The Illinois DOT has discovered large voids in the core of the slip formed bridge barrier rails that could significantly reduce the structural capacity and shorten the service life of the rail. While Iowa DOT is not aware of similar situations in barrier rails in Iowa, it may be that the problem has simply not yet been discovered. Traditional investigation techniques would require taking cores to inspect the subsurface conditions. Apart from the destructive nature of this testing, it is also hampered by the location of the tests.



Without other indications of suspected defects, the investigators can only select random locations with the hope that a sufficient number of test locations will provide for an accurate determination of the overall conditions. If a non-destructive means could be used to evaluate the suspect rail, a large volume of rail could be examined more thoroughly with the destructive testing reserved to confirm suspect areas.

★ **Result:** Improved capacity and longer service life of bridge railings

Washing Weathering Steel Bridges

The objectives of this work are to determine if and at what locations chloride contamination above the critical threshold is occurring on weathering steel bridges. Information that indicates that salt plumes may be extending significant distances from the point of application. At the same time, weathering steel is being used more extensively and its performance is reliant upon the formation and maintenance of a protective patina which is negatively impacted by chlorides. The degree (including location, rate of accumulation, etc.) and location of contamination in existing bridges needs to be determined. The consultant is being hired, but work on the project has not yet begun.

★ **Result:** Policy recommendations on the frequency and location of washing to preserve structures

Performance of Embedded Galvanic Anodes

Four different corrosion protection systems have been installed on bridge elements in Iowa. The corrosion protection systems include: Zinc sheet Cathodic Protection - Cedar Rapids; Galvashield XP anodes - Council Bluffs; Norcure Chloride Extraction - Council Bluffs; and Arc spray metalizing – Ottumwa. The intent of the studies is to determine a) if the systems are working properly and b) to compare the effectiveness of the different systems. Researchers performed site inspections that include visual inspection, system continuity checks, system diagnosis, depolarization testing, and sampling. Laboratory work includes chloride testing of concrete samples (Norcure system) and microscopic examination of field samples of anode materials.

★ **Result:** Extended life of prestressed concrete beams and reduce maintenance cost

Denver Bypass Structural Monitoring

In 2006, Iowa DOT in cooperation with the FHWA successfully demonstrated the use of precast concrete panels in the construction of new bridge approaches (Iowa 60 in O'Brien County). The next step in this endeavor is to demonstrate this accelerated construction



technique on existing bridge approaches under live traffic condition with limited lane closures. A project on U.S. 63 in Bremer County has been identified. To evaluate the effectiveness of the repair, and to provide validation for similar potential remedial measures in the future, the goal of this study would be to quantify the repair performance through instrumentation and monitoring.

★ **Result:** If results of monitoring show this project is successful, approach replacements could be completed over night with 12 hour lane closure.

Wapello UHPC Bridge Deck



This research was intended to implement a new solution for replacement of deteriorating highway bridge decks; namely, to use a precast concrete deck and approach slab panels made of Ultra High Performance Concrete with Glass Fiber Reinforced Polymers in the top mat and curbs and field cast UHPC in the infill portions to develop continuity in deck panels. Utilizing the superior characteristics of the material technology will enable the

designer to greatly simplify the precast panel fabrication and installation processes. This simplified design provides improved tolerances, reduced risk, an overall cost savings in construction and a more durable solution. Advantages are high strength, low steel and high permeability. The project was funded through several sources, including SPR, Iowa Highway Research Board, and county funds. The SPR portion will be used to test a hybrid UHPC top/HPC bottom deck panel.

★ **Result:** The project is not yet completed.

Monitor Red Rock Mile Long Bridge

The Office of Bridges and Structures will oversee installation of a data collection system similar to that installed on the Saylorville Reservoir bridge that will 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 will be 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.



★ **Result:** Enhanced ability to interpret the impact of future wind events

Evaluation of Dynamic Warning Signs at High Crash Curves

The crash rate on horizontal curves is about three times that of normal straight highway sections. This research will evaluate the effectiveness of low cost dynamic speed signs and other low cost treatments on rural roadways in reducing speeds and crashes. Curve related crashes result from a number of causes, including driver workload, driver expectancy, and speeding. Reducing speed on curves can be done in the short term and at significantly lower costs than making geometric improvements. Dynamic curve warning signs are one method to be tried.

★ **Result:** Safer roads at lower cost than reconstruction

Evaluation of Iowa's Driver Improvement Program

This study seeks to determine the cost- effectiveness of the driver improvement programs in Iowa from 2004-2007 by examining crash and conviction records and driver training history.

Statistical analysis will be applied to compare performance of drivers who attend the programs at various locations across the state. Survival analysis will be applied to determine the period of time when the effects of the driver improvement course remain significant.

★ **Result:** The study is still underway.

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.

★ **Result:** Identify gaps in the Iowa crash data and appropriate priorities for Graduated Driver Licensing (GDL) enhancements.

PathfindIR

Night vision during snow storms can sometimes hamper our plowing operations as well as put our drivers in danger during blizzard conditions. The PathfindIR camera is an infrared camera able to see through snow, fog, and increase nighttime sight distance. The camera is mounted on the vehicle and a monitor is mounted in the cab. The camera produces a thermal image of the road ahead which looks similar to a black and white video, except that it is unaffected by the dark or headlight glare and is less impaired by blowing snow or fog. Maintenance hopes it will allow plows to operate well after conditions deteriorate to the point that they would have had to pull plows off the roads.

★ **Result:** Enhanced ability to plow snow in poor visibility conditions

Automated Liquid Deicer Blending System



An automated liquid deicing chemical blending system consists of miscellaneous plumbing pieces, pumps, valves, tanks, electronic hydrometers, and other electronic components. The system can be used to automatically blend different ratios of liquid deicing chemicals to produce a customized liquid deicer blend with more melting ability. Wash water from truck bays can also be recycled into the system to take advantage of any salt brine produced during truck washings. The system will automatically detect the salinity concentration of the wash water

and adjust the concentration of salt or water to add to the solution to make sure the final product is a 23% solution of salt brine or other desired liquid deicer concentration. The system will be tested and evaluated by the Mount Pleasant maintenance garage to make sure the system blends the deicers properly.

★ **Result:** A garage can remarkably reduce the volume and salt content of waste water entering the sewer/drainage network by recycling wash water with this system. Some garages may be required to reduce the amount of salt entering the sewer/drainage systems in the near future.

Portable Weather Station

The Office of Maintenance wishes to determine if a portable weather station can be created for use as a multi-use station (winter and non-winter maintenance, construction projects, emergency management, chemical detection, environmental impact analysis, etc.), and a cost-effective alternative or complementary technology to permanent weather stations like RWIS or AWOS, and if the effort of portability is overcome by optimized usefulness for specific projects.

Data from the station will be collected to determine if it reports in a timely and reliable way, if it can withstand the rigors of frequent relocation and the roadside environment, and whether the observations from it are accurate enough to use in decision-making for its assigned tasks. Data will be compared to nearby permanent weather stations to evaluate differences in data quality. If successful, more weather stations will be purchased to help with summertime projects and fill gaps in coverage of permanent station observations.

★ **Result:** Cost effective and portable alternative to permanent weather stations

Combination Snow/Deer Control Fence

Developing a fence design that can provide livestock control (deer) and snow fence will provide benefits by keeping deer from the roadway and also minimize the impact of blowing and drifting snow on the roadway. Some work has been done on snow fences to control blowing and drifting snow and work has also been done on fences to control deer but we are not aware of any research done on combination fences. This proposal includes three steps: 1) Design 1-2 dual purpose fence prototypes, 2) Contract with a fence manufacturer to make small batches of test fences, 3) Test the combination fence in several locations on Interstate 35.



★ **Result:** Improved safety for motorists from deer collisions and blowing snow.

Thermal Mapping

The Office of Maintenance began testing and evaluating thermal mapping during the 2008-2009 winter season and plans to continue testing through 2010. This low-priced mapping system



combines an infrared thermometer commonly used on maintenance vehicles, a GPS antenna, and a laptop computer. A computer software application developed by Iowa State University allows an Iowa DOT laptop to collect and store pavement and air temperature data from the thermometer and apply location data from the GPS antenna as a vehicle drives the roadway. This data is collected under different weather conditions (clear skies, cloud cover, partial clouds, etc.) over time to develop a temperature profile of the road.

Thermal mapping can also be used to correlate weather conditions from a location to a known weather reporting site over 20 miles away. The data is then displayed on maps showing temperature differences along the road. If continued testing is successful, the Iowa DOT will provide the system to field staff and supervisors throughout the state for quick location and mapping of roadway areas.

★ **Result:** Understanding these differences could eventually lead to customized treatments for roads in the future.

APWA Snow Conference

Iowa hosted the American Public Works Association Snow Conference in April 2009. Representatives from around the country attended education sessions, round table discussions, vendor displays and demonstrations and a tour of local maintenance facilities around the Des Moines metropolitan area, including an Iowa DOT display at the Grimes Maintenance Facility. About 100 DOT employees attended the conference for one day. When surveyed, 87% of DOT respondents said they would like to attend another APWA Snow Conference if it were held near Iowa in the future.



★ **Result:** This meeting provides the opportunity to discuss each state's best practices in order to improve winter operations.



Intelligent Compaction Peer Exchange

In April 2009, Iowa DOT hosted a second focus group meeting to discuss "Intelligent Construction/Intelligent Compaction for the Future". The meeting was attended by about 85 participants from Iowa and other states, FHWA, contractors, consultants and equipment manufacturers. The first day was spent discussing the status of intelligent compaction of soils and HMA with presentations by experts in the area. Afterward, small groups brainstormed to identify future initiatives, and concluded with a wrap-up session of how to take the information and move forward.

★ **Result:** A clearer understanding of changing technology

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 09, three NHI and other technical courses were presented, attended by over 150 employees of Iowa DOT, FHWA, and local agencies. In addition, two non-NHI courses were held, and three DOT staff attended outside conferences. The Technical Training and Conference Plan is Attachment 4 to this report.



★ **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.

MIT Scan T2 Units

Sufficient PCC pavement thickness is critical to the service life of the pavement. Iowa has an incentive-disincentive specification to encourage contractors to strive for the target thickness consistently. To measure thickness, cores must be drilled at random locations throughout the project. This is costly to both the contractor and the DOT.

The Office of Materials purchased two MIT-Scan-T2 units for study. These units are being used in Europe to measure pavement thickness using electromagnetic tomography. The equipment determines the thickness by measurements taken over a metal plate placed on the subbase during paving. The reported accuracy by the manufacturer is +/- 2.5 mm on 300 mm thick pavement.

The objectives of the study/technology implementation are:

- Develop a procedure for maintaining the integrity and randomness of the thickness verification with the NDT equipment.
- Compare results with current pavement thickness acceptance procedures on actual projects.
- Develop a PWL specification based on the NDT procedure and results.

★ **Result:** The units are being evaluated.

Automated Chain Drag System (ACDS)

This equipment is designed to automate the sounding of concrete bridge decks for hollow or delaminated areas. It may be used in conjunction with the “NDE of Bridge Decks” project and could potentially be used for routine bridge deck investigations and in preparation of deck repair projects.

The equipment was first developed as a research project by Mississippi State University. Since that time, the rights were acquired by Excelerate, Inc. Excelerate, Inc. had performed further development but has not brought it to full production. This purchase would be used to test the equipment by comparing it to current sounding techniques and further development for the Department’s needs.

Based on the results of this test, a determination could be made for the purchase of additional equipment. The proposed time frame is two years for acquisition and testing/development. The Office of Bridges and Structure, Maintenance and Inspection Unit will supervise the project with assistance and advice from the District Bridge Repair Crews as needed. There will be a brief report prepared on the effectiveness of the equipment.

★ **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. In FY 09 Iowa received the benefit of nearly \$2 million in research for its investment of \$327,000 in Iowa-led pooled fund studies, more than a six-fold return. See *Attachment 7* for details of the investment leverage.

Iowa currently leads 17 national pooled fund projects and is an active participant in 16 others. Each pooled fund study and its anticipated impact are described here.

Iowa-led Pooled Fund Projects

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 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:** Safe, efficient, convenient, and socially and environmentally sound movement of people and goods

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:** More efficient highway maintenance operations and safer winter road conditions

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:** More effective ice and snow removal and safer winter driving for motorists and for maintenance personnel.



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:** Motorists can make critical decisions such as postponing a trip when road conditions are deteriorating or rerouting if an incident has closed a roadway.

Long-Term Maintenance of Load Resistance Factor Design (LRFD) Specifications – TPF-5(068)

LRFD incorporates state-of-the-art analysis and design methodologies for bridges with load and resistance factors based on the known variability of applied loads and material properties. The load and resistance factors are calibrated from actual bridge statistics to ensure a uniform level of safety. Forty-eight states are partners in the project. The project consultant assists the AASHTO Highway Subcommittee on Bridges and Structures in interpreting, implementing, revising, and refining the AASHTO *LRFD Specifications*.



★ **Result:** Uniform service levels and bridge reliability resulting from using LRFD should ensure superior serviceability and long-term maintainability for bridges.

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:** Increased safety and efficiency of traffic operations and highway work

Performance Properties of Ternary Mixes – TPF-5(117)

DOT's have long used fly ash and ground granulated blast-furnace slag (slag cement) as a partial replacement for Portland cement in concrete production, but few attempts have been made to optimize the use of fly ash or slag cement to produce concrete mixtures that meet specific performance objectives. This project provides information needed to make sound engineering judgments pertaining to use of supplementary cementitious materials in conjunction with Portland or blended cement. Two phases have been completed and the third is



underway. Project partners include six other states, FHWA and the Concrete Pavement Technology Center at InTrans (CP Tech Center).

★ **Result:** More effective utilization of supplementary materials and/or blended cements, enhancing the life-cycle performance and reducing the cost of transportation pavements and structures.

High Speed Pavement Analyzer – TPF-5(136)

The purpose of this project is to develop a device that will measure (at highway speeds) pavement structural condition which is known to impact the performance of PCC and composite pavements.

Analysis of pavement distress and structural condition is a key component of all pavement management systems and provides a method to schedule rehabilitation and maintenance activities to minimize life-cycle costs for these facilities. With current technology it is costly and difficult to obtain the needed measurements over a large network of highways without disruption to the traveling public and exposing field personnel to dangerous working conditions.



★ **Result:** The project identified technologies that appear promising for the measurement of deflection and load transfer efficiency in rigid pavements.

Surface Characteristics – TPF-5(139)



One pressing issue for the PCC paving industry is surface characteristics, the pavement properties that affect smoothness, friction, noise, drainage, splash and spray, rolling resistance, and reflectance. This study is the continuation of a comprehensive data collection and analysis program on new and existing pavements started in 2005. The research has produced a broader range of applicability and developed innovative texturing techniques with the potential to significantly reduce noise. Field sites consist of both conventional and innovative texturing techniques. Project

partners include three other states, FHWA, industry and the CP Tech Center.

★ **Result:** Lower pavement noise and acceptable levels of smoothness, friction, and safety

Urban Teen Driver Study – TPF-5(144)

Newly licensed teens have an extremely high risk for crashes. The objective of this project is to examine the use of event-triggered video feedback to reduce unsafe driving by urban teens. “Unsafe events” trigger the video system to begin recording a 20-second video and audio clip. Triggered events include situations where a driver exceeds a lateral or longitudinal physical limit, such as when abrupt accelerations, braking or erratic steering occurs. Parents receive a weekly report card of their teens driving that describes each event in narrative form. Coaching protocols for parents to use when discussing unsafe events have been developed.



★ **Result:** New possibilities for educating both driver license examiners and driver education instructors, greater insight in how younger drivers use (and misuse) the state's roadways

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:** This project will help meet the challenge to design and build longer life concrete pavements that result in a higher level of user satisfaction for the public by using innovative materials and construction optimization technologies and practices.

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:** Established guidelines for the use of integral abutments with curved girder bridges



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.

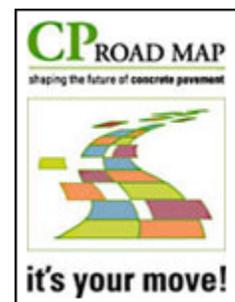
★ **Result:** Pavement foundations that are more durable, uniform, constructible, and economical

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:** Concrete pavements that are consistently long-lasting, constructible, and cost efficient



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:** Reduced crashes and related injuries among teen drivers by increasing driving skill and safe driving practices.

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:** Longer lasting pavements

Structural Health Monitoring – TPF-5(219)



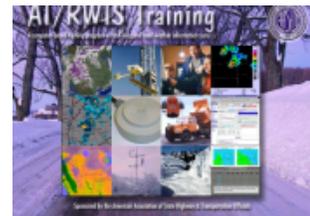
Numerous damage detection algorithms exist to detect a change in the structure, but that information by itself is of little value to a state bridge engineer. What is needed is a structural health monitoring (SHM) system capable of evaluating the structural capacity and remaining service life of a bridge. The objective of this project is to integrate a damage detection algorithm capable of evaluating a bridge's structural capacity and estimating remaining service life into a structural health monitoring system.

★ **Result:** A reliable means of predicting service life and capacity of bridges

Pooled Fund Projects with Iowa Participation

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 (WMTSP). 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:** Continued improvements in winter operations and safety.

Base Funding for the North Central Superpave Center – TPF-5(021)



This pooled fund provides for continued operation of the North Central Superpave Center (NCSC) at Purdue University to assist agencies and industry with Superpave implementation and hot mix asphalt issues. The NCSC provides technical assistance, training, communication, and research and development work to meet the needs of the seven-state region.

★ **Result:** Ready access to sophisticated research and testing capabilities with expertise and training in the area of HMA dynamic testing and surface friction

Pacific Northwest Snowfighters – TPF-5(036) 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. Corrosion inhibited Magnesium Chloride, Calcium Chloride, and Sodium Chloride (PNS Categories 1, 2, and 4, respectively) will be utilized for this research.

Each product will be applied at varying rates, road conditions, temperatures, and humidity in order to establish their performance.

Testing will also be performed on the materials stored in the covered and uncovered storage sites and the storage tanks to determine if there is separation of the deicer and inhibitor and whether the product breaks down during storage (i.e. how long can the product be stored and still be effective when applied to the roadway).

★ **Result:** Better stewardship of resources through improved understanding of chemical performance

Falling Weight Deflectometer (FWD) Calibration Center – TPF-5(039)

Use of FWDs is increasing as states use the recently developed AASHTO Design Guide. Iowa is now entering the FWD testing field with two FWD units, requiring annual certification for Federal approval of test results. FWD devices require frequent calibration to provide reliable results. However, changes in computer technology have rendered some FWD calibration equipment nearly obsolete. This pooled fund project involves updating the calibration hardware, software and procedures, as well as training and installation of the new calibration system in the four calibration centers (CO, TX, MN and PA).



★ **Result:** Accurate data for programming pavement rehabilitation

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



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://www.nhi.fhwa.dot.gov/tccc/>.

★ **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.

Midwest States Accelerated Testing Program – TPF-5(048)



The Civil Infrastructure Systems Laboratory at Kansas State University evaluates various pavement components such as bases, AC and PCC using full scale accelerated pavement testing. The load testing can be conducted under a variety of environmental conditions in short time frames due to the ability to place more loading cycles on the pavement than can be achieved on a highway during the same time period.

★ **Result:** Conducting full-scale, accelerated testing of full-depth pavement section under realistic loading at a reduced operation cost

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

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:** Assessment of new tools and technologies

Clear Roads – TPF-5(092)



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 project web site at www.clearroads.org.

★ **Result:** Improved winter maintenance techniques, safer winter driving conditions

Transportation Library Connectivity - TPF-5(105)

Transportation information services are developing at a rapid rate in the U.S. with significant advances almost every month. This pooled fund supports many of those initiatives and is dedicated to serving as a link to the future, when access to transportation information by practitioners and researchers will be rapid, reliable and institutionalized. Members also receive cost offsets and subscription



management services to the Online Computer Library Center (OCLC). Progress can be tracked at www.libraryconnectivity.org.

★ **Result:** Shared knowledge and more cost efficient services

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

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:** Longer lasting asphalt pavements.

Evaluation of Non Intrusive Traffic Detection Technologies - TPF-5(171)



Non-intrusive sensors are those sensors that can be installed, calibrated, and used without disruption to traffic. The most common non-intrusive technologies (NIT) used for traffic detections include: passive or active infrared, magnetic, microwave or radar, ultrasonic, passive acoustic, and video. The objective of the proposed project is to conduct field tests of the

latest generation of non-intrusive traffic sensors. The field tests will assess the capabilities and limitations in detecting traffic under a variety of conditions.

★ **Result:** More accurate data collection technology

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

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:** A test procedure that directly evaluates the permeability (transport properties) of concrete and relates these to anticipated performance with the use of exposure conditions.

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



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:** Safer roadsides and roadways

2009 National Asset Management Conference – TPF-5(196)

The conference is designed to be a forum for practitioners, researchers, and others to share information on a variety of transportation asset management topics. Sessions covered a broad range of topics that will be of interest to agencies that are in the early stages of implementation of asset management as well as agencies that are in later stages of the implementation process.

The focus of the conference was to share real experiences from real transportation professionals who are implementing aspects of asset management. Iowa's representative was John Adam, Highway Division Director of Statewide Operations.

★ **Result:** Broader knowledge of asset management practices

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

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:** The software improvements will make the program more versatile and provide additional analysis capabilities.

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

The use of recycled asphalt shingles (RAS) in hot-mix asphalt (HMA) applications has grown across the U.S. over the last 10 years. Although the majority of states are using manufacturers' RAS, there has been a rapidly growing interest in the use and applications of tear-off RAS in hot-mix asphalt. Many states share common concerns and questions in the use of tear-off shingles. Previous research has allowed for only limited laboratory testing and field surveys. Researchers and bituminous/material engineers still require additional research to study the effects of tear-off RAS on the performance of HMA applications and their economic value.

★ **Result:** Understanding the best practices for use of recycled asphalt shingles in hot-mix asphalt applications

B. Iowa Highway Research Board

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 2009 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.

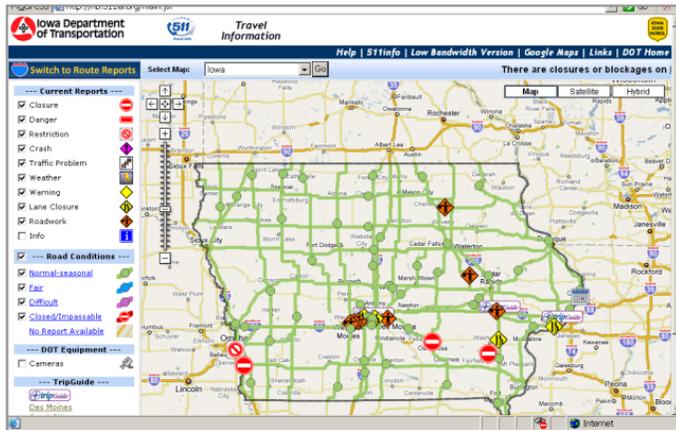


CARS/511 Usage				
Month	FY 09 Calls	FY 08 Calls	FY 09 Web Visits	FY 08 Web Visits
July	21,932	10,161	28,040	24,683
August	10,647	15,938	12,222	40,111
September	10,410	8,191	13,158	20,161
October	8,885	9,166	9,590	27,134
November	17,770	18,930	37,323	62,293
December	154,311	135,581	267,121	434,816
January	112,435	52,922	154,714	213,938
February	30,106	163,149	61,831	545,416
March	22,324	33,374	31,116	100,294
April	22,943	14,271	28,031	22,907
May	10,101	11,566	17,886	14,179
June	12,186	213,312	19,964	404,924
Total	434,050	686,561	680,996	1,910,856

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 511 web site received near-record use in June, 2008, due to flooding across eastern Iowa. Also in June, 511 calls logged the third highest volume since the system's inception in 2003.

The high-bandwidth 511 web site (below) was launched in 2008. 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.



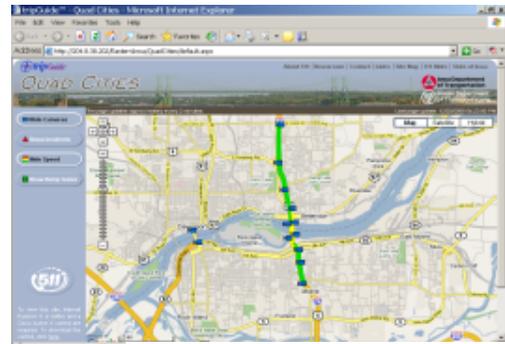
High Bandwidth 511 page

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.

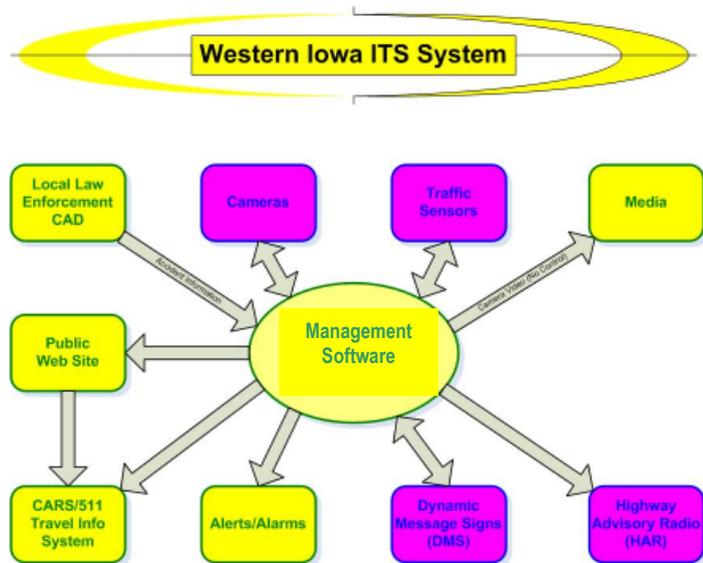


Both the Iowa City and Quad Cities projects have been developed in close coordination with local law enforcement, emergency responders, and traffic officials. The project was funded jointly by the Iowa and Illinois Departments of Transportation.

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 2009, Iowa DOT had 49 overhead 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. 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.



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. SuperHAR was also deployed in Iowa City and Quad Cities in 2008. HAR transmissions can be monitored at http://www.iowadot.gov/research/har_listen.htm.

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)

In November of 2009 the Iowa DOT signed a contract with TransCore ITS, Inc. for the Statewide ITS Management Software (SIMS) project. 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 legacy camera equipment 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 and one month after the new signs were installed. Overall, the new school zone speed limit signs are more effective in reducing speeds than the original signs. The new signs were effective for both directions of traffic and for both start and dismissal periods.

AGM Batteries for ITS Field Devices

Iowa DOT has switched from powering its ITS devices from flooded lead-acid batteries to Valve Regulated Lead-Acid (VRLA) gel electrolyte sealed lead-acid (Gel) batteries and more recently to VRLA Absorbent Glass Mat (AGM) batteries. Deep cycle batteries are primarily used in ITS field devices for backup power as they are designed to provide a steady amount of current over a long period of time. Frequent maintenance and shorter life are two primary reasons why flooded cell batteries are being replaced by VRLA batteries in ITS field devices. The switch was made from flooded batteries to Gel and AGM batteries to reduce maintenance time and cost. Since the switch to Gel and AGM batteries, Iowa DOT has experienced few problems and plans to continue installing them in the future.



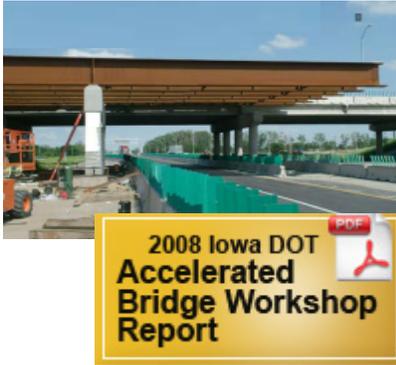
D. Primary Road Research

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 2009 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.

Accelerated Bridge Construction (ABC) Workshop



In August, 2008, Iowa DOT hosted a multi-state workshop in order to get an in-depth overview of accelerated bridge construction (ABC) practices, including reviews of three completed Iowa ABC projects. The workshop explored specific ideas for ABC approach to three major projects in Iowa that require construction acceleration (Broadway Viaduct in Council Bluffs, Steel Arch Bridge in Iowa Falls, and I-80 Reconstruction) and examined design details for prefabricated bridge components that have been used in Iowa. Participants discussed obstacles to implement ABC for these types of bridges. The final workshop report can be found at

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

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. Nine bridge decks are being investigated for the purpose of determining the location and extent of deteriorated concrete prior to future rehabilitation or replacement. All the decks are PC concrete decks with or without dense low-slump concrete overlay. The proposed work concentrates on bridge deck evaluation by several 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:

- 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

New videos in production:

- 2009 Mid-Continent Research Symposium Opening Session and Presentations
- Intelligent Compaction Research
- 2009 Human Factors Workshop Opening Session
- Non-Destructive Bridge Testing & Evaluation
- Pavement Characteristics

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).

The screenshot shows a Windows Internet Explorer browser window displaying the website for the Iowa Department of Transportation's Research and Technology Bureau. The browser's address bar shows the URL <http://www.iowadot.gov/research/index.htm>. The website features a blue header with the text "Iowa Department of TRANSPORTATION" and a navigation menu including "INDEX ABCDEFGHIJKLMNOPQRSTUVWXYZ", "DOT Home", "DOT Phone Book", and "Contact Us". A search bar with "Google Custom Search" is also present. The main content area includes a banner for "IOWA DOT DMS SIGN TEST IN PROGRESS" with a background image of a highway construction site. Below this is a "Research and Technology Bureau" section with a sidebar of navigation links: "Research Home", "Research and Technology", "Research News", "State Planning and Research", "ITS", "(NEW) TRB Conference", "Operations Research", and "DOT Library". The main content area features a "RESEARCH news" section with the subtext "Iowa's winter maintenance technologies research" and an image of a truck on a snowy road. To the right is a "State Planning and Research" section with links for "Iowa-led pooled-fund studies" and "Iowa Highway Research Board". Below this is a video player for "VIDEO 1 (NEW)" showing a man, Kevin Mahoney, speaking at a podium. The video title is "2009 Mid-Continent Transportation Research Symposium" and the description mentions an "Opening session" by Kevin Mahoney, highway division director and chief engineer, Iowa Department of Transportation.

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 8* 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 FY09 awarded research projects are listed in *Attachment 10*. Because proposals are received in August, projects often don't get underway until the next fiscal year. Some projects underway in FY09 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

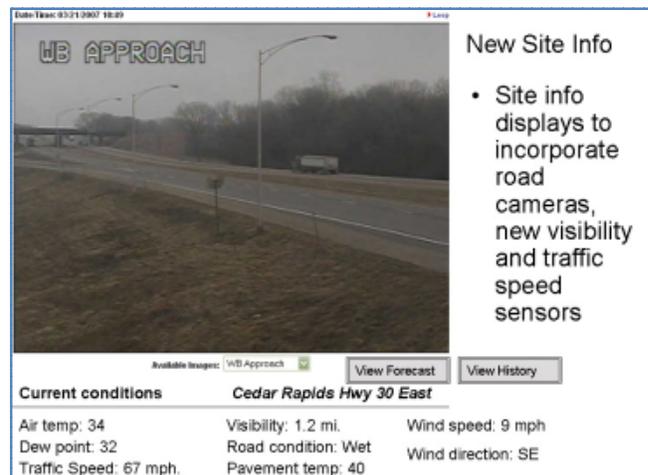
Today, the Department maintains 62 RWIS sites throughout the state. Most sites are equipped with the traditional atmospheric and pavement sensors found on the majority of RWIS sites;



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.



NaI/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.

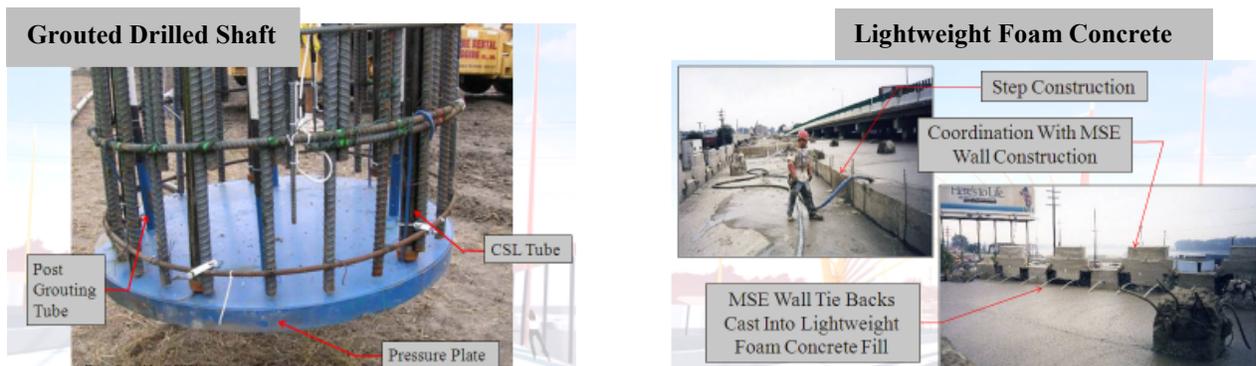
9th Street Bridge Monitor

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 2009 totaling \$94,776.

LRTF Grants Awarded FY 2009		
Researcher	Amount	Research Topic
Kirk Larsen, Luther College	\$ 9,253	Impact of roadside prairie plantings on plant and insect communities
Kathryn Yurkonis, et al, Iowa State University	\$ 11,753	Effects of planting method on species diversity and nutrient cycling in grassland reconstruction
Daryl Smith, University of Northern Iowa	\$ 24,870	The effects of mycorrhizal inoculants and micronutrients on early plant establishment in prairie reconstruction
Daryl Smith, University of Northern Iowa	\$ 24,750	The effects of seeding time on emergence and growth of prairie grasses, sedges, legumes and forbs
Daryl Smith, University of Northern Iowa	\$ 24,150	Comparison of water interception and infiltration by selected grass dominated communities

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
- Committee for Pavement Technology Review and Evaluation - Sandra Larson, member
- NCHRP Project Panel on IDEA - Sandra Larson, member
- NCHRP Panel on Development of Guidelines to Improve Safety During Nighttime Construction or System Preservation Work - Mark Bortle, Chair
- Transportation Safety Management - Tom Welch, member
- Safety Data, Analysis and Evaluation - Tom Welch, member
- Task Force on Highway Safety Workforce Development - Tom Welch, member
- NCHRP Project Panel on Median Intersection Design for Rural High-Speed Divided Highways - Tom Welch, chair

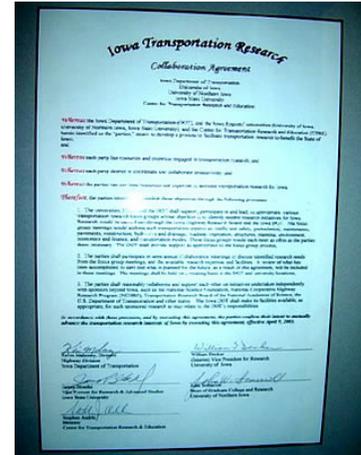
- NCHRP Project Panel on AASHTO Strategic Highway Safety Plan Implementation Support - Tom Welch, member
- NCHRP Project Panel on 2006 AASHTO Bottom Line Scoping – Tom Welch, member
- NCHRP Project Panel on Balancing the Benefits and Tradeoffs of Shoulder Rumble Strips and Centerline Rumble Strips on Divided and Undivided Highways in Urban and Rural Areas - Troy Jerman, 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 Testing and Calibration Methods for RWIS Sensors – Dennis Burkheimer, chair
- Characteristics of Nonbituminous Components of Bituminous Paving Mixtures – Jon Hinrichsen, member
- NCHRP Project Panel on Improvement of Procedures for the Safety-Performance Evaluation of Roadside Features – Dave Little, member
- NCHRP Project Panel on Criteria for Restoration of Longitudinal Barriers – Dave Little, AAASHTO Monitor
- NCHRP Project Panel on Cost Effective Measures and Planning Procedures for Travel Time Variation, Delay, and Reliability – Phil Mescher, member
- SHRP 2 Expert Task Group on Freight Demand Modeling and Data Improvement Strategic Plan – Phil Mescher, member
- NCHRP Project Panel on Administration of Highway and Transportation Agencies – Nancy Richardson, member
- 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 to Develop AASHTO Guidelines for Vegetation Control – 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
- SHRP 2 Expert Task Group on Strategic Approaches at the Corridor and Network Level to Minimize Disruption from the Renewal Process – Brad Hofer, member
- NCHRP Project Panel on Thermally Sprayed Metallic Coatings to Protect Steel Pilings – Joe Putherickal, member
- NCHRP Project Panel on Research for AASHTO Standing Committee on Planning: Support for Improved Transportation Planning and Project Development – Neil Volmer, member
- Statewide Transportation Data and Information Systems – Peggi Knight, member
- NCHRP Project Panel on Next Generation of Pooled Fund Web Site – Carol Culver, 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.

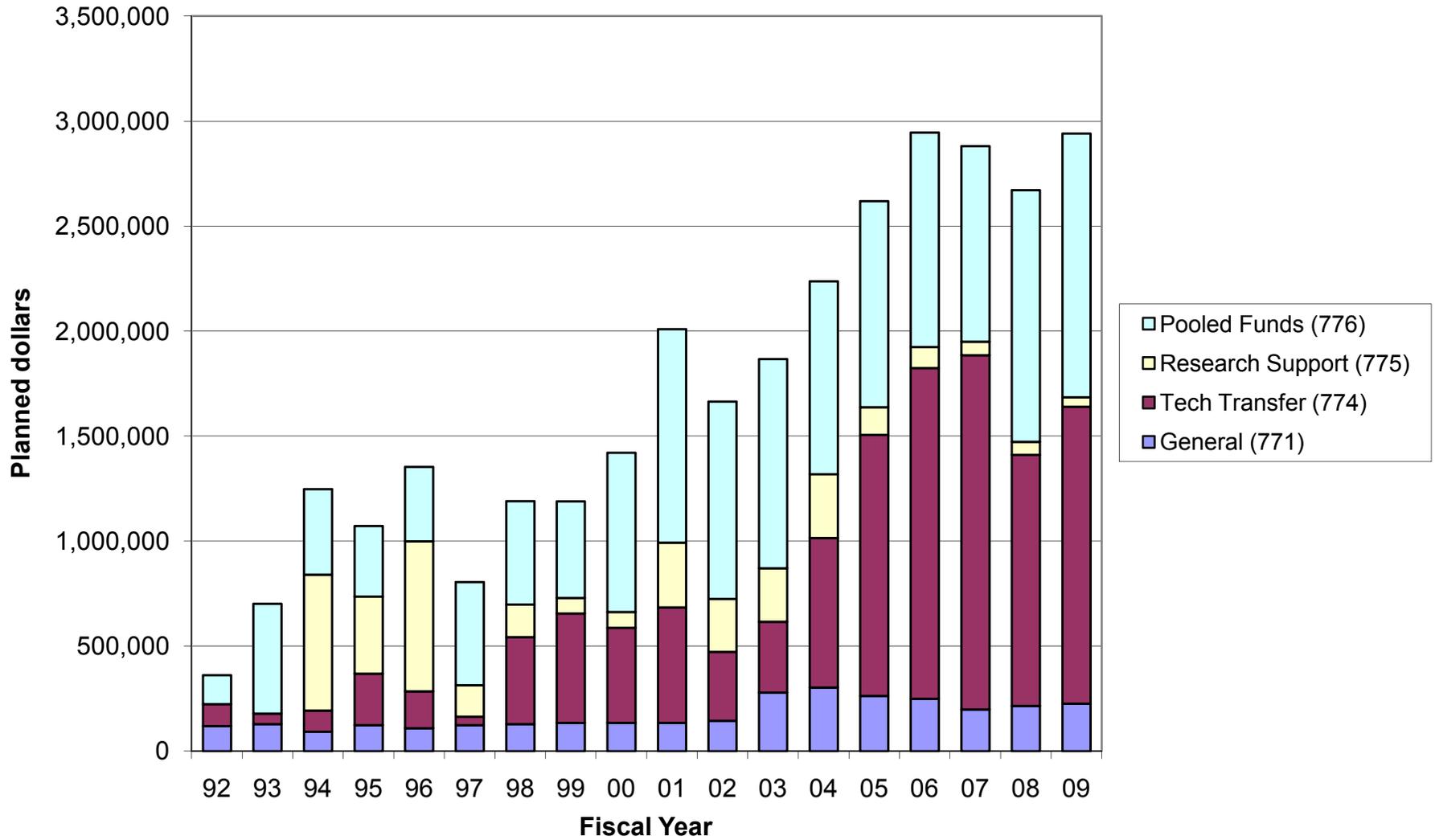


InTrans also supports the Iowa DOT through administration of the DOT Library. The librarian selects, catalogs and retains materials for the library, conducts literature searches for researchers, posts research activities to the Transportation Research Information System (TRIS) and Research in Progress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

V. Attachments

Annual SPR Plan - Distribution of Funds



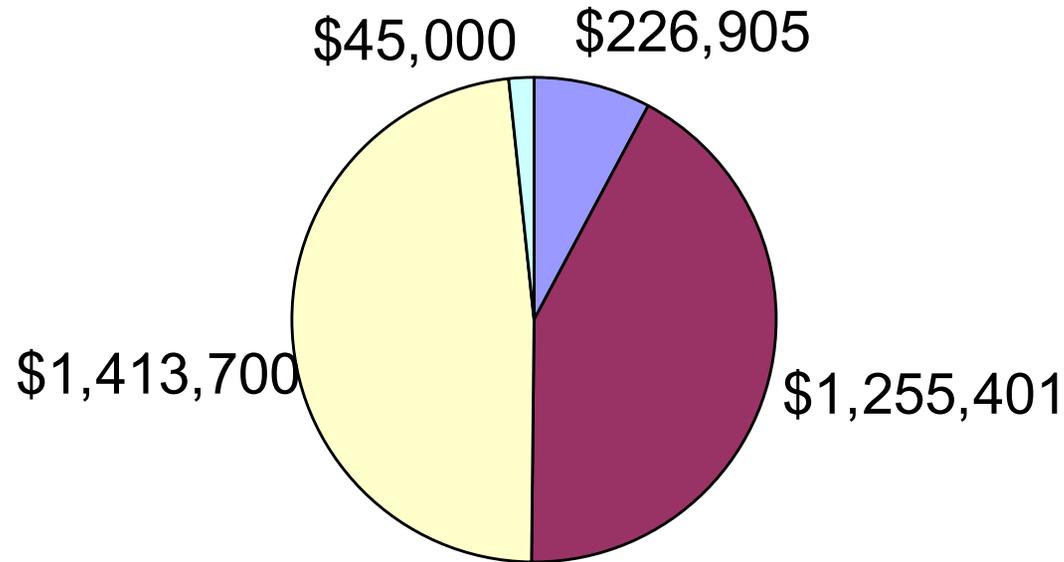
FY 09 SPR					Rev 3 3/31/09	
771 - Administration & Support						
	Title	Est. \$ FY 09	Federal Funds	Iowa DOT Contact	FHWA Contact	# Yrs
	TRB Research Correlation Service	105,905	105,905	Larson	Grogg	
	Library	121,000	96,800	Larson	Grogg	
	General Funds for Future Needs	0	0	Larson	Grogg	
	Total w/ TRB	226,905	202,705			
776 - Pooled Fund Studies (100% Federal)						
Project #	Title (bold print = Iowa led)	Est. FY 09	Federal			
HPR-4(201)	NCHRP	424,401	424,401	Larson	Grogg	Ongoing
SPR-3 (017)	Midwest States Pooled Fund Crash Test Program	55,000	55,000	Maifield	Roche	5+
SPR-3 (020)	Enterprise (IVHS Study)	50,000	50,000	Whited	Grogg	5+
SPR-3 (042)	Aurora Program	25,000	25,000	Burkheimer	Roche	5+
SPR-3 (060)	Highway Maintenance Concept Vehicle	0	0	Burkheimer	Grogg	5+
TPF-5(054)	Maintenance Decision Support System	0	0	Burkheimer	Grogg	1
SPR-3 (079)	REPORT (CARS)	0	0	Whited	Grogg	Complete
TPF-5 (009)	SICOP: AI/RWIS Computer Based Training	4,000	4,000	Burkheimer	Grogg	5+
TPF-5 (021)	Base Funding for North Central Superpave Center	25,000	25,000	Berger	Grogg	5+
TPF-5 (035)	Pacific Northwest Snowfighters	10,000	10,000	Burkheimer	Grogg	2
TPF-5(036)	Transportation Asset Management	0	0	Beane	Grogg	1
TPF-5 (039)	Falling Weight Deflectometer	20,000	20,000	Omundson	Grogg	5+
TPF-5 (046)	TCCC	25,000	25,000	C. Anderson	Grogg	1
TPF-5 (048)	Midwest States Accelerated Testing Program	75,000	75,000	Dunn	Grogg	5+
TPF-5 (065)	Traffic Control Device Consortium	20,000	20,000	Crouch	Roche	1
TPF-5 (068)	LRFD Specifications	20,000	20,000	Larson	Monk	2
TPF-5 (081)	Smart Work Zone Deployment Initiative	30,000	30,000	Sprengeler	Roche	5+
TPF-5 (092)	Clear Roads	25,000	25,000	Burkheimer	Grogg	5+
TPF-5 (098)	Self Consolidating Concrete	0	0	Berger	Grogg	Complete
TPF-5 (100)	Deicer Scaling / Slag Cement	0	0	Berger	Grogg	Complete
TPF-5 (105)	Transportation Library Connectivity	5,000	5,000	Zaletel	Grogg	1
TPF-5 (106)	Guidelines for Designing Bridge Piers and Abutments for Vehicle Collisions	0	0	McDonald	Monk	1

TPF-5(116)	Investigation of Fatigue Life of Steel Base Plate to Pole Connections	15,000	15,000	B Brakke	Monk	2
TPF-5 (117)	Performance Properties of Ternary Mixes	15,000	15,000	Berger	Grogg	2
TPF-5 (132)	Low Temp Cracking of Asphalt Pavement - Ph 2	5,000	5,000	Hinrichson	Grogg	3
TPF-5(139)	PCC Surface Characteristics – Part 3	0	0	C Brakke	Grogg	1
TPF-5 (144)	Teen Driving Study	40,000	40,000	Andre	Roche	1
TPF-5 (148)	Implements of Husbandry (IHRB contributes)	0	0	Dunn	Grogg	1
TPF-5 (159)	TTCC (Iowa led)	7,000	7,000	T Hanson	Grogg	4
TPF-5 (169)	Investigation of Curved Girder Bridges with Integral Abutments	50,000	50,000	McDonald	Monk	1
TPF-5(179)	Evaluation of Test Methods for Permeability	25,000	25,000	Hanson	Grogg	3
TPF-5(183)	Foundations for Concrete Pavements	35,000	35,000	Larson	Grogg	4
TPF-5(187)	Updating U.S. Precipitation Frequency Estimates for the Midwestern Region	20,000	20,000	Claman	Monk	1
TPF-5(185)	CP Roadmap Administration	25,000	25,000	Larson	Grogg	4
TPF-5(189)	Enhancement of Welded Steel Bridge Girders	25,000	25,000	Abu Hawash	Monk	3
TPF-5(194)	Policy on Highway Drainage & Drainage Design Manual	10,000	10,000	Claman	Monk	1
TPF-5(202)	Hy-8 Culvert Analysis Program – Ph 3	10,000	10,000	McDonald	Monk	3
TPF-5(205)	Mix Design and Analysis	25,000	25,000	Hanson	Grogg	3
TPF-5(207)	Novice (School Age) Drivers	20,000	20,000	Andre	Roche	3
TPF-5(213)	Performance of Recycled Asphalt Shingles in Hot Mix Asphalt	40,000	40,000	Schram	Grogg	2
TPF-5(219)	Structural Health Monitoring	50,000	50,000	McDonald	Monk	4
TPF-5(224)	Joint Deterioration in Concrete Pavements	15,000	15,000	Hanson	Grogg	4
Sol 1212	Asset Management	10,000	10,000	Adam	Grogg	2
	General Funds for Future Projects	0	0	Larson	Grogg	
	Total w/ NCHRP	1,255,401	1,255,401			
774 - General Implementation (80% Federal)						
	Title	Est. FY 09	Federal			
	Basic Agreement with CTRE	233,000	186,400	Larson	Grogg	5+
	Remote Sensing Support	10,000	8,000	Kadolph	Grogg	5+
	AASHTO - NTPEP	6,000	4,800	Berger	Grogg	5+
	AASHTO - APEL (Approved Product Eval List)	1,200	960	Dunn	Grogg	5+
	AASHTO - TIG (Technology Implementation Group)	6,000	4,800	Larson	Grogg	5+

	AASHTO - Env Tech Assistance Program	8,000	6,400	Rost	Kennedy	5+
	AASHTO - TSP2	6,000	4,800	Todey	Grogg	5+
	Regional TSP2	3,500	2,800	Todey	Grogg	5+
	PGA Support	50,000	40,000	Larson	Grogg	5+
	Information Technology Development	160,000	128,000	Peperkorn	Grogg	2
	LRFD Training	10,000	8,000	McDonald	Monk	1
	Sign Management System	25,000	20,000	Crouch	Roche	1
	Pavement Marking Management System	25,000	20,000	Crouch	Roche	1
	Investigate Defects in Existing Concrete Railing	20,000	16,000	McDonald	Monk	1
	Accelerated Bridge Const Workshop	13,000	10,400	Abu Hawash	Monk	1
	Bridge Construction Web Management	50,000	40,000	J Nelson	Monk	4
	Performance of Embedded Galvanic Anodes	50,000	40,000	Abu Hawash	Monk	1
	Wapello UHPC Bridge Deck	50,000	40,000	McDonald	Monk	1
	Denver Bypass Monitoring	50,000	40,000	McDonald	Monk	1
	Weathering Steel Bridges	30,000	24,000	McDonald	Monk	1
	Reduce Speed and Crashes on High Crash Curves	40,000	32,000	Welch	Roche	1
	Non Destructive Evaluation of Bridge Decks	114,000	91,200	McDonald	Monk	1
	Monitor Red Rock Mile Long Bridge	46,000	36,800	Abu Hawash	Monk	1
	Teen Driver Fatalities Study	50,000	40,000	Andre	Roche	1
	Evaluation of Iowa's Driver Improvement Program	60,000	48,000	Andre	Roche	1
	Automated Liquid Deicer Blending System	50,000	40,000	Burkheimer	Grogg	1
	Pathfinder IR	40,000	32,000	Burkheimer	Grogg	1
	Portable Weather Station	25,000	20,000	Burkheimer	Grogg	1
	Develop Combination Snow/Deer Control Fence	25,000	20,000	Burkheimer	Grogg	1
	Intelligent Compaction Field Pilot Project	50,000	40,000	Smythe	Grogg	1
	Geotechnical Peer Exchange	35,000	28,000	Adam	Grogg	1
	APWA Snow Conference	7,500	6,000	Burkheimer	Grogg	1
	Technical Training & Conference Plan	138,500	110,800	Larson	Grogg	
	Research Implementation	0	0	Larson	Grogg	
	General Funds for Future Projects	0	0	Larson	Grogg	
	Total	1,487,700	1,190,160			

775 - Highway Research Support (80% Federal)						
	Title	Est. FY 09	Federal			
	MIT Scan T2 Units	45,000	36,000	Jones	Grogg	1
	Automated Chain Drag System	20,000	16,000	Abu Hawash	Monk	1
	General Funds for Future Projects	0	0	Larson	Grogg	
	Total	65,000	52,000			
	Grand Total Research	3,035,006	2,700,266			
	FY 09 SPR ½ % Apportionment		2,476,823			
	Previous Years Unobligated Funds		223,443			
			2,700,266			

FY09 SPR Funding

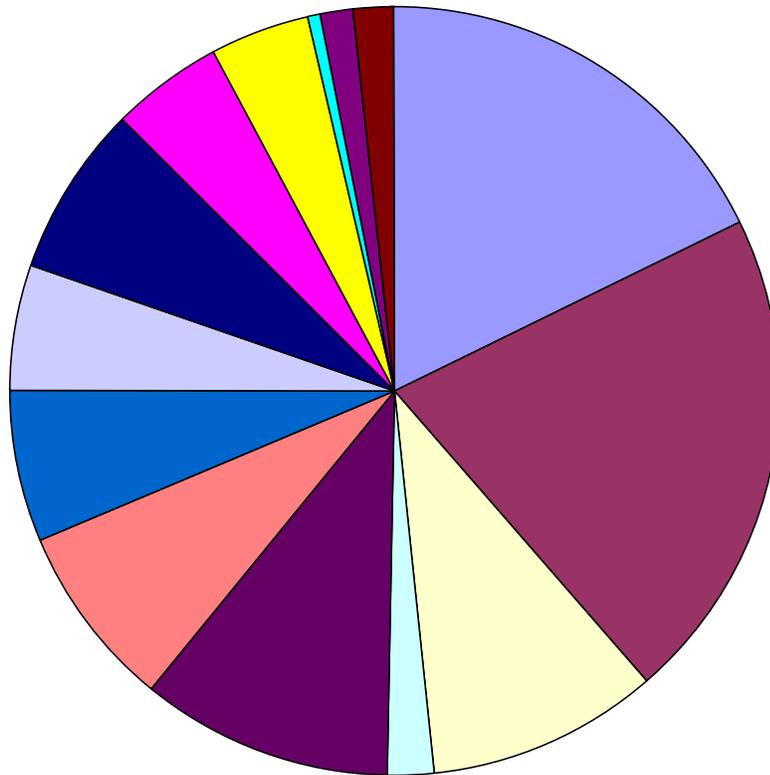


- 771 - Administration
- 776 - Pooled Funds
- 774 - In-house Research and Implementation
- 775 - Research Support

FY 2009 SPR Allocations by Type of Work

Type	\$ Amount	%	Count	% Ct	08 \$
NCHRP & TRB	530,306	18	2	3	508,819
Bridges & Structures	609,000	21	15	22	341,000
Pavements	257,000	10	10	15	194,000
Materials	93,200	2	4	6	108,200
Traffic & Safety	310,000	10	9	13	290,000
InTrans (CTRE)	233,000	8	1	1	243,000
Training & Tech Transfer	187,500	6	2	3	227,000
Info Tech	160,000	5	1	1	180,000
Winter Maintenance	211,500	7	9	13	145,775
Geotechnical	135,000	5	3	4	145,000
Library	126,000	4	2	3	115,000
Highway Design	20,000	1	2	3	65,000
Other	37,500	1	5	7	59,250
ITS	50,000	2	2	3	50,000
Total	2,960,006	100	67	100	2,672,044

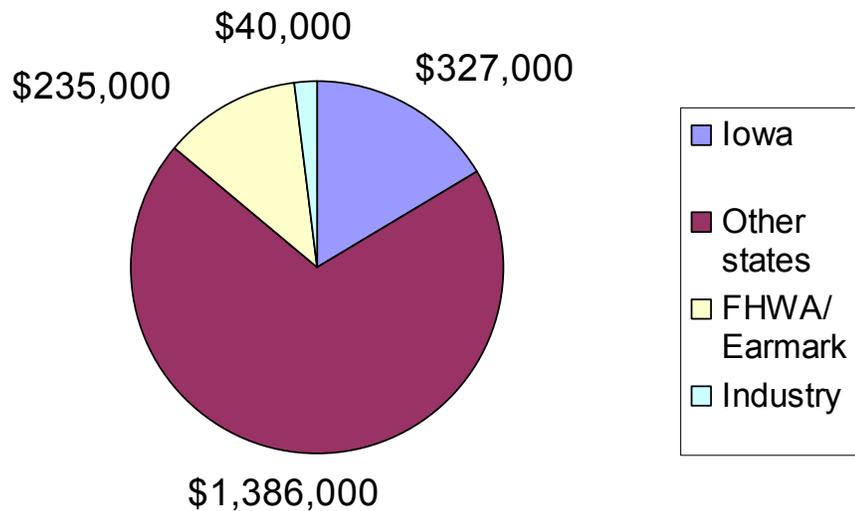
FY 09 SPR Funding by Work Type



FY 2009 Research Funds Leveraged Through Iowa-Led Pooled Fund Projects

Pooled Fund	Iowa 09 \$	Other state 09 \$	FHWA/Earmark \$	Industry 09 \$	Total	% Iowa
Enterprise	50,000	175,000			225,000	22.2%
Aurora	25,000	150,000			175,000	14.3%
LRFD	20,000	370,000			390,000	5.1%
Smart Work Zone	25,000	150,000			175,000	14.3%
Ternary Mix	15,000	105,000			120,000	12.5%
Surface Characteristics	0	15,000			15,000	0.0%
Teen Drivers	40,000	40,000		40,000	120,000	33.3%
TTCC	7,000	96,000			103,000	6.8%
Integral Abutments	50,000	15,000			65,000	76.9%
Foundations	35,000	105,000			140,000	25.0%
Mix Track	25,000	100,000	235,000		360,000	6.9%
Novice Drivers	20,000	35,000			55,000	36.4%
Joint Deterioration	15,000	30,000			45,000	33.3%
Total	327,000	1,386,000	235,000	40,000	1,988,000	16.4%

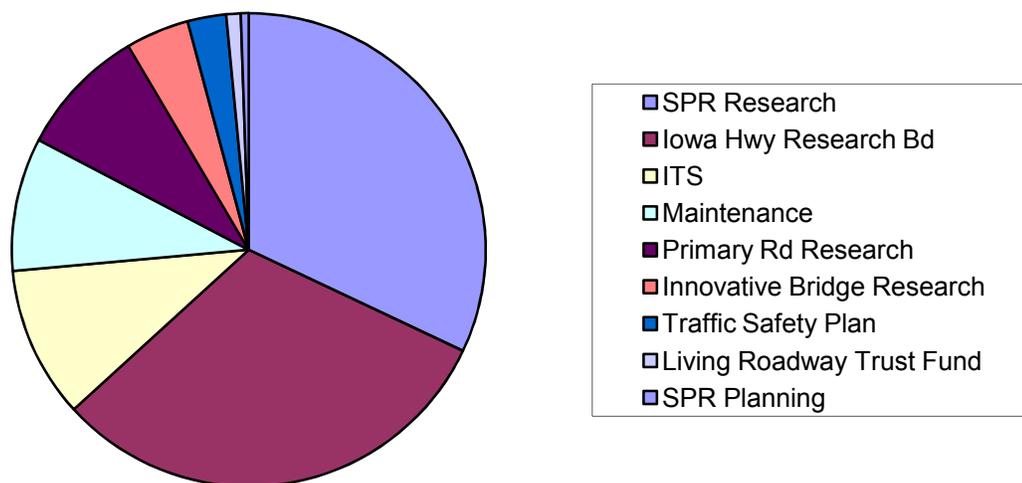
FY 09 Leveraged Funds - Iowa Led Pooled Fund Projects



FY 2009 All DOT Research Funding Sources

Office	\$ Amount	Source
Bridges & Structures	400,000	IBRC
Design	94,776	Living Roadway Trust Fund
Maintenance	862,000	Operating Funds
Research & Technology	982,500	ITS
Systems Planning	50,000	SPR Planning Funds
Traffic & Safety	250,000	TSIP (1/2% State Road Use Tax Fund)
Subtotal	\$2,639,276	
SPR Research	3,037,006	
IHRB	2,959,388	
Primary Road Research	838,732	
Grand Total	\$ 8,587,402	

FY09 Research Funding Sources



**FY 2009 Traffic Safety Improvement Program
Research Projects**

Title	Amount
Dilemma Zone Protection Pilot Study	50,000
Exploration & Comparison of Alternate Methods for Developments of the Top 5% Severe Safety Needs	30,000
Evaluation of Dynamic Warning Signs at High Crash Rural Curves, Phase 1	40,000
Benefits & Costs of Three Alternate Methods of Safety Resource Programming	40,000
Older Driver & Pedestrian Safety Pilot Project – Iowa City	40,000
Wet Reflective Pavement Marking Demonstration Project	50,000
	250,000

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

**FOR THE
FISCAL YEAR ENDING JUNE 30, 2009**

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

HIGHWAY DIVISION
IOWA DEPARTMENT OF TRANSPORTATION
AMES, IOWA 50010

DECEMBER 2009

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 2009.....	7
Projects Completed During FY 2009.....	8
Table II - Financial Summary of Research and Development Project Expenditures	9
Research Project Descriptions	12

LIST OF ACRONYMS

AASHTO - American Association of State Highway and Transportation Officials	LVR - Low Volume Road
ACC - Asphalt Cement Concrete	MOVITE - Missouri Valley Section of the Institute of Transportation Engineers
ADV - Acoustic Doppler Velocimeter	NAT - Nottingham Asphalt Tester
APWA - American Public Works Association	NCHRP - National Cooperative Highway Research Program
ASCE - American Society of Civil Engineers	NDT - Non-Destructive Testing
BMP - Best Management Practice	NPDES - National Pollution Discharge Elimination System
CIPR - Cold In-Place Recycling	NRCS - National Resource Conservation Service
CP - Concrete Pavement	PCA - Portland Cement Association
CPTP - Comprehensive Public Training Program	PCC - Portland Cement Concrete
CTRE - Center for Transportation Research and Education	PI - Principal Investigator
DOT - Department of Transportation	QA - Quality Assurance
DSM - Decision Support Model	QC - Quality Control
FHWA - Federal Highway Administration	QM-E - Quality Management - Earthwork
FRP - Fiber Reinforced Polymer	RC - Reinforced Concrete
FWD - Falling Weight Deflectometer	RRFC - Railroad Flat Car
GIS - Geographic Information System	RSAP - Roadside Safety Analysis Program
HMA - Hot Mix Asphalt	SHRP - Strategic Highway Research Program
IHRB - Iowa Highway Research Board	SUDAS - Statewide Urban Designs and Specifications
ISRCIM - Iowa Stormwater Runoff Control Interactive Manual	TAC - Technical Advisory Committee
ISU - Iowa State University	TRB - Transportation Research Board
LRFD - Load and Resistance Factor Design	USGS - United States Geological Survey
LTAP - Iowa State University Local Technical Assistance Program	

RESEARCH AND DEVELOPMENT

The Highway Division of the Iowa Department of Transportation (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 FY2009” 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, 2009. It is also a report on projects completed during the fiscal year beginning July 1, 2008 and ending June 30, 2009. 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: *WORKING TO HELP IOWA*

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

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, 2009, is listed in Table I.

The Research Board held eight regular meetings during the period from July 1, 2008, through June 30, 2009. 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.

www.iowadot.gov/operationsresearch/iowa_highway_research_board.asp

TABLE I

2009 IOWA HIGHWAY RESEARCH BOARD MEMBERS & ALTS

June 30, 2009

<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 (515) 239-1393	12-31-09	Deanna Maifield Methods Engineer Iowa DOT – Office of Design 800 Lincoln Way Ames, IA 50010 (515) 239-1402
John Adam - Deputy Director Iowa DOT - Statewide Operations Bureau 800 Lincoln Way Ames, IA 50010 (515) 239-1333	12-31-11	Will Zitterich - Assistant Director Iowa DOT – Office of Maintenance 800 Lincoln Way Ames, IA 50010 (515) 239-1396
James Alleman Dept. of CCE Engineering Iowa State University 390 Town Engineering Bldg. Ames, IA 50011 (515) 294-3532	12/31/11	
Wade Weiss Green County Engineer 114 N. Chestnut Jefferson, IA 50129 (515) 386-3316 SS# 037	12-31-11 District 1	Robert Kieffer Boone County Engineer 201 State Street Boone, IA 50036-3988 (515) 433-0530 SS# 008
Vicki Dumdei - District Engineer Hwy Div - District 2 1420 Fourth St. S.E. Mason City, IA 50401-4438 (641) 422-9465	12-31-10	Robert Younie - Director Office of Maintenance 800 Lincoln Way Ames, IA 50010 (515) 239-1542
Keri Hornbuckle Dept. of Civil & Env. Engineering The University of Iowa 4138 Seamans Center Iowa City, IA 52242 (319) 384-0789	12-31-10	Douglas Schnoebelen The University of Iowa – IIHR 323A SHL 300 South Riverside Drive Iowa City, Iowa 52242-1585 319-335-6061
J. Jay Waddingham Franklin County Engineer 1341 Olive Avenue, PO Box 118 Hampton, IA 50441 (641) 456-4671 SS# 035	12-31-10 District 2	J.D. King Fayette County Engineer 114 N. Vine Street, PO Box 269 West Union, IA 52175 (563) 422-3552 SS# 033
Scott Rinehart Clay County Engineer 300 W. 4 th Street #5 Spencer, IA 51301-2806 (712) 262-2825 SS# 021	12-31-09 District 3	Jack Moellering Pocahontas County Engineer 1 Ct Square, 99 Court Square – Ste. 4 Pocahontas, IA 50574-1629 (712) 335-3252 SS#076

Continued. 2009 IOWA HIGHWAY RESEARCH BOARD MEMBERS & ALTS

Jim Berger Director Iowa DOT – Office of Materials 800 Lincoln Way Ames, IA 50010 (515) 239-1843	12-31-09	Mark Kerper Assistant Director Iowa DOT - Office of Loc & Environment 800 Lincoln Way Ames, IA 50010 (515) 239-1591
John Joiner Public Works Director 515 Clark Avenue P.O. Box 811 Ames, IA 50010 (515) 239-5165	12-31-11	Ronald Knoche City Engineer 410 E. Washington Street Iowa City, IA 52240-1825 (319) 356-5138
Jeff Krist Public Works Project Manager 209 Pearl Street Council Bluffs, IA 51503 (712) 328-4635	12-31-09	Richard Fosse Director of Public Works 410 E. Washington Street Iowa City, IA 52240-1825 (319) 356-5141
Mark Nahra Woodbury County Engineer 620 Douglas Sioux City, Iowa 51101 (712) 279-6484 SS# 097		
Dan Ahart Shelby County Engineer 1313 Industrial Parkway Harlan, IA 51537 (712) 755-5954 SS# 083	12-31-11 District 4	Kevin Mayberry Mills County Engineer 403 Railroad Avenue Glenwood, IA, 51534 (712) 527-4873 SS# 065
Brian Moore Wapello County Engineer 536 Mill St. Ottumwa, Iowa 52501 (641) 684-5425 SS# 090	12-31-10 District 5	Ernie Steffensmeier Lee County Engineer 933 Avenue H Fort Madison, IA, 52627 (319) 372-2541 SS#056
Steve Gannon Linn County Engineer 1888 County Home Road Marion, IA 52302-9753 (319) 892-6400 SS# 057	12-31-09 District 6	Clark Schloz Jackson County Engineer 201 W. Platt Maquoketa, IA 52060 (563) 652-4782 SS#049

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 funds for research and development are 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, 2009. Total expenditure was \$2,959,388.29.

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 National Cooperative Highway Research Program (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 Transportation Research Board (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 percent 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 and road inventories 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 24 counties during fiscal year 2009 as part of the Annual Traffic Count Program. This activity consisted of 6100 portable recorder classification counts, 100 portable recorder volume counts and 48 manual 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 and submitted by 98 counties. 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 percent 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 2009 financial summary is:

Beginning Balance 7-1-08		\$1,685,667.62
Receipts		
State Road Use Tax Fund		
(1½% of receipts)	\$1,173,460.50	
Federal Aid Secondary		
(1½% of receipts)	0.00	
Research Income	0.00	
Sub-Total		<u>\$1,173,460.50</u>
Total Funds Available		\$2,859,128.12
Obligation for Expenditures		
Obligated for		
Contract Research	\$1,705,000.99	
Non-Contract		
Engineering Studies	<u>\$99,474.79</u>	
Total Expenditures		<u>\$1,804,475.78</u>
Ending Balance 6-30-09		\$1,054,652.34

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 2009 financial summary is:

Beginning Balance (7-1-08)	\$ 29,841.00
Unobligated (Unused) Funds from Previous Projects	140,419.98
FY09 Street Research Funding	<u>\$200,000.00</u>
Total Funds Available for Street Research	\$370,260.98
Total Obligated for Expenditure FY09	<u>\$235,172.00</u>
Ending Unobligated Balance 6-30-09	\$135,088.98

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 FY09 was \$928,659.81 and the estimate for FY10 is \$750,000.

PROJECTS INITIATED DURING FY 2009

- HR-140 (140F) Special Flood Profiles
- HR-140 (140G) Collection and Analysis of Streamflow Data
- HR-296 Iowa State University Local Technical Assistance Program (LTAP)
- TR-595 Autonomous Measurements of Bridge Pier and Abutment Scour Using Motion-Sensing Radio Transmitters
- TR-596 Insights into the Origin and Characteristics of the Sedimentation Process at Multi-Barrel Culverts in Iowa
- TR-597 Wet Reflective Pavement Marking Demonstration Project
- TR-598 Development of Updated Specifications for Roadway Rehabilitation Techniques
- TR-599 Investigation of Warm Mix Asphalt Using Iowa Aggregates
- TR-600 Improving Concrete Overlay Construction
- TR-601 Roadway Lighting and Safety: Phase II - Monitoring, Quality, Durability and Efficiency
- TR-602 Updating Portions of the Three-Span Prestressed Concrete Beam Bridge Standards to LRFD Specifications – Part I
- TR-603 Updating Portions of H-Standard Three Span Prestressed Beam Bridges, T-Pier and Pile Bent Pier Update to LRFD - Part II
- TR-604 Field Testing and Evaluation of a Demonstration Timber Bridge
- TR-605 Evaluation of the Buena Vista IBRD Bridge: A Furthering of Accelerated Bridge Construction in Iowa
- TR-606 Leadership Academy (LTAP)
- TR-607 Review of Inconsistencies Between SUDAS & Iowa DOT Specifications
- TR-608 Assessment of Iowa County Roadway Financing Needs
- TR-610 On-The-Spot Damage Detection Methodology for Hwy Bridges During Natural Crisis
- TR-611 Wireless Sensor Networks for Infrastructure Monitoring

19 Projects Initiated

PROJECTS COMPLETED DURING FY 2009

The following projects were completed during FY 2009 and project Final Reports were approved by the Iowa Highway Research Board:

TR Number	TITLE	REPORT
516	Measurement of Seasonal Changes and Spatial Variation in Pavement Subgrade Support Properties - A Link to Pavement Performance	7/25/08
545	Development of Self-Cleaning Box Culvert Designs	6/26/09
554	Performance & Evaluation of Concrete Pavement Granular Subbase	7/25/08
480	Investigation of the Long Term Effects of Concentrated Salt Solutions on Portland Cement Concrete	4/24/09
533	Evaluation of Design Flood Frequency Methods for Iowa Streams	6/26/09
525	Design Guide for Improved Quality of Roadway Subgrades and Subbases	9/26/08
541	The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa	1/30/09
558	Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications	12/4/08
560	Clear Zone - A Synthesis of Practice and Benefits of Meeting the Ten-Foot Clear Zone Goal on Urban Streets	12/4/08
561	Laboratory, Field Testing and Evaluation of Precast Bridge Elements	3/27/09
569	Quantitative Mapping of Waterways Characteristics at Bridge Sites	12/4/08
571	GIS-Based Decision and Outreach Tools for Aggregate Source Management	9/26/08
572	Improving Safety for Slow Moving Vehicles on Iowa's High-Speed Rural Roadways	5/29/09
576	Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavements - Phase II	5/29/09
587	Crack Development in Ternary Mix Concrete Utilizing Various Saw Depths	4/24/09
588	Statewide Consultant Services from Stanley Consultants, Update Bridge "J" Standards	12/1/08
590	Cold In-Place Recycling (TR-553) Phase II-Measuring Temperature, Moisture, Deflection and Distress for the Test Section	4/24/09
239	(HR-239) Load Ratings for Standard Bridges - Phase IV	6/26/09

18 Projects Completed

Table II

FINANCIAL SUMMARY OF RESEARCH AND DEVELOPMENT PROJECT EXPENDITURES

July 1, 2008 to June 30, 2009

(Active projects with no current fiscal year expenditures are not included)

<u>Project</u>	<u>Project Title</u>	<u>Primary Road</u>	<u>Secondary Road</u>	<u>Street Research Fund</u>	<u>Total</u>
		<u>Research Fund Expenditures</u>	<u>Research Fund Expenditures</u>	<u>Expenditures</u>	<u>Expenditures</u>
140	Collection and Analysis of Stream Flow Data	184,056.00	181,295.00		365,351.00
239IV	Load Ratings for Standard Bridges - Phase IV		74,847.15		74,847.15
296	ISU Local Technical Assistance Program (LTAP)	75,713.58	59,632.45	13,000.00	148,346.03
375	TRB Education for County Engineers		2,570.43		2,570.43
428	Effective Structural Concrete Repair	13,264.09	13,264.06	2,947.59	29,475.74
468	Technology Transfer Program for the Iowa Highway Research Board (IHRB)	334.96	1,093.40		1,428.36
519	Developing Flood-Frequency Discharge Estimation Methods for Small Drainage Basins in Iowa		64,892.50		64,892.50
520	Evaluation of Dowel Bar Retrofits for Local Road Pavements		14,480.29	764.65	15,244.94
529	Construction and Evaluation of a Prestressed Concrete Bridge Constructed Using Ultra High-Performance Concrete	4,284.20	7,933.91	1,918.49	14,136.60
530	Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection	444.78			444.78
533	Design Flood Frequency Methods for Iowa Streams	14,982.62	11,407.80	1,279.02	27,669.44
539	Instrumentation and Monitoring of Precast, Post-tensioned Bridge Approach Pavement	743.25	1,362.97	393.94	2,500.16
545	Development of Self-Cleaning Box Culvert Designs	38,334.26	29,424.76	1,447.81	69,206.83
546	Revision to the SUDAS Traffic Signal Design Guide	2,446.91	1,308.90	20.92	3,776.73
550	Performance Evaluation of Rubblized Pavements in Iowa	8,394.56	4,724.99	65.41	13,184.96
551	Local Agency Pavement Marking Plan	13,132.42	10,229.83	4,038.23	27,400.48
553	Examination of Curing Criteria for Cold In-Place Recycling	3,999.99	4,999.99	1,000.00	9,999.98
555	Evaluation of Hot Mix Asphalt Moisture Sensitivity using the Nottingham Asphalt Test Equipment	17,079.51	21,777.42	3,169.58	42,026.51
556	Feasibility Investigation of Segmentally Precast Bridge Piers for Accelerated Construction	138.51			138.51
558	Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications	320.61			320.61
559	Improved Method for Determining Wind Loads on Highway Sign and Traffic-Signal Structures	13,125.06	11,430.35	4,525.00	29,080.41
560	Clear Zone - A Synthesis of Practice and Benefits of Meeting the Ten-Foot Clear Zone Goal on Urban Streets	5,559.94			5,559.94
561	Precast Bridge Elements	6,571.38			6,571.38
564	Adding Scour Estimation to the Iowa Bridge Backwater Software		2,988.00	4,374.00	7,362.00
566	Investigation of Utility Cut Repair Techniques to Reduce Settlement in Repair Areas	37,673.85			37,673.85
567	Development of Stage-Discharge Relations for Ungaged Bridge Waterways	29,237.02	20,547.56	2,881.16	52,665.74
568	Modified Sheet Pile Abutments for Low Volume Bridges	41,181.38	85,524.34	8,760.61	135,466.33

Project	Project Title	Primary Road	Secondary Road	Street Research	Total
		Research Fund	Research Fund	Fund	
		Expenditures	Expenditures	Expenditures	Expenditures
569	Quantitative Mapping of Waterways at Bridge Sites		19,086.64	153.69	19,240.33
570	Identification of Practices, Design, Construction and Repair Using Trenchless Technology	37,866.60	20,155.20	4,870.55	62,892.35
571	GIS-Based Decision and Outreach Tools for Aggregate Source Management	34,544.00	43,178.00	8,635.00	86,357.00
572	Improving Safety for Slow Moving Vehicles on Iowa's High-Speed Rural Roadways	10,571.42	38,540.51		49,111.93
573	Development of LRFD Design Procedures for Bridge Piles	14,561.42	42,040.11		56,601.53
574	Structural Design Construction & Evaluation of a Pre-stressed Concrete Bridge Using UHPC Pi Girders	163.80	9,513.83	8,000.00	17,677.63
576	Investigation of Electromagnetic Gauges for Determination of In-Place Density of HMA Pavements - Phase II	6,822.57	3,588.59	251.33	10,662.49
577	Evaluation of Rumble Stripes on Rural Roads in Iowa	809.70	2,545.85	4,643.50	7,999.05
578	Development of Mix Design Process for Cold In-Place Recycling Using Emulsion - Phase 3	17,584.12	14,785.59	1,470.68	33,840.39
579	Strategies to Reduce Speed and Crashes on Curves	7,799.46	4,155.12	3,779.02	15,733.60
580	Pavement Markings and Safety	9,780.08	48,000.00	4,548.31	62,328.39
581	Development of an Improved Agricultural-Based Deicing Product	4,285.94	21,953.76	6,984.44	33,224.14
582	Ethanol By-Product Geo-Material Stabilization		22,212.06	3,679.60	25,891.66
583	Field Testing of Piles & Development of a Wave Equation Method for Pile Design in IA	55,056.86	31,107.67	21,454.92	107,619.45
584	Establishing a Dynamic Formula for Pile Design & Construction Control of Pile Driving	14,835.38	20,695.84	6,040.08	41,571.30
585	National Agriculture Image Program Participation	70,000.00	30,000.00		100,000.00
586	Pavement Thickness Design for Local Roads in Iowa	8,361.16	19,297.25	1,649.34	29,307.75
587	Impact of Low Shrinkage Mixes on Late-age Random Cracking in Pavements with Use of Early Entry Sawing	10,874.70	20,000.00	4,000.00	34,874.70
588	Statewide Consultant Services from Stanley Consultants, Update Bridge "J" Standards		116,805.24		116,805.24
590	Cold In-Place Recycling (TR-553) Phase II-Measuring Temperature, Moisture, Deflection and Distress for the Test Section	19,055.12	27,859.44	5,766.00	52,680.56
591	Stabilization to Mitigate Edge Rutting for Granular Shoulders	18,270.97	37,156.30	5,502.47	60,929.74
592	Bridge Rails and Approach Railing for Low-Volume Roads in Iowa	17,549.86	25,000.00	5,000.00	47,549.86
593	Infrastructure Impacts on Iowa's Changing Economy	9,359.73	36,060.56	12,000.00	57,420.29
594	Development of Non-Petroleum Based Binders for Use in Flexible Pavements	9,724.45	13,950.05	3,309.47	26,983.97
595	Autonomous Measurements of Bridge Pier and Abutment Scour Using Motion-Sensing Radio Transmitters	8,773.28	25,918.75	5,700.00	40,392.03
596	Insights into the Origin and Characteristics of the Sedimentation Process at Multi-Barrel Culverts in Iowa	29,101.00	17,140.61	5,031.01	51,272.62
597	Wet Reflective Pavement Marking Demonstration Project	1,889.31	931.14		2,820.45
598	Development of Updated Specifications for Roadway Rehabilitation Techniques		25,907.84	1,848.80	27,756.64
599	Investigation of Warm Mix Asphalt Using Iowa Aggregates		20,126.00	4,553.74	24,679.74

<u>Project</u>	<u>Project Title</u>	Primary Road	Secondary Road	Street	Total
		Research Fund	Research Fund	Research Fund	
		<u>Expenditures</u>	<u>Expenditures</u>	<u>Expenditures</u>	<u>Expenditures</u>
600	Improving Concrete Overlay Construction		88,884.70	16,914.99	105,799.69
601	Roadway Lighting and Safety: Phase II (TR-540) Monitoring, Quality, Durability and Efficiency		1,754.18		1,754.18
602	Part I - Updating Portions of the Three-Span Prestressed Concrete Beam Bridge Standards to LRFD Specifications		57,103.28		57,103.28
603	Part II - Updating Portions of H-Standard Three Span Prestressed Beam Bridges, T-Pier and Pile Bent Pier Update to LRFD		136,177.12		136,177.12
604	Field Testing and Evaluation of a Demonstration Timber Bridge		34,899.42		34,899.42
606	Leadership Academy (LTAP		13,190.36	5,105.07	18,295.43
607	Review of Inconsistencies Between SUDAS & Iowa DOT Specifications		3,645.15	8,545.90	12,191.05
1027	Secondary Road Research Coordinator		101,601.90		101,601.90
Total of Expenditures		928,659.81	1,820,704.16	210,024.32	2,959,388.29

HR-140

Agency:

United States
Geological Survey

Principal Investigator:

Rob Middlemis-
Brown

Research Period:

July 1, 1967 to
September 30, 2010
Annual Renewal

Research Board Funding:

\$239,440

Funding Source:

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

Collection and Analysis of Stream Flow Data

Objective: To 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; To 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. Extensive flooding in Iowa during June, 2008, resulted in a request to researchers for creation of several special Flood Event Reports.

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:
Duane Smith

Research Period:
October 1, 1986 to
December 31, 2008

Research Board Funding:
\$130,000

Funding Source:
35.9% Federal funds,
15.4% 402 Safety funds,
14.4% ISU/Midwest Transportation Center funds,
8.7% Workshop income funds and
25.6% State –
10% Primary funds
45% Secondary funds
45% Street funds

*promote research -
encourage implementation -
distribute research data*

Iowa State University Local Technical Assistance Program (LTAP)

Objective: To 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 at least five *Technology News* newsletters per year
- Conduct at least 10 training courses/workshops per year
- Distribute publications
- Provide service and information to users
- Present transportation safety information to rural communities by employing a Transportation Safety Circuit Rider

Reports: Newsletters

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.



Participants at the 2007 Expo discover the latest technology and equipment
Photo: Iowa State University/InTrans

HR-375

Agency:

Iowa Department of
Transportation,
Highway Division

**Principal
Investigator:**

Edward J. Engle

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: To annually send two county engineers to the Transportation Research Board (TRB) Annual Meeting in Washington, D.C., for research education. County engineers selected are generally those starting their term as regular members of the Iowa Highway Research Board (IHRB). Attending 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: In the time period from 1995 - 2009, a total of 23 county engineers have been sent to TRB.

Reports: None

Implementation: County engineers who have attend 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.



New and Young Attendees Welcome Session held during the TRB 2009 Annual Meeting in Washington, D.C.

Photo: Cable Risdon, Transportation Research Board

TR-428

Agency:
Iowa State University

Principal Investigator:
F. Wayne Klaiber and
Terry J. Wipf

Research Period:
February 1, 1999 to
December 31, 2009

Research Board Funding:
\$294,760

Funding Source:
100% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Effective Structural Concrete Repair

Objective: Objectives are to develop innovative repair methods and/or materials that result in cost effective repair of structural concrete elements.

Progress: A Final Report summarizing the work to date was presented at the April 2004 IHRB meeting. Also, a synopsis of the installation procedures used for each of the Fiber Reinforced Polymers (FRP) wraps has been created for use by maintenance personnel. The synopsis is included as an appendix to the Final Report. A revised Final Report will be prepared in 2009 to reflect the service life of the documented repairs.

Reports: Final Report, April 2004

Implementation: Results from this investigation will provide technical information that bridge and other engineers can use to lengthen the useful life of structural concrete bridges.



A transverse CFRP jacket being installed on a beam
Photo: Iowa State University/InTrans

TR-450

Agency:

Purdue University,
sub-contract with
Iowa State University

Principal Investigator:

Rebecca S. McDaniel
(Purdue University)
and Brian Coree
(Iowa State
University)

Research Period:

June 1, 2001 to
June 30, 2007

Research Board Funding:

\$80,000 (Purdue
University - \$23,674;
Iowa State University
- \$56,326)

Funding Source:

Pooled funds
coordinated by North
Central Superpave
Center at Purdue
University –
50% Institute for
Safe, Quiet, and
Durable Highways
funds,
25% Indiana DOT
funds and
25% State -
100% Primary funds

Identification of Laboratory Techniques to Optimize Superpave HMA Surface Friction Characteristics

Objective:

- Evaluate various blends of aggregates
- Optimize the combination of micro- and macro-texture to achieve a desired level of friction
- Evaluate aggregate classifications and properties currently used to provide desirable friction levels for high traffic and possibly revise them based upon this research

Progress: Draft Final Report being written for delivery, January, 2010

Reports: None

Implementation: These research findings will identify blends of aggregates to be used in Iowa for maintaining the current baseline of friction. It is anticipated that increased macrotexture will diminish the need for high quality friction aggregates (to provide increased microtexture), resulting in more economical surface courses through reducing the need to import friction aggregates.

TR-458

Agency:

The University of Iowa

Principal Investigator:

Wilfrid A. Nixon

Research Period:

May 1, 2001 to
April 30, 2006

Research Board Funding:

\$151,920

Funding Source:

100% State -
30% Primary funds,
60% Secondary funds
and 10% Street funds

Field Testing of Abrasive Delivery Systems in Winter Maintenance

Objective: To conduct a series of experiments aimed at improving the ability of abrasives to increase friction on snow and ice-covered roads. Two novel delivery methods were tested and compared with existing delivery methods, using a friction measuring device.

Reports: Final Report, September 2009

Implementation: Maintaining roads during winter in Iowa is difficult. The safety of the driving public is paramount.

A series of field experiments have been conducted to determine whether a standard or a chute based delivery system provides better friction when used to deliver abrasives to the road during winter storms. On the basis of these tests, no significant differences can be found between the two systems.

Reviews of other methods for material delivery have been made, together with an extensive report of a series of Iowa DOT tests on zero-velocity spreaders. On the basis of field testing and the reviews, a number of recommendations with respect to material delivery systems are available in printed and online pdf copies.



A sander chute in operation mode
Photo: The University of Iowa/IHR

TR-468

Agency:

Iowa Department of
Transportation

**Principal
Investigator:**

Mark J. Dunn

Research Period:

December 1, 2001 to
on-going

**Research Board
Funding:**

\$10,000

Funding Source:

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

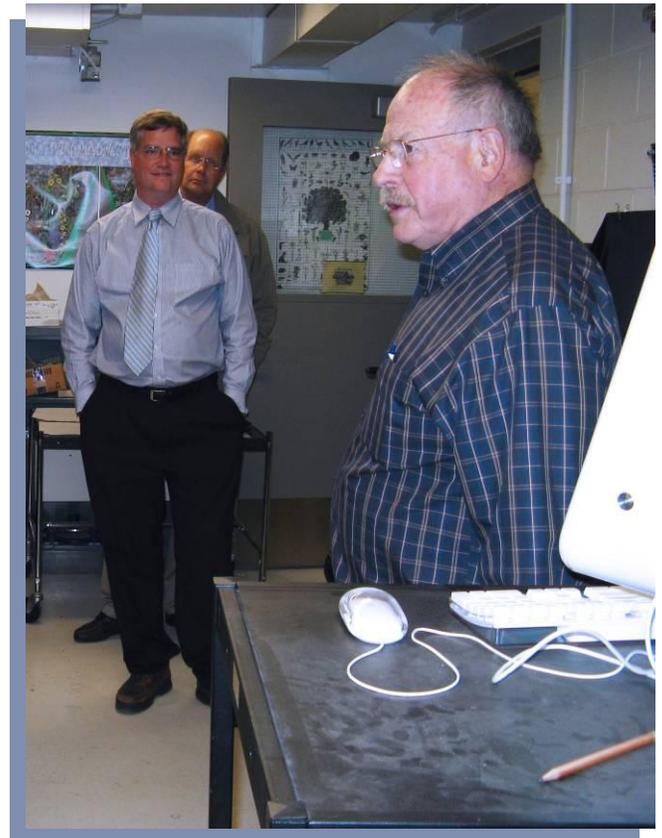
Technology Transfer Program for the Iowa Highway Research Board

Objective: To provide improved research technology transfer and information distribution to the Iowa Highway Research Board (IHRB) and to transportation professionals in Iowa and provide resources for facility costs for small workshops related to IHRB research when it would be beneficial to transfer technology.

Progress: This project covers meeting costs for the Iowa Highway Research Board's Annual Travel Meeting at field sites in Iowa. Costs for the digital conversion of research report HR-29 "Drainage Areas for Iowa Streams" were also covered by this project.

Reports: None

Director of the Tallgrass Prairie Center at the University of Northern Iowa, Dr. Daryl Smith, discusses the Iowa Ecotype Project with the Iowa Highway Research Board during their Annual Travel Meeting on September 25, 2009.
Photo: Mary Starr, Iowa DOT, Research Bureau



TR-472

Agency:
The University of
Iowa

**Principal
Investigator:**
Wilfrid A. Nixon

Research Period:
May 1, 2002 to
December 31, 2004

**Research Board
Funding:**
\$80,000

Funding Source:
100% State -
60% Primary funds,
35% Secondary funds
and 5% Street funds

Investigation of Materials for the Reduction and Prevention of Corrosion on Highway Maintenance Equipment

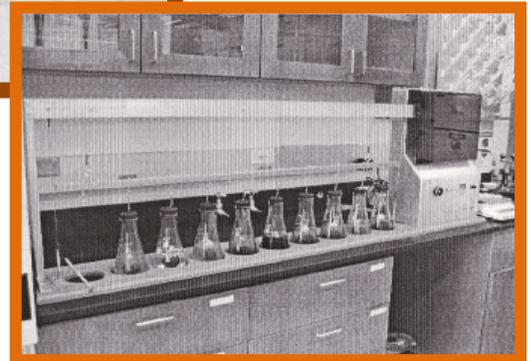
Objective: To find methods that can effectively and economically reduce corrosion on maintenance vehicles, especially when liquid deicing chemicals are being used.

Reports: Final Report, September 2009

Implementation: The recommendations and conclusions identified as having potential to minimize corrosion in winter maintenance equipment, thus reducing lifetime costs for vehicles, are presented in the report which is available via email to all subscribers on the snow and ice mailing list and online at the Iowa Department of Transportation Research Operations Web site.



Corrosion on snow plow blade



Corrosion Testing Apparatus

Photos: The University of Iowa/IIHR

TR-480
(SD2002-01)

Agency:
Michigan
Technological
University

**Principal
Investigator:**
Lawrence L. Sutter

Research Period:
July 15, 2002 to
June 30, 2007

**Research Board
Funding:**
\$80,000

Funding Source:
Multi-state pooled
funds coordinated by
South Dakota
Department of
Transportation -
86.7% other sources
and
13.3% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Investigation of the Long Term Effects of Concentrated Salt Solutions on Portland Cement Concrete

Objective: To determine the long-term effects of concentrated solutions of magnesium, sodium and calcium chloride as well as calcium magnesium acetate or other alternative liquid deicers on durable Portland cement concrete; To estimate the potential for reduction in performance and service life for pavements (jointed plain, reinforced and continuously reinforced) and structures subjected to various concentrated deicing brines.

Reports: Final Report, April 2009

Implementation: The results of this research may be used to aid in the decision-making processes, with respect to the continued use of concentrated liquid deicers, while minimizing any potential damage to concrete pavements and structures.

TR-488

Agency:
The University of
Iowa

**Principal
Investigator:**
Wilfrid A. Nixon

Research Period:
February 1, 2003 to
July 31, 2005

**Research Board
Funding:**
\$90,000

Funding Source:
100% State -
70% Primary funds,
25% Secondary funds
and 5% Street funds

Economics of Using Calcium Chloride vs. Sodium Chloride for Deicing & Anti-icing

Objective: To determine what mixture of calcium chloride and sodium chloride when applied to the road surface under winter weather conditions provides the best possible level of service to the public in the most economical way possible; To examine economic factors as well as ice melting capabilities and operational impacts that are major factors of successful winter maintenance operations.

Progress: There have been numerous delays in the progress of this project; completion of the Final Report is anticipated in 2009.

Reports: None

Implementation: The result of this study will be presented at an appropriate meeting in Iowa after completion. The report will also be made available via e-mail to all subscribers listed on the Snow and Ice mailing list and will be placed on the Snow and Ice Cooperative Program Web site at www.sicop.net and the Iowa Department of Transportation Operations Research web site at www.iowadot.gov/operationsresearch/reports.aspx.



Test chamber measures the freezing characteristics of Calcium Chloride brine.

Ice is treated with Calcium Chloride brine to determine melting rate.



A low temperature cooling bath used to determine the very low temperature performance of Calcium Chloride brine.

*Photos: Dr. Wilf Nixon,
The University of Iowa/IHR*

TR-491

Agency:

The University of Iowa

Principal Investigator:

Wilfrid A. Nixon

Research Period:

July 1, 2003 to
June 30, 2005

Research Board Funding:

\$100,000

Funding Source:

100% State -
80% Primary funds,
10% Secondary funds
and 10% Street funds

Development of Winter Performance Measures for Maintenance Operations

Objective: To create a method for measuring performance levels of winter maintenance operations during winter storms. The method must consider the severity of the storm, and be able to measure the outcomes of the winter maintenance actions in such a way as to cumulatively assess the performance of those actions.

Reports: Final Report, September 2009

Implementation: Performance in winter maintenance operations can be measured by the speed reduction observed on the road. For a given road type and a given storm severity, a target speed reduction is given, and performance can be measured in relation to this speed reduction. The results of this study are available via e-mail to all subscribers to the snow and ice mailing list. The Final Report is also available in PDF format on the Iowa Department of Transportation's Operations Research Web site.



Iowa DOT Maintenance Operations snow removal during a winter storm
Photo: Iowa DOT

TR-501

Agency:
Iowa State University

Principal Investigator:
Vern Schaefer

Research Period:
January 1, 2004 to
February 29, 2008

Research Board Funding:
\$175,000

Funding Source:
100% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Optimization and Management of Materials in Earthwork Construction

Objective:

- Identify the impact of not doing material management and optimization through a forensic study of recent geotechnical problems and failures in Iowa
- Determine appropriate parameter values to use in optimizing geotechnical system performance and material placement (i.e. shear strength, volumetric stability) in particular geotechnical applications, including subgrades, retaining structures, embankments, box culverts, and foundations
- Develop guidelines (i.e. flow chart) for selection, mixing, stabilization and/or ground improvement of materials that provide desired engineering properties to obtain optimal performance for the various applications
- Provide recommendations for Phase II pilot studies and development of design tools/software

Reports: Final Report completion expected January, 2010

Implementation: In addition to the written report, a summary sheet will be created, and presentations will be made at appropriate local and regional conferences. The observations and conclusions from this study will provide recommendations for better management and optimization of on-site and select earth materials through the use of new ground improvement technologies. State, county, and local transportation agencies and contractors can implement the recommendations for improved geotechnical construction.



Soil mixing operation through layered soils, Des Moines, Iowa
Photo: Vern Schaefer, Iowa State University/CCEE

TR-517

Agency:

University of
Nebraska - Lincoln

**Principal
Investigator:**

Dean L. Sicking and
Ronald K. Faller

Research Period:

April 1, 2004 to
December 31, 2005

**Research Board
Funding:**

\$24,995

Funding Source:

100% State -
45% Primary funds,
45% Secondary funds
and 10% Street funds

Guidelines for Safety Treatment of Roadside Culverts

Objective: To develop general guidelines for safety treatment alternatives for cross-drainage culverts. Cost-effective analysis procedures will be utilized to determine traffic characteristics and roadside geometries for which each of the above safety treatments are most cost-beneficial.

Progress: Draft Final Report under review, Final Report delivery expected December, 2009

Reports: None

Implementation: Generalized guidelines for safety treatment of cross-drainage culverts will greatly simplify development of plans for reconstruction, rehabilitation & resurfacing (3R) projects. These guidelines will provide reasonably accurate and consistent safety treatment designs for roadside cross-drainage culverts. Further, the simplified design guidelines will significantly reduce the effort required to develop safety treatment plans for roadside cross-drainage culverts.

It is anticipated that the Iowa DOT will be able to immediately implement the simplified design guidelines developed under the study proposed herein. A short seminar will be presented at the end of this study in order to train Iowa highway designers in the application of the guidelines.

TR-519 Phase II

Agency:

United States
Geological Survey
(USGS)

Principal Investigator:

David Eash

Research Period:

June 1, 2004 to
December 31, 2011

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: To develop a comprehensive flood-estimation method for unregulated, rural streams in Iowa. Specifically, to:

- 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 objectives for Phase I have been achieved. Additional Phase II funding for the implementation of StreamStats was approved and work has begun.

Reports: None

Implementation: This study will provide a flood estimation method that will enable engineers, managers, and planners to estimate flood-frequency discharges for small drainage basins with great predictive accuracy.

Regional regression equations developed will only include basin characteristics that are considered easy for users to apply. The probabilistic rational method of flood estimation developed in this study will present runoff coefficient and rainfall frequency maps of the state from which users will determine runoff and rainfall values for small drainage basins.

The study will produce a standard USGS Scientific Investigation Report that will describe the study and present example applications of flood-estimation methods.

TR-520

Agency:
Iowa State University

Principal Investigator:
James K. Cable

Research Period:
August 1, 2004 to
July 31, 2008

Research Board Funding:
\$146,708

Funding Source:
100% State -
95% Secondary funds
and 5% Street funds

Evaluation of Dowel Bar Retrofits for Local Road Pavements

Objective:

- Evaluate the feasibility of using elliptical or round dowels to retrofit an eight-inch depth local road pavement as part of a retrofit/grind rehabilitation project
- Evaluate the impact of applying two, three or four dowels in the outer wheel path only on pavement performance
- Evaluate the impact of utilizing FRP or steel dowels in the retrofit of the test pavement, on long-term performance
- Determine the relative cost of elliptical shaped dowels (FRP and steel) for the retrofit project

Reports: Final Report, February 2008

Implementation: The report provides guidance on the:

- Relative number of dowels per joint required to achieve a given level of performance
- Relative costs vs. performance of the various dowel material types
- Potential benefits of dowel bar retrofits versus overlay alternatives for this type of pavement rehabilitation

The results of this research are expected to provide guidance to local government officials in the use of dowel bar retrofits as a method of rehabilitation. This will provide local governments with an alternative to extensive overlays or reconstruction of such pavements.

Proper Slot Length
*Photo: Dr. James Cable,
Associate Professor Emeritus
Iowa State University*



TR-525

Agency:
Iowa State University

Principal Investigator:
Vernon R. Schaefer

Research Period:
November 1, 2004 to August 31, 2007

Research Board Funding:
\$153,212

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

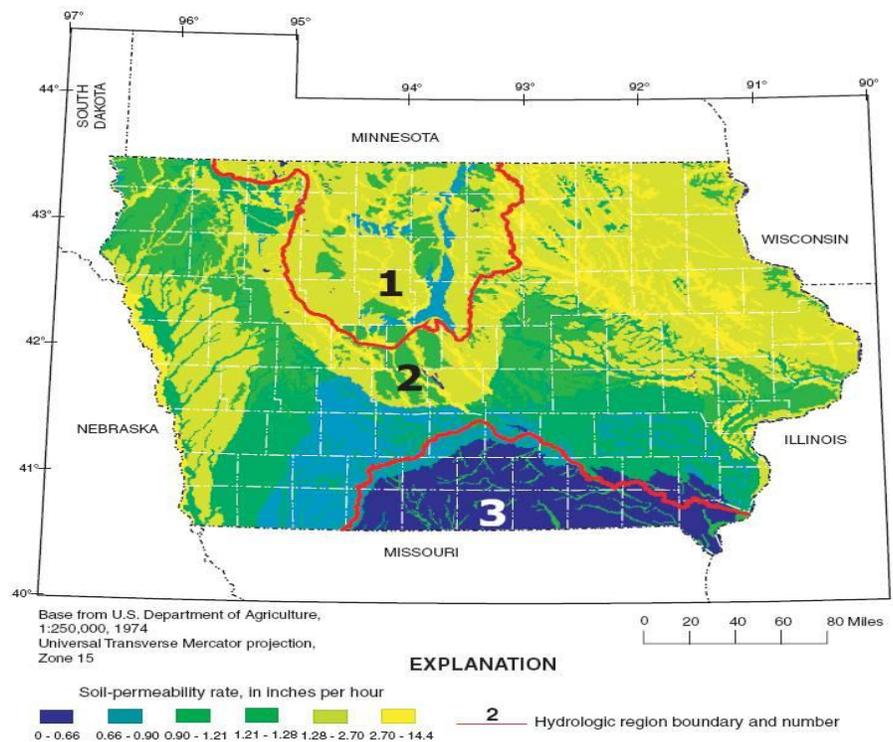
Design Guide for Improved Quality of Roadway Subgrades and Subbases

Objective: To analyze, synthesize, and present in a practical design guide, the findings of recent research relating to subbase and subgrade from Iowa and other states. The design guide will be incorporated into the Iowa DOT and SUDAS manuals.

Construction practices for subgrades and subbases will be reviewed and analyzed so as to identify typical problems that can occur due to poor construction practices. An assessment of stabilization and treatment techniques in relation to construction of subgrades and subbases will be conducted with the goal of selecting reliable geotechnical and foundation treatments. The purpose and expected outcome of best practices for different subgrade and subbase types and treatments will be outlined.

Reports: Final Report, September 2008

Implementation: The conclusions and design guide from this study will provide recommendations on roadway subgrade and subbase design. The design guide and integrated best practices will be incorporated as a chapter in the Statewide Urban Design Manual and the specification recommendations will be included in the Statewide Urban Specifications Manual.



Shaded soil-permeability rates and hydrologic regions in Iowa
Image: Iowa State University/InTrans

TR-529

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
February 1, 2005 to
October 31, 2008

Research Board Funding:
\$154,310

Funding Source:
45 % FHWA,
31 % Wapello
County,
24 % State (IHRB) -
49 % Primary funds,
49 % Secondary
funds and
2 % Street funds

Construction and Evaluation of a Prestressed Concrete Bridge Using Ultra-High Performance Concrete

Objective:

- Advance the state-of-the-art in concrete bridge construction technology by constructing the first bridge in the United States to use a novel concrete mix
- Develop experience in the State of Iowa in the design and construction of bridges using advanced materials
- Develop recommended design procedures for the shear design of ultra-high performance concrete beams

Reports: Final Report, October 2008

Implementation: These advances will be useful to all jurisdictions within Iowa by ultimately reducing costs and utilizing a higher strength material with almost zero permeability. This could essentially eliminate deterioration of bridge decks.

The results of this research will be compiled in design recommendations and specifications that potentially may be adopted by the American Association of State Highway and Transportation Officials (AASHTO).



A UHPC prestressed bridge constructed on Little Soap Road in Wapello County, Iowa

Photo: Dr. Brent Phares, Iowa State University/CCEE

TR-530

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
March 1, 2005 to
April 30, 2008

Research Board Funding:
\$169,433

Funding Source:
100 % State -
48 % Primary funds,
48 % Secondary
funds and
4 % Street funds

Development of an Improved Integral Bridge Abutment-to-Approach Slab Connection

Objective:

- Develop an effective approach slab-to-integral abutment connection detail for use on Iowa bridges
- Install a structural monitoring system to document and assess the performance of the connection detail and its effects on overall bridge performance

Reports: Final Report (combined with TR-539), June 2008

Implementation: The successful development of an integral abutment-to-approach slab connection will be useful to all jurisdictions within Iowa. This improved connection detail will be incorporated into the Iowa DOT standard bridge plans and utilized for state, city and county bridge projects statewide.



Installation of an improved bridge-to-pavement connection detail
Photo: Dr. Brent Phares, Iowa State University/CCEE

TR-533

Agency:

The University of
Iowa

**Principal
Investigator:**

Allen Bradley

Research Period:

March 1, 2005 to
May 31, 2008

**Research Board
Funding:**

\$99,544

Funding Source:

100 % State -
51 % Primary funds,
45 % Secondary
funds and
4 % Street funds

Evaluation of Design Flood Frequency Methods for Iowa Streams

Objective: The objective of this project is to assess the predictive accuracy of two standard design flood methods, the Rational Method and the National Resource Conservation Service/NRCS (or SCS) method, for flood frequency estimation on Iowa streams. The evaluation will be based on comparisons of flood frequency estimates at sites with sufficiently long stream gage records.

Reports: Final Report, June 2009

Implementation: The results of this project will be most relevant to city and county engineers, who are frequently engaged in design and planning of stormwater management facilities for changing land use conditions. Research findings will be presented to the Iowa Stormwater Comprehensive Workgroup, which plays an advisory role in SUDAS. The evaluation may result in specific recommendations for changes in the current SUDAS procedures.



A stream in southern Iowa overflows its banks closing a road,
August 2007

Photo: The University of Iowa

TR-536

Agency:

The University of Iowa

Principal Investigator:

Marian Muste

Research Period:

April 1, 2005 to December 31, 2008

Research Board Funding:

\$44,048

Funding Source:

100 % State -
55 % Primary funds,
40 % Secondary funds and
5 % Street funds

Implementation of the Water Quality Control BMPs and Design and Specifications Manuals

Objective: To incorporate the content of the new best management practices and design and specification manuals for erosion and sediment control measures (currently under development through project TR-508, “Design Guide and Construction Specifications for NPDES Site Runoff Control”) in the existing web-based erosion control expert system.

Progress: Manuals to be incorporated into the interactive Web site are:

- *Iowa Construction Site Erosion Control Manual*
- Statewide Urban Standard Design and Specification Manuals for Erosion and Sedimentation Control
- *Design of Guidelines and Specifications for Improving Stormwater Water Quality*

Guidelines for *The Best Management Practices and Design and Specification Guidelines for Erosion and Sedimentation Control* have been incorporated into the interactive manual. The Water Quality section is still under development.

The software is operationally robust and works well.

Reports: None

Implementation: Once Finalized, the *Iowa Stormwater Runoff Control Interactive Manual (ISRCIM)* will be transferred onto one of the Iowa DOT existing Web servers. Strong outreach, testing and upgrading activities are envisioned during the dissemination of the ISRCIM to a wide category of users; the training programs incorporated in Part 3 of research project TR-508, “Design Guide and Construction Specifications for NPDES Site Runoff Control” presents a major portion of this implementation.

Additionally, training sessions on ISRCIM use will be organized according to requests formulated by IHRB, Iowa cities and counties, and other specialized state offices with responsibilities in the area of sediment, sedimentation and water quality control.

TR-539

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
July 1, 2005 to
April 30, 2008

Research Board Funding:
\$149,126

Funding Source:
100 % State -
49 % Primary funds,
49 % Secondary
funds and
2 % Street funds

Instrumentation and Monitoring of Precast, Post-tensioned Bridge Approach Pavement

Objective: A structural health monitoring system was installed to document and evaluate the performance of a precast, post-tensioned approach pavement and its effects on overall bridge performance. The research team installed a monitoring system to collect overall bridge movement and bridge component strain.

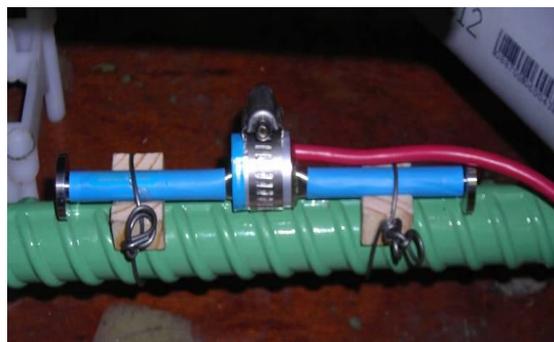
Performance evaluation was formulated through comparisons with recognized codes and standards including the AASHTO specifications.

Demonstrating the benefits of a precast, post-tensioned approach pavement through this pilot project may provide an opportunity for the Iowa DOT to successfully pursue CPTP funding for accelerated construction of other precast concrete pavement projects under the FHWA Highways for Life program.

Reports: Final Report, June 2008

Implementation: The successful development of a precast, post-tensioned bridge approach pavement system will be a useful extension to the proposed integral abutment-approach slab connection that is currently being studied by the research team under IHRB project TR-530. An improved approach pavement system may be incorporated into the Iowa DOT standard bridge plans and utilized for bridge projects throughout the state.

These results will be distributed to the engineering community through the publication of technical papers in the engineering press and presentations at bridge and transportation conferences, and through posting of pertinent information on the Web site of Iowa DOT's Office of Bridges and Structures and Iowa State University's Bridge Engineering Center Web site.



Installed embedded strain gauge
Photo: Iowa State University

TR-541

Agency:

The University of Iowa

Principal Investigator:

Thanos Papanicolaou

Research Period:

Sept 1, 2005 to
September 30, 2008

Research Board Funding:

\$63,749

Funding Source:

80 % State (IHRB) -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

The Effects of Headcut and Knickpoint Propagation on Bridges in Iowa

Objective: Research suggests that where headcuts and knickpoints form and migrate, more than 60% of bed erosion occurs in susceptible streams. The objectives of this research are:

- Understand the processes causing formation and migration of headcuts and knickpoints in the field
- Develop a sound but practical model that predicts the formation and migration of headcuts and knickpoints, and associated scour

Reports: Final Report, January 2009

Implementation: Knowledge of the initiation of knickpoint formation will allow the design and construction of grade-stabilization structures at an early stage before sizeable knickpoints have developed.

The specific products of the project will be 1) A practical manual what will aid engineers in monitoring knickpoints, and 2) The development of a model that will predict migration rate and scour depth of knickpoints.



Students conduct bi-annual surveys of channel morphology at knickpoint study site, Mug Creek

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

TR-545

Agency:
The University of
Iowa

**Principal
Investigator:**
Marian Muste
Peter Haug

Research Period:
March 15, 2005 to
December 31, 2008

**Research Board
Funding:**
\$144,785

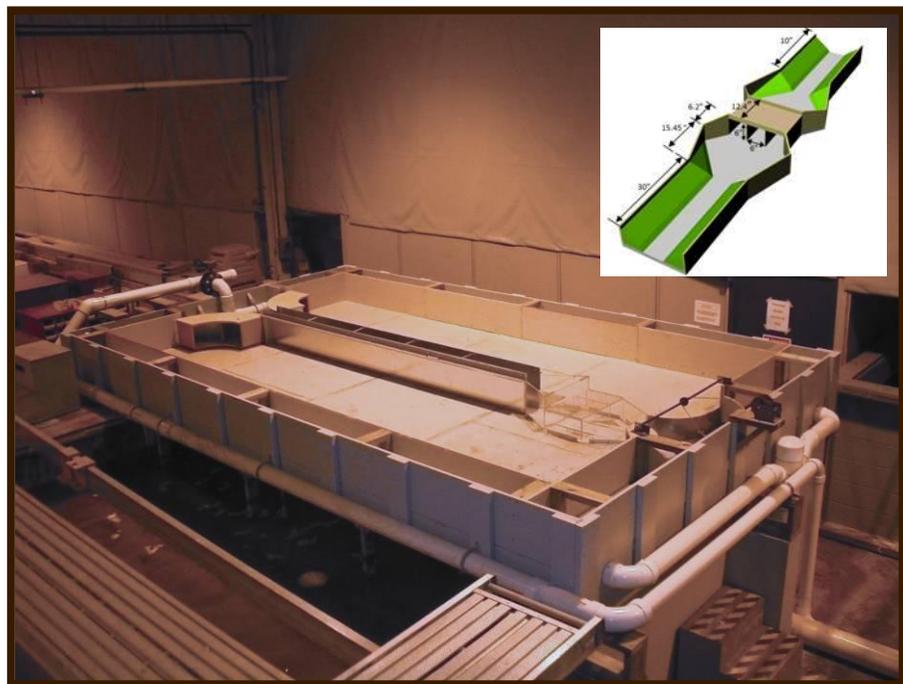
Funding Source:
80 % State -
40 % Primary funds,
50 % Secondary
funds and
10 % Street funds

Development of Self-Cleaning Box Culvert Designs

Objective: To identify and/or develop methods for constructing or retrofitting box culverts so that the typical flow through a culvert will clean the culvert's barrels and keep the structure performing well with little or no maintenance.

Reports: Final Report, June 2009

Implementation: The methods identified will be limited to those that can be contained within the right-of-way of the roadway under which the culvert passes. It is anticipated that the results of the project will be applicable to culverts in general.



Laboratory hydraulic model and (insert) schematic of channel with three-barrel culvert geometry

Photo: Dr. Marian Muste, The University of Iowa/IIHR

TR-546

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
December 1, 2005 to
June 30, 2009

Research Board Funding:
\$80,000

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

Revision to the SUDAS Traffic Signal Design Guide

Objective: To update and publish new Chapter 13 (Traffic Signal Design) and Division 8 (Traffic Signal Specification) documents for the SUDAS manual. This effort will require a significant amount of collaboration with numerous groups including a project advisory group, the SUDAS Traffic Signal Sub-Committee, consultants, contractors, Iowa DOT and municipal agency staff, the signal industry as well as professionals from fields such as electrical, geotechnical and soils engineering.

Reports: Final Report, July 2009

Implementation: Research findings will be shared through incorporation into the SUDAS manual as well as through presentations at the county engineer conference, MOVITE traffic engineering conference, ASCE transportation conference, APWA conference, and through a variety of other professional, municipal, and national group presentations.



SUDAS specifications are updated to stay current with new traffic signal technologies and methods

Photo: Neal Hawkins, Iowa State University/InTrans

TR-548

Agency:
Iowa State University

Principal Investigator:
Chris Albrecht

Research Period:
December 1, 2005 to
April 30, 2007

Research Board Funding:
\$80,000

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

Investigation of the Impact of Rural Development on Secondary Road Systems

Objective: To quantify traffic and fiscal impacts of two common types of rural development on the secondary road system in Iowa:

- Rural residential subdivisions which are commonly found 30 minutes or less from centers of employment
- Livestock production facilities which are typically located in remote areas

Progress: The Draft Final Report is being prepared at this time. The Draft will be reviewed by the TAC and then a presentation scheduled with the Iowa Highway Research Board.

Reports: None

Implementation: The research team will work with the Iowa Association of Counties and its affiliated groups, LTAP, Iowa State Extension (ISE), Iowa Chapter of the American Planning Association and other associations and agencies who serve to disseminate the research and knowledge of how to use the impact tool. The research team will work with ISE and LTAP to develop a series of informational workshops on the topic of rural development impacts on transportation networks.



A rural residential subdivision located in prime farmland
Photo: Susan Deblieck, Iowa State University

TR-550 Phase II

Agency:
Iowa State University

Principal Investigator:
Halil Ceylan

Research Period:
December 1, 2005 to
August 31, 2007

Research Board Funding:
\$46,212

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

Performance Evaluation of Rubblized Pavements in Iowa

Objective: Based on IHRB TR-473, the primary objective of this study is to evaluate the structural condition of existing rubblized concrete pavements across Iowa through Falling Weight Deflectometer (FWD) tests, Dynamic Cone Penetrometer (DCP) tests, visual pavement distress surveys, etc. Through back-calculation of FWD deflection data, the rubblized layer modulus values will be determined for various projects and compared with each other for correlating with long term pavement performance.

The results will be useful in establishing design modulus and for providing AASHTO layer coefficient recommendations for rubblized PCC layers.

Reports: Final Report, April 2008

Implementation: The results of this study show that rubblization is a valid option to use in Iowa in the rehabilitation of PCC provided the foundation is strong enough to support construction operations during the rubblization process. The M-E structural design methodology developed during Phase I can estimate the HMA overlay thickness reasonably well to achieve long-lasting performance of HMA pavements. The rehabilitation strategy is recommended for continued use in Iowa under those conditions conducive for rubblization.

Layer condition underneath HMA after coring:

PCC layer without rubblization on
IA-139 in Winneshiek County, Iowa



Rubblized PCC layer on IA-3 in Delaware
County, Iowa

*Photos: Dr. Halil Ceylan, Iowa State
University/CCEE*

TR-551

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
January 1, 2006 to
June 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

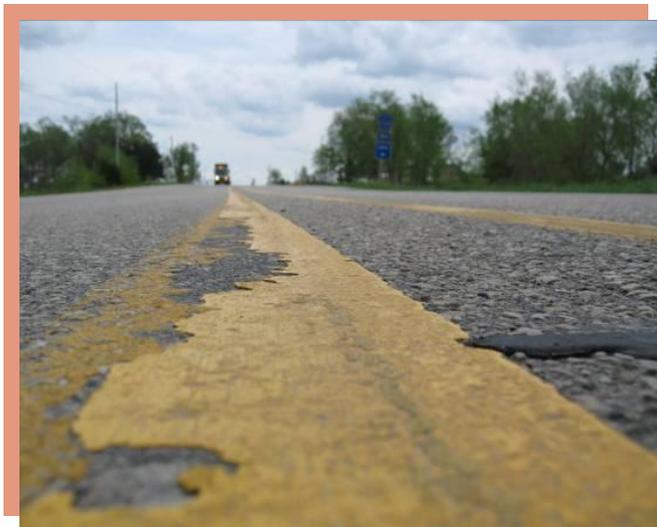
Objective: To produce a Reflectivity Guideline to assist local agencies in identifying application of pavement marking needs due to wear or marking damage over the winter and in development of marking needs and priorities each spring. This research will also:

- 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 the efficiency and effectiveness of pavement markings on all marked public roadways

Progress: Work continues on case study data collection for counties and cities; monitor test decks in West Des Moines and Dallas County.

Reports: None

Implementation: Research findings will be shared through presentations at the County Engineer Conference, the American Society of Civil Engineers (ASCE) Transportation Conference, the American Public Works Association (APWA) Conference, and through a variety of other professional, municipal, and national group presentations. These guidelines could eventually be incorporated into a pavement marking design section within the Iowa Statewide Urban Designs and Specifications (SUDAS) manual.



One goal of this project is to find new products and methods for improving both durability and retroreflectivity of centerline markings.

Photo: Neal Hawkins, Iowa State University/CCEE

TR-553

Agency:

The University of Iowa

Principal Investigator:

Hosin "David" Lee

Research Period:

April 1, 2006 to
March 31, 2008

Research Board Funding:

\$100,000

Funding Source:

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

Examination for Curing Criteria for Cold In-Place Recycling

Objective: To advance Iowa's development of asphalt recycling technology using technically sound and more effective ways to identify minimum in-place CIR properties necessary to permit placement of the HMA overlay or chip seal.

Reports: Final Report, February 2008

Implementation: Research efforts focused on procedures that will minimize the CIR exposure time while retaining the potential for the owner agency's investment to succeed; this includes minimizing the risk of CIR layer and HMA damages.

One of the procedures researched was a maturity curve for CIR layer under various curing conditions. The research developed a better analysis tool that the industry and owner agencies can apply to monitor the CIR layer in preparation for a timely placement of the wearing surface.



Simple Performance Testing Equipment at The University of Iowa
Photo: Dr. Hosin "David" Lee, The University of Iowa/IHR

TR-555

Agency:

Iowa State University

Principal Investigator:

Chris Williams

Research Period:

April 1, 2006 to
May 31, 2009

Research Board Funding:

\$75,000

Funding Source:

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

Evaluation of Hot-Mix Asphalt Moisture Sensitivity Using the Nottingham Test Equipment

Objective: This project evaluates the moisture susceptibility of the individual components of HMA through an experimental plan which will isolate different variables. Dynamic Modulus and Flow Number testing will be used to evaluate the moisture susceptibility of the HMA. Research objectives include:

- Comparison of test results for materials tested in a moisture-saturated environment and a dry environment - the research plan will integrate a range of Iowa DOT asphalt mixtures.
- Using results obtained from Dynamic Modulus and Flow Number Tests, develop a new test protocol for determining moisture susceptibility.

Progress: A Draft Report was submitted and review comments received. The review comments are being addressed. A revised Final Report should be delivered in the autumn of 2009 for approval.

Reports: None

Implementation: Several products will be developed from this project. The research team will deliver concise recommendations on acceptable test protocol conditions and limitations along with appropriate user variability in the Draft and Final reports. The Final Report will include an executive summary. The research team will also provide quarterly progress reports to the Technical Advisory Committee (TAC). The research team will also evaluate different anti-stripping agents.

The implementation plan will include recommendations for integrating moisture testing. This research will also evaluate different anti-stripping agents and their success in mitigating moisture damage; technology developments will be dispersed through electronic, web-based and paper formats.

TR-556

Agency:
Iowa State University

Principal Investigator:
Matt Rouse

Research Period:
May 1, 2006 to
December 31, 2007

Research Board Funding:
\$89,623

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

Feasibility Investigation of Segmentally Precast Bridge Piers for Accelerated Construction

Objective: To simulate, evaluate and test several component materials, connection details, and component configurations to identify the most cost-effective and structurally advantageous means of constructing a radically different design approach of segmentally precast bridge piers for accelerated construction. The basic proposed pier assembly features steel belts at the ends of segments, external reinforcement of segment joints which have bolted connections, and bearing pads between segments to avoid labor-intensive grouting procedures.

This steel belt assembly serves three purposes:

- Reinforcement of fragile concrete corners
- Confinement of the concrete at the ends of the segments to provide additional concrete strength and ductility
- Convenient and aesthetically pleasing means for the connection of the exterior reinforcement plates

Progress: Experiments and simulations are complete. A Final Report is being prepared.

Reports: Final Report, July 2008

Implementation: Results of the research will include cost-benefit analyses of varying materials and component configurations, calibrated analytical models for future designs, and recommendations for full-scale field prototype demonstrations.



Segmented column joint and foundation prior to testing
Photo: Dr. Matt Rouse, Iowa State University/CCEE

TR-558

Agency:
Iowa State University

Principal Investigator:
Muhannad Suleiman

Research Period:
July 1, 2006 to
November 30, 2007

Research Board Funding:
\$80,266

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

Use of Ultra-High Performance Concrete in Geotechnical and Substructure Applications

Objective: One quarter of our nation's 590,000 bridges, including their substructures, are currently classified as structurally deficient or functionally obsolete, primarily due to material deterioration. This is driving the engineering community to design durable bridges and infrastructures that can last for a minimum of 75 years with minimal maintenance.

To achieve longer life of bridges, new and innovative materials must be used. Ultra-High Performance Concrete (UHPC) provides a unique combination of durability, strength, ductility and aesthetic flexibility, which not only improves longevity of bridges but can produce long-term cost-effective solutions. Iowa is one of the pioneering states in the use of UHPC in bridge superstructure applications.

The unique engineering properties of UHPC show great potential for producing durable foundation elements, which in turn lead to longer lasting substructures and soil stabilization remedies in different conditions. This research aims to investigate and evaluate the use of UHPC for geotechnical applications related to transportation structures.

Reports: Final Report, December 2008

Implementation: Conclusions from this study provide recommendations on the use of UHPC in geotechnical applications related to transportation facilities for Iowa engineers. Using precast, prestressed pile foundations made of UHPC may help achieve the targeted service life, avoid drivability problems, and ensure durability in future bridges.

TR-559

Agency:

The University of Iowa

Principal Investigator:

George Constantinescu

Research Period:

August 28, 2006 to September 28, 2007

Research Board Funding:

\$45,253

Funding Source:

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

Improved Method for Determining Wind Loads on Highway Sign and Traffic-Signal Structures

Objective:

- Obtain information on airflow around highway sign and traffic signal structures and then estimate the unsteady forces and moments acting on them using state-of-the-art Computational Fluid Dynamics (CFD) tools [including Large Eddy Simulation (LES)].
- Perform structural analysis of the highway sign and traffic structures subjected to these loads, and study new design ideas for panels that will include a certain number of holes to reduce the pressure forces acting on them under strong wind conditions.

Additionally, there is a need to determine how best to minimize wind loads on structure supporting signs and lights. Several options are available for doing this, including:

- Development of improved shape and dimensions of signs and their support structures
- Development of air-flow panels (panels with holes disposed on a certain pattern) to reduce wind loadings (especially drag form) and addition of flow-modifying fixtures

Reports: Final Report, January 2008

Implementation: The report will present the methodology (e.g., description of CFD and structural analysis codes, parameters, boundary conditions, assumptions, etc.), definition of test cases and presentation of simulation results, comparison among the numerical methods, design recommendations and relevance to other problems of interest to DOT in a clear manner that is easy to understand for engineers.

Main benefits from this research include a better understanding of the effects of wind on highway sign and traffic signal structures, including a dynamic analysis of aeroelastic effects and the degree to which the presence of holes disposed in a certain pattern over the main plate of these structures can reduce wind loads.

TR-560

Agency:
Iowa State University

Principal Investigator:
Tom Maze

Research Period:
July 1, 2006 to
December 31, 2008

Research Board Funding:
\$54,814

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

Clear Zone – Synthesis of Practice and Benefits of Meeting the Ten-Foot Clear Zone Goal on Urban Streets

Objective: To determine the status for practice of clear zone design guidance (standards) and the experiences other jurisdictions have had with applied clear zone guidance; to identify experience in other jurisdictions with clear zone guidance with respect to application of traffic calming designs and/or context sensitive solutions, and to observe the benefits or drawbacks in Iowa that have resulted from providing ten feet of clear zone or from providing less than the ten foot goal.

Reports: Final Report, December 2008

Implementation: The project will produce a Final Report and technology transfer brief. The investigators anticipate making presentations at the Iowa American Society of Civil Engineers (ASCE) transportation engineering conference, the Iowa American Public Works Association (APWA) Chapter conference, and the Missouri Valley Section of the Institute of Transportation Engineers (MOVITE) chapter of Institute of Transportation Engineers (ITE) biannual conference.

The main benefit of this project is enhanced understanding of the benefits in meeting the ten foot clear zone goal and the costs of providing something less than ten feet. The result should also help the Iowa DOT clarify their policy on clear zone width so that there is less uncertainty in the process.

Utility poles along a Des Moines, Iowa, street are within a few feet of the roadway.
Photo: Iowa State University/InTrans



TR-561

Agency:
Iowa State University

Principal Investigator:
Terry Wipf

Research Period:
May 1, 2006 to
November 30, 2008

Research Board Funding:
\$341,089

Funding Source:
100 % State -
25 % Primary funds,
65 % Secondary
funds and
10 % Street funds

Laboratory and Field Testing and Evaluation of Precast Bridge Elements

Objective: To test and evaluate precast components for three separate bridge projects in order to assess overall design, construction, and bridge structural performance, and to design and install monitoring systems; perform laboratory structural tests on bridge specimens that represent structural details for use on the three projects.

Reports: Final Report, March 2009

Implementation: Demonstrating benefits of precast, post-tensioned bridge components through this project may provide an opportunity for the Iowa DOT and Iowa County Engineers to design and construct more cost-effective and durable bridges. The benefits derived from developing accelerated construction concepts may also be significant.



Concrete being placed in the first series of abutment specimen



Boone County bridge substructure (West abutment) being placed
Photos: Dr. Terry Wipf, Iowa State University/BEC

TR-562

Agency:

Robert Connor &
Assoc

Principal Investigator:

Robert Connor &
Bruce Brakke (Iowa
DOT)

Research Period:

July 14, 2006 to
September 30, 2008

Research Board Funding:

\$36,755

Funding Source:

100 % State -
100 % Primary funds

Field Instrumentation and Testing of High-Mast Lighting Towers in the State of Iowa

Objective: The Iowa DOT owns 233 high-mast lighting towers ranging from 100-feet to 180-feet tall. In 2003, a 140-foot tower collapsed due to a fracture at the welded connection at the base plate. Subsequently, cracks were found in twenty other towers. In addition to cracks at the base plate, a crack was also found at the welded access opening detail on one tower; cracked towers were removed from service.

The goal is to determine how the reinforcing jacket affects the tower's response to wind induced vibrations and to also determine the magnitude of stresses in both the jacket and the original tower, including the anchor rods.

Progress: The field work for the research project to Monitoring Wind-Induced Vibrations/Stresses in a High-Mast Lighting Tower was started in the summer of 2006, with the goal of collecting data for a least one year. The instrumentation is providing information as intended from the original tower shell, the bolted reinforcing jacket and the anchor rods. It has been decided to continue to collect additional data in order to better understand the tower's long-term response to wind.

Reports: A Draft Final Report is complete. The Final Report is expected in late 2009.

Implementation: The research will likely provide a more cost effective repair to cracked high-mast towers and a more efficient retrofit for un-cracked towers with fatigue susceptible details. The Iowa DOT would be able to expeditiously address the problems associated with these towers at a large cost savings.



Bolted Reinforcing Jacket



A bolted reinforcing jacket was placed on a tower in the I-35 & US 18 Interchange near Clear Lake

TR-563
(TPF-5, 148)

Agency:
Minnesota
Department of
Transportation

Principal Investigator:
Tim Clyne
(Minnesota
Department of
Transportation)

Research Period:
July 2006 to
July 2009

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: 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 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: Four iterations of testing have been completed. These tests have included a wide range of vehicles and configurations. Two testing seasons remain: autumn, 2009 and spring, 2010.

Reports: None

Implementation: This research will allow policy and design decision-making 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.



TR-564

Agency:
Digital Control, Inc.

Principal Investigator:
LaDon Jones

Research Period:
September 1, 2006 to
December 31, 2009

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: To 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 2 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 flowrate copying
- Updated User Manual
- Online Help

Progress: The calculation sections are being completed and the scour information in the user manual is being updated. Estimation of scour at bridges is approximately 95% complete.

Reports: None

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 engineer's office in Iowa.

TR-566

Agency:
Iowa State University

Principal Investigator:
Larry Stevens

Research Period:
December 1, 2006 to
May 31, 2009

Research Board Funding:
\$165,316

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

Utility Cut Repair Techniques – Investigation of Improved Utility Cut Repair Techniques to Reduce Settlement in Repaired Areas: Phase II

Objective: Based on the results of Phase I (IHRB TR-503), the research team will monitor the constructed utility cuts for two more years, construct new trenches using the three methods suggested by the research team in Phase I and instrument utility trenches to further understand the mechanisms of trench backfill settlement and load distribution.

This research examines utility cut construction practices using continued monitoring of restored cuts to improve understanding of trench settlement and load transfer through the instrumentation of utility trenches. The goal of increasing the pavement patch life and reducing the maintenance of the repaired areas is priority.

Progress: Final Report in progress

Reports: None

Implementation: The observations and conclusions from this study will provide recommendations on effective utility cut repairs. State, county and city transportation agencies and jurisdictions can implement the recommendations for utility cut repairs. It is anticipated that the best practices manual will be incorporated as a chapter into the Statewide Urban Design and Specifications (SUDAS) Design Manual, and that specification recommendations will be included in the SUDAS Specifications Manual.



Large lift thickness used in utility cut trench backfilling
Photo: Iowa State University/InTrans

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

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

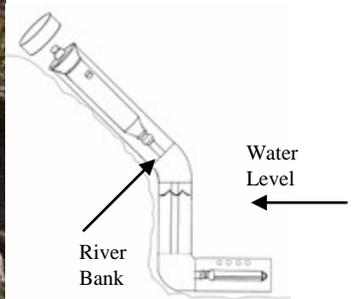
Objective: To establish stage-discharge relationships for ten ungaged streams in western Iowa through implementation of a semi-automatic sensor network. This project seeks to describe and document knickpoint propagation and identify and prioritize at-risk sites, thereby avoiding potential safety and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

Progress: Water levels, velocity and stream discharge measurements are ongoing.

Reports: None

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 potential safety and asset risks due to knickpoint propagation and channel vertical shift. Main findings would be presented at conferences and information made available to those 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, 2009

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: To 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, to evaluate and understand the cost and construction effort associated with building the sheet pile bridge abutment demonstration project and materials that provide recommendations for use and potential limitations of sheet pile bridge abutment systems.

Progress:

- Black Hawk County - Construction of the project has been completed and load tested. Data collected from the testing is currently being analyzed.
- Boone County - Construction of the project has been completed and a load test scheduled. The monitoring system has been installed and is ready for load testing.
- Tama County - Bridge design is complete, flatcars for the superstructure are on site, and demolition of the existing bridge is expected to begin within two weeks. The structural monitoring system for the Tama project has been acquired.

[Soil borings and CPT's have been obtained for all sites and subsequent laboratory analysis has been completed.]

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 will provide recommendations for use of sheet pile abutments in LVRs and in-situ soil testing. County engineers (responsible for 80% of Iowa's LVRs) can implement recommendations for use of an alternative abutment system.

TR-569

Agency:

The University of Iowa

Principal Investigator:

Marian Muste

Research Period:

January 15, 2007 to August 15, 2008

Research Board Funding:

\$85,891

Funding Source:

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

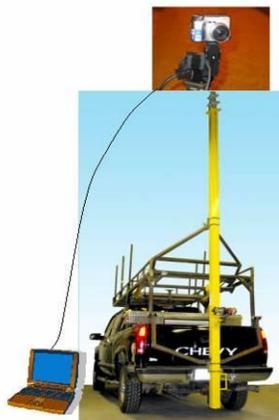
Quantitative Mapping of Waterways Characteristics at Bridge Sites

Objective: To dramatically improve current capabilities for quantifying and monitoring bridge scour. Eventually this methodology can be refined to include long term development of bridge monitoring platforms to be comprised of multiple non-intrusive instruments (image, acoustic- and laser-based principles proven through this research), allowing cost effective, informative, comprehensive measurements with improved accuracy and information detail at minimal effort and expense; especially well suited for monitoring small bridges typical in Iowa and surrounding states.

Reports: Final Report, December 2008

Implementation: A software package that calculates quantitative mapping of bridge waterways will be developed and be a modular structure so equipment interchange and addition of hardware can be easily accommodated. The code developed will be an open source to all interested parties. Companion user manuals will be provided instructing users on methodology background and implementation.

The details of the Mobile Large-Scale Particle Image Velocimetry (MLSPIV) truck-based prototype will be available for users willing to construct such observational platforms with demonstrations for various interested user groups to illustrate the prototype's developed capabilities. The Final Report was delivered in both electronic and hard copy formats.



MLSPIV unit with mast deployed and ancillary equipment



River reach plan decomposition; numbers indicate the quasi-planar surfaces: One and five are floodplains; two and four are sloping banks; three is the river water surface.

*Photos: Dr. Marian Muste,
The University of Iowa/IHR*

TR-570

Agency:
Iowa State University

Principal Investigator:
Muhannad Suleiman

Research Period:
March 1, 2007 to
July 31, 2009

Research Board Funding:
\$174,980

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

Identification of Practices, Design, Construction, and Repair Using Trenchless Technology

Objective: To collect and analyze information recommending practices for design, construction and repair utilizing trenchless technology by state and local jurisdictions; these recommendations will be a synthesis of known field practices and/or documented research from studies conducted as part of this research, which can be used by jurisdictions in their utility and restoration permit process.

These recommendations will be proposed for incorporation into the Statewide Urban Design and Specifications (SUDAS) Design Manual Chapter 14.

Progress: Final Report in progress

Reports: None

Implementation: This study will provide recommendations on effective utility installation and repair. State, county and city transportation agencies/ jurisdictions can implement the recommendations for utility construction or repair.

It is anticipated that the best practices recommendations will be incorporated in the SUDAS Design Manual and the specification recommendations will be included in the SUDAS Specifications Manual.

In addition to the written report, a summary sheet will be created and presentations will be made at appropriate local and regional conferences and the research team will publish the results in refereed journals.

TR-571

Agency:

Iowa Department of
Natural Resources -
Geological Survey

**Principal
Investigator:**

Robert D. Libra

Research Period:

May 1, 2007 to
April 30, 2008

**Research Board
Funding:**

\$86,357

Funding Source:

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

GIS - Based Decision and Outreach Tools for Aggregate Source Management

Objective: To create useful statewide mapping tools for Iowa DOT and local entities with a focus on initial investigations, including locations and descriptions of aggregate resource and factors with implications for extraction; consultation with county planning and zoning officials (Iowa State Association of Counties - County Zoning Affiliate), Iowa DOT Office of Materials and the Iowa Limestone Producers Association (ILPA) will assure development of tools that best address aggregate resources and the barriers to aggregate access.

Reports: Final Report, September 2008

Implementation: The Final product will be delivered in two mediums for two specific audiences: shapefiles created of historical and current quarry operations for the State, with data linked as specified by Iowa DOT for staff use and the Internet Map Service (IMS) created for use by Iowa DOT, planning groups and the public.

This data will be used in planning aggregate source access prior to planning and development of residential/business subdivisions. Internet Map Service with GIS layers relevant to aggregate access planning and education with National standard GIS metadata will accompany all layers/coverages.



Development occurring around Crawford and Morgan Creek quarries in Linn County, outside the western city limits of Cedar Rapids, Iowa
Photo: Iowa Department of Natural Resources, Geological Survey

TR-572

Agency:
Iowa State University

Principal Investigator:
Neal Hawkins

Research Period:
June 1, 2007 to
November 30, 2008

Research Board Funding:
\$99,881

Funding Source:
100 % State -
40 % Primary funds,
60 % Secondary funds

Improving Safety for Slow Moving Vehicles on Iowa's High Speed Rural Roadways

Objective: To focus on improving transportation safety for drivers of slow-moving vehicles and other drivers in the proximity of these vehicles on the public roadway system; this work will include the guidance of an advisory panel made up of IHRB members, city and county engineers, city and Iowa DOT planners, industry representatives and other relevant stakeholders.

A matrix of recommended strategies in dealing with agricultural and non-motorized user groups based upon roadway conditions such as speed, shoulder treatment, volume, and frequency of use by these groups and seasonal variations will be made.

Reports: Final Report, May 2009

Implementation: This research seeks to improve safety for both motorists and operators of slow moving vehicles on Iowa's roadways. This work focused on design and technology improvement strategies to systematically address crash experience and exposure to assist technical and nontechnical staff in assessing what can be done to improve safety for slow moving vehicles while providing links to other resources and best practices. This project was designed to improve transportation safety for SMVs on Iowa's public roadway system. The report includes a literature review showing various SMV statistics and laws across the United States, a crash study based on three years of Iowa SMV crash data, and recommendations from the SMV community.



An Amish buggy travels along one of Iowa's high speed rural roads
Photo: Iowa DOT

TR-573

Agency:
Iowa State University

Principal Investigator:
Sri Sritharan

Research Period:
July 1, 2007 to
December 31, 2009

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: To 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 Load and Resistance Factor Design (LRFD). It is a priority to work towards recommended changes that do not significantly increase design and construction costs.

Progress:

- Reformatting of the database providing a user-friendly interface and improved relational model uploading of all steel H, wood, concrete, and steel monotube/pipe pile data and addition of data from ongoing field tests in project TR-583
- Continuation of literature review of current LRFD practice, static analysis methods, construction control aspects, and other relevant topics
- Calibration of resistance factors for all data available in PILOT for steel H-piles in three different soil types using static analysis methods and comparing the values with those recommended by AASHTO and other DOTs
- Completion of static analysis for all piles tested in project TR-583 and evaluation of the test and predicted capacity differences using an advanced analysis methods for three different piles

Reports: None

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 Prestressed Concrete Bridge Using Ultra High-Performance Concrete Pi Girders

Objective: To 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.

Progress: The bridge was constructed in the autumn of 2008. A second load test was conducted on the bridge. Unlike the first test, dynamic data were collected that will allow investigation of these behaviors.

Reports: None

Implementation: The successful application of ultra high performance concrete (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 super-structure 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-576

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
August 1, 2007 –
December 31, 2008

Research Board Funding:
\$39,795

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

Investigation of ElectroMagnetic Gauges for Determination of In-Place Density of Hot Mix Asphalt (HMA) Pavements – Phase II

Objective: The first phase of this research project found that the electronic gauge technology was promising for use in determining the density of intermediate and surface course mixtures. However, there was indicated a need to understand whether the correction factor obtained in the first day of paving operations for a specific mix and paving conditions is applicable for the ensuing paving days under those same conditions. Objectives are to:

- Determine the consistency of gauge correction factors for multiple paving days
- Determine the number of gauge readings that need to be made for representative quality assurance testing

Reports: Final Report, May 2009

Implementation: The research team will work with the Technical Advisory Committee to develop recommendations for electromagnetic use in quality assurance testing. This will include gauge calibration and/or obtaining gauge correction factors, and determining how they are applied to gauge readings.

TR-577

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark

Research Period:
November 1, 2007 –
September 30, 2011

Research Board Funding:
\$53,807

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

Evaluation of Rumble Stripes on Low-Volume Rural Roads in Iowa

Objective: The objectives of this project are to investigate the economic and physical feasibility of installing narrow rumble stripes along the edge of selected paved secondary roads in Iowa. A painted edge line will be placed directly over the rumble strips, thus providing anticipated improved longevity and wet weather visibility of the paint. Evaluation of reduced run-off and drift-off crashes will be undertaken as well as enhanced performance of the painted edge lines.

Reports: Final Report, October 2009

Implementation: Iowa counties, in particular will benefit from this research by obtaining another tool for improving rural roads safety and extending the effective life and wet weather visibility of painted edge lines. With expanded use of this technique, installation costs should be reduced and more common use of rumble stripes may occur. Narrow width installation may also provide more options to the Iowa DOT for future rumble stripe installation on the primary road system.

A test section of rumble stripes and reflective paint completed in June 2008
*Photo: Dr. Shauna Hallmark,
Iowa State University/CCEE*



TR-578

Agency:

The University of Iowa

Principal Investigator:

Hosin "David" Lee

Research Period:

December 1, 2007 – December 31, 2009

Research Board Funding:

\$65,646

Funding Source:

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

Development of Mix Design Process for Cold In-Place Recycling Using Emulsion - Phase III

Objective: The first two phases of the research developed and validated the mix design procedure for cold-in-place recycling using foamed asphalt (CIR-foam). They also demonstrated that the field performance of various CIR-foam mixtures could be predicted based on the test results from newly purchased performance testing equipment. The objective of the phase III study is to develop a new mix design process for cold-in-place recycling using an emulsion (CIR-emulsion) by applying the knowledge gained and using the equipment purchased during the previous two phases.

Progress: A Draft Final Report is under review. It is anticipated the report will be presented for approval in December, 2009.

Reports: None

Implementation: Cold-in-place recycling is increasingly being used as the prices of virgin raw materials for paving continue to rise. The results of this Phase III study will provide a mix design process for CIR-emulsion which can be implemented as part of Iowa DOT specifications.



CIR-emulsion mixtures tested using Interlaken Performance Testing Equipment
Photo: Dr. Hosin "David" Lee, The University of Iowa/IIHR

TR-579

Agency:
Iowa State University

Principal Investigator:
Shauna Hallmark

Research Period:
November 1, 2007 –
March 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: The main goal is to 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: The team reviewed additional sites in Iowa which may be potential test or control sites. A list of potential sites was available from the initial study to where sites were determined for speed feedback signs. An additional 21 sites were identified and site visits were made. Site visits consisted of taking pictures and collected speeds for 20 - 30 vehicles using a radar gun.

Sites where the mean or average speed was not more than 5 mph over the posted or advisory speed were removed from further analysis. A total of 20 sites were determined to be suitable for either a test or control site. Several treatments were selected based on consultation with a FHWA pooled fund study on low cost curve treatments. The team is currently working on preparing documents to receive approval from MUTCD for several of the treatments.

Reports: None

Implementation: Iowa counties in particular will benefit from this research 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.

TR-580

Agency:

Iowa State University

Principal Investigator:

Omar Smadi

Research Period:

January 1, 2008 –
December 31, 2009

Research Board Funding:

\$96,113

Funding Source:

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

Pavement Markings and Safety

Objective: Using Iowa DOT data under nighttime conditions, this research effort is focused on achieving the following objectives:

- 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

Progress: All data collection and analysis are completed. A Final Report is being written. A set of conclusions addressing impacts of pavement marking retroreflectivity on safety is being prepared.

A presentation was prepared for DOT staff to be presented at the annual state DOT research meeting during the Midwest Transportation Symposium.

Reports: None

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

Progress: Lab tests are completed. A report is being written.

Reports: None

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 –
February 28, 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: The objective of this research is to investigate the utilization of processed corn stover or corn grain fermentation by-product in pavement base/subbase soil stabilization. Specifically, it will:

- Demonstrate 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.
- Evaluate the effect of lignin on the engineering properties of soil-lignin mixtures for Iowa conditions. It is anticipated that the successful completion of the proposed research will lead to extended and rigorous evaluation of this concept both in the lab and in terms of field performance.

Progress: Research efforts have focused on the analysis of secondary experimental test results. The research team also carried out experimental test program to compare the moisture susceptibility property of bio-fuels co-products treated soils with untreated and traditional stabilizer (fly ash) treated soil samples. Combined additive combinations (bio-oil and fly ash, bio-oil and E310) on soil stabilization were also evaluated. The laboratory tests for moisture susceptibility evaluation consisted of two types of tests; the unconfined compression strength (UCS) tests after “dry” and “wet” conditioning procedure and the visual observations of soaked specimens (so-called soaking tests).

Reports: None

Implementation: The usefulness of industrial lignins has been demonstrated by the profitability of the lignin chemicals business 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. Recently 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, the results of 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 –
December 31, 2009

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

Progress: Project progress:

- Completion of static and dynamic pile tests in Mills, Mahaska Polk, Jasper, Clark, Buchanan 1 and Buchanan 2, and Poweshiek counties, conducting in-situ and laboratory soil tests (CPT, SPT, Borehole Shear Test, sieve analysis, Atterburg Limits, and soil classification) for all test sites
- Conducting PDA and CAPWAP analyses for records collected from Mills, Mahaska and Clark counties
- Conducting GRLWEAP analysis on usable data from electronic database PILOT-IA established in TR-573 and determining resistance factors using four different soil input options
- Examining the use of WEAP for construction control purposes using a probability based approach
- Investigating the influence of setup on pile capacity using recently collected test data in Clay and Drafting of a conference paper based on this outcome

Reports: None

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 office of Construction at the Iowa DOT, the course will be delivered over a period of one to three days and will 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 –
December 31, 2009

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:

- Completion of an on-line survey of Iowa counties in the following topic areas: foundation practice, usage of timber piles, pile analysis and design, as well as drivability and construction control
- Completion of analysis of usable steel H-pile and timber pile data from the database using eight different dynamic pile driving formulas
- Examination of dynamic formulas in construction control using a probability based approach
- Analyzed the capacity prediction capabilities of various dynamic pile driving formulas with regard to the type of hammer utilized for driving the pile
- Analyzed the relationship between the predicted pile capacity of various dynamic pile driving formulas and capacity dependent parameters such as pile length and blow count

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 will 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 be largely 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-585

Agency:
United States
Geological Survey

Principal Investigator:
Jim Giglierano

Research Period:
April 15, 2008–
September 30, 2009

Research Board Funding:
\$100,000

Funding Source:
100 % State -
70 % Primary funds,
30 % Secondary
funds

National Agriculture Image Program Participation

Objective: To participate in funding the acquisition of high resolution quality aerial imagery on an annual basis and make it publically available free of charge. Duplication of aerial imagery acquisition will be eliminated by providing a product that meets the needs of state, county and local officials in a majority of cases. It is imperative ways are found to combine limited resources that best meet the needs of those utilizing this imagery frequently.

Reports: Final Report, December 2008

Implementation: The USDA Farm Service Agency (FSA) uses this imagery to keep farm records current, verify crop reporting and commodity compliance. Many departments of city, county, and state government use the imagery for integral government business such as property appraisal, law enforcement, emergency management, road and bridge maintenance, water resource management, etc. An annual imagery program also allows change detection of photo-identifiable features.

Iowa state government uses this imagery in multiple ways. In many cases availability of quality, yearly imagery has become a substitute for field visits, saving staff time and mileage. Aerial imagery also enhances field visits, making staff more efficient by locating features more quickly or identifying potential problems before they become acute.



2008 NAIP imagery of an intersection on US 18 and I-35 in Cerro Gordo County
Photo: United States Geological Survey

TR-586

Agency:

The University of Iowa

Principal Investigator:

Hosin “David” Lee

Research Period:

April 1, 2008 – September 30, 2009

Research Board Funding:

\$50,000

Funding Source:

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

Pavement Thickness Design for Local Roads in Iowa

Objective:

- Identify the most critical input parameters by performing a sensitivity analysis
- Determine the minimum pavement thickness by performing a mechanistic analysis of pavement structure
- Develop a new SUDAS pavement design procedure which can provide more appropriate design thicknesses for a broad range of pavement conditions

Progress: Draft Final Report is under review

Reports: None

Implementation: Institutions and individuals who will take leadership in applying the new SUDAS pavement design procedure and software will be identified. These leaders will probably be engineers from the SUDAS board of directors, six SUDAS districts and Iowa DOT, who will use the procedures and then publicize the benefits to other cities and counties in Iowa.

At the project's initiation, the research team will recruit leaders to guide the development process as potential users. They will be invited to serve on the Technical Advisory Committee (TAC), who will guide the PI and his project team following established specific objectives.

Through proper guidance by the SUDAS board of directors and six districts, the research team can periodically adjust the development of new pavement design procedure and software interfaces to meet the demands from users.

TR-587

Agency:
Iowa State University

Principal Investigator:
Kejin Wang

Research Period:
March 1, 2008 –
February 28, 2009

Research Board Funding:
\$40,000

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

Impact of Low Shrinkage Mixes on Late-Age Random Cracking in Pavements with Use of Early Entry Sawing

Objective: The objective of this project is to investigate whether or not there is an increased risk of delayed random cracking in early-entry sawed pavements. Since cracking is related to the stress development in concrete, the specific objective of this study is to examine the levels of stresses developed at early entry sawed joints of pavements in comparison to conventional depth joints.

Reports: Final Report, April 2009

Implementation: The results of the study can be used by the Iowa DOT and the paving industry to identify potential late-age random cracking problems in the pavement constructed with early-entry sawing operations. The results may also provide insights into any modifications of the current early entry operations, such as sawing depth and joint spacing.



Strain gages installed at joints just before paving monitor stress resulting from concrete shrinkage (US 34 Fairfield bypass)

Photo: Dr. Kejin Wang, Iowa State University/CCEE

TR-588

Agency:
Stanley Consultants

Principal Investigator:
Larry Badtram

Research Period:
March 1, 2008 –
June 30, 2008

Research Board Funding:
\$113,239

Funding Source:
100 % State -
100 % Secondary
funds

Update of the Continuous Concrete Bridge Standards (J Standards)

Objective: The Iowa Highway Research Board (IHRB) has recently released updated Three Span, Continuous Concrete Slab Bridge Standards (J Standards). The standards were updated to bring the superstructure design up to current LRFD design standards.

At the time of the update, the AASHTO LRFD substructure design standards were not ready for use. Recent changes in Iowa DOT design standards for abutment wings, barrier rail end sections and paving notches have also been completed but were not included in the J standard update.

This project will update the J standards to LRFD substructure design, the barrier rail end section, paving notch and wing design sections.

Reports: Standards Complete, December 2008

Implementation: Detail sheets are available to all local jurisdictions in Iowa as well as the Iowa DOT (in Microstation and PDF format) at: www.dot.state.ia.us/bridge/index.htm.

Cost savings from using these standards instead of individual consultant designs for each bridge will be available for use in other parts of the roadway network.

TR-589

Agency:
National Weather
Service

**Principal
Investigator:**
National Weather
Service

Research Period:
April 1, 2008 –
March 31, 2011

**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: To 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: Recent focus has been on data acquisition, evaluation, and reformatting. A total of 39 potential data sources were identified. Seventeen datasets were downloaded from the internet or received after contacting the data sources. Two datasets (NCDC and USGS data) were reformatted into the HDSC standard format. After preliminary evaluation, it was decided not to use data from nine sources, either because they had no stations with more than ten years of data or because data was duplicated from another source.

The main focus for the next period will be data reformatting, evaluation, extraction of annual maximum series, and quality control, as well as a review of related literature.

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.

TR-590

Agency:

The University of
Iowa

**Principal
Investigator:**

Hosin "David" Lee

Research Period:

April 1, 2008 –
March 31, 2009

**Research Board
Funding:**

\$57.666

Funding Source:

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

Examination of Curing Criteria for Cold In-Place Recycling (CIR) – Measuring Temperature, Moisture, Deflection and Distress for the Test Section

Objective: During the phase I study, research efforts focused on the laboratory experimentation. However, it is suspected that the moisture conditions measured in the laboratory may not be equivalent to the moisture conditions in the field. The main objectives of this phase II study are to:

- Measure the moisture levels throughout a CIR layer
- Develop a relationship between field moisture measurements and laboratory moisture measurements
- Develop a curing index to determine the optimum curing time for a CIR layer before overlay

Reports: Final Report, April 2009

Implementation: The results of the research were presented as a set of curing indices based on experimentation to measure moisture and temperature conditions throughout a CIR layer in the field.

This curing index will be useful for pavement engineers because it can accurately determine an optimum timing for an overlay to prevent premature failure of the CIR layer and HMA overlay.

TR-591

Agency:

Iowa State University

Principal**Investigator:**

Charles Jahren

Research Period:

April 1, 2008 –
February 28, 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

Progress: The first set of test sections were completed on US 20 just east of Jesup, Iowa. Stabilizers included Sodium Silicate, Magnesium Chloride and Calcium Chloride.

A second set of test sections was constructed on US 75 north of Sioux Center and US 20 WB lanes near Jessup. Post construction observations for the second test sections are currently being conducted. A Final Report is expected in early 2010.

Reports: None

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.

TR-592

Agency:
Iowa State University

Principal Investigator:
Brent Phares

Research Period:
August 1, 2008 –
January 31, 2010

Research Board Funding:
\$50,000

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

Bridge Rails and Approach Railing for Low-Volume Roads in Iowa

Objective: To provide guidance to county engineers for replacing or upgrading bridge and bridge approach guard railing by:

- Determining criteria and guidelines used by other states for bridge and approach guardrail implementation low-volume roads
- Performing benefit/cost analysis for using bridge and approach guardrails based on traffic levels and road classifications
- Investigating the use of non-standard and innovative bridge and approach guardrails for low-volume roads

Progress: Most project tasks are completed and the Final Report is being written. However, due to the low number of crashes occurring, few statistically justifiable results can be extracted.

Reports: None

Implementation: The successful completion of this project will provide useful technical information on the future feasibility of using bridge and approach guardrails on low-volume roads for the State of Iowa.



Example of a non-standard timber bridge rail located on a very low-volume road in Central Iowa, June 2009

Photo by: Zach Hans, Iowa State University/InTrans

TR-593

Agency:
Iowa State University

Principal Investigator:
Nadia Gkritza

Research Period:
August 15, 2008 –
January 15, 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: To 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; To 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; To quantify and visualize the impacts to the extent possible.

Progress: The research team interviewed county engineers from Des Moines and Lee counties to better understand county roadway maintenance expense and traffic and pavement condition fluctuations over the analysis period. The findings from the local agency survey were included in Chapter 3, while the results of the traffic impact analysis (traffic growth in truck traffic in 5-, 10- and 20-mile radii around the plants) and associated pavement deterioration were included in Chapter 4. The results of pavement analysis (recommended pavement design thickness based on ESALs) as well as the results of the fiscal impact analysis will be included in Chapter 5.

Reports: None

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 traveling along Iowa roads.
Photo: Iowa Energy Center

TR-594

Agency:
Iowa State University

Principal Investigator:
Chris Williams

Research Period:
August 15, 2008 –
February 28, 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: To optimize a bio-oil product (production and post-production) for use as a bio binder. Varying bio-oils will be produced and pyrolytic lignins derived for modifying asphalt binders. Liter quantities of bio-oil from five different fractions will be obtained and analyzed for their properties such as acidity, char content, and stability.

Progress: The bio-oil production facilities have been dismantled and the Bio-Economy Institute (BEI) & Center for Sustainable Environmental Technologies (CSET) encountered issues associated with purchasing components for the new pilot plant that is under construction. The BEI/CSET had the new pilot plant operational in late March, but is encountering production inconsistency.

Analysis of data collected (with some additional data) was used to develop reaction curves. The research team has exhausted the supply of bio-oil fractions provided by CSET and are waiting for additional bio-oil fractions to complete the experimental plan.

Physio-chemical analysis of the various fractions was done and is showing the various components that are influencing the behavior of the developed binders.

Reports: None

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 foreign crude oil.

TR-595

Agency:

The University of
Iowa

**Principal
Investigator:**

Thanos Papanicolaou

Research Period:

August 1, 2008 –
December 31, 2009

**Research Board
Funding:**

\$57,000

Funding Source:

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

Autonomous Measurements of Bridge Pier & Abutment Scour Using Motion- Sensing Radio Transmitters

Objective:

- Evaluate the Radio Frequency Identification systems (RFID) performance and if necessary make adjustments for facilitating direct and autonomous measurements of scour holes using RFIDs
- Examine the performance of different transponder types and geometric shapes at critical scour bridges found in eastern and western Iowa, and provide a QA/QC protocol as a way of testing the performance of the RFIDs relationships statewide
- Train users in the use, maintenance, collection and analysis of the data obtained from the RFID dataloggers and provide the software developed to the Iowa DOT

Progress: Work on this project is essentially complete. A Final Report is being written and will be delivered in December, 2009.

Reports: None

Implementation: An RFID system fitted with data telemetry equipment can collect and transmit data to a maintenance office. Remote monitoring could mitigate inefficiencies and dangers in current practices and provide early warning of impending bridge failure and tracking of long-term degradation as a result of scouring.



The water/sediment re-circulating flume for the RFID tests
(antenna is at the center of the flume)

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

TR-596

Agency:

The University of Iowa

Principal Investigator:

Marian Muste

Research Period:

August 1, 2008 –
February 28, 2010

Research Board Funding:

\$72,752

Funding Source:

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

Insights into the Origin and Characteristics of the Sedimentation Process at Multi-Barrel Culverts in Iowa

Objective: To initiate a comprehensive study for determination of specific conditions leading to culvert sedimentation in Iowa, engaging field inspection and measurement, physical modeling in a laboratory, and numerical simulations. The sedimentation process will be investigated in terms of: Culvert geometry; Soil characteristics at the culvert site; Hydrologic characteristics; and Sedimentation cumulative effects.

Progress: Supplemental field information, literature review, numerical modeling and experimental work are done. The simulation using HEC RAS were focused on establishing the stage/discharge relationship in the culvert responsible for the creation of the settling pools in the expansion leading to the culvert. Progressive simulations with rectangular, trapezoidal and unsteady flow conditions were tested to identify the factors responsible for sedimentation. Of special interest was capturing the hysteresis in the stage - discharge relationship.

The experiments in the flume modeled the newly synthesized information from literature and field surveys, as well as from numerical simulations. Of particular interest was implementing a realistic flow and sediment hydrograph in the model that can lead to reliable sediment deposition patterns and spatial and temporal variability induced by the unsteady flows.

Reports: None

Implementation: This research will provide fundamental insights in the sedimentation process at multi-barrel culverts and general understanding of processes that are currently not documented by analytical, experimental or numerical simulation means. Practical recommendations will be shared during workshops with county engineers. Research findings will be presented during the annual meeting of the Iowa County Engineers.

Sedimentation at culvert Buena Vista County
*Photo: Dr. Marian Muste,
The University of Iowa/IIHR*



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: To develop a two year line-test deck that allows the evaluation and demonstration of a variety of wet reflective pavement marking materials and treatments under wet night conditions.

Progress: The research team worked with the vendors to install the different pavement marking materials selected for the wet reflective test deck. So far, 12 out of 16 different products have been installed.

Dry and wet retroreflectivity measurements will be collected next quarter and for a period of two years to determine durability and performance for each product.

Reports: None

Implementation: Having the opportunity to document the performance of these various products and treatments will assist the Iowa DOT and local agencies in determining when and where use of these products might be most effective. Performance parameters will include durability, presence, retroreflectivity, 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/CCEE

TR-598

Agency:
Iowa State University

Principal Investigator:
Charles Jahren

Research Period:
December 1, 2008 –
February 28, 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: To 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.

Progress: Specification revision recommendations are complete. Review of recommendations is underway. Input on the specification changes will be provided during the early winter season. The Final Report is expected in spring 2010.

Reports: None

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 –
August 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: To identify technologies for producing Warm Mix Asphalt (WMA) and recommend up to three with the greatest potential for success using Iowa aggregates. These three technologies will be:

- Developed and tested in the laboratory for performance (permanent deformation, fatigue and moisture susceptibility), aging characteristics, and laboratory compaction effort
- Documented in a Draft set of procedures for field implementation; Field trials constructed and monitored and laboratory performance tested; Performance of field produced mixtures compared to laboratory produced mixtures and standard HMA control mixtures

Progress: The scope of the project is changing from the intended laboratory study to a field study. 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.

During the quarter, two field research projects were done including ones using Evotherm 3G/Revix and Sasobit. The warm mix asphalt (WMA) sampled last year (and the control mix) have undergone substantial mix testing (dynamic modulus) as well as viscosity testing and binder grading. Preliminary results illustrate the WMA mixture increases in stiffness when reheated as compared to the field compacted specimens. Also, the Evotherm 3G appears to have some anti-stripping potential.

All of the aggregate was sampled for the laboratory portion of the research project and the aggregate sieved. Control mix designs have been completed too.

Reports: None

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

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: To reduce quantity overrun concerns with GPS mapping of the project and reduce construction survey time with GPS mapping; To evaluate GPS and 3-D construction equipment control (milling machine, slipform paver and 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 that construction is not impacted.

Progress: An open house focusing on stringless paving was held September 2, 2009. Over 100 people representing five states visited the US 65 project. Grades were finalized on the US 65 project using GPS survey and total stations. All construction is completed or near completion on the Iowa 9 Osceola County, V-18 Poweshiek County and US 65 Worth County, sites. Construction work will be completed on this project in the upcoming quarter.

The Final Report outline and some background and discussion of the construction process used on each project are completed.

Reports: None

Implementation: It is anticipated the findings of the project will provide guidance on the implementation of WMA technology in Iowa. The research team will assist in the implementation of WMA technology 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 –
December 31, 2010

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: This Phase II study addresses the quality of lighting rather than just the presence of light with respect to safety. Iowa State University (ISU) staff have 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, un-signalized intersections. Recommendations to address lighting design and maintenance will be developed.

Progress: Project staff are working and coordinating with VTTI to collect lighting data for close to 145 intersections that were used in the Phase I of the project. The database of the location and characteristics of each intersection was sent to VTTI for testing and evaluation. Testing is to take place in November 2009.

Reports: None

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-602

Agency:
WHKS & Company

Principal Investigator:
Fouad Daoud

Research Period:
November 26, 2008 –
August 31, 2009

Research Board Funding:
\$66,476

Funding Source:
100 % State -
100 % Secondary
funds

Part I – Updating Portions of the Three-Span Prestressed Concrete Beam Bridge Standards to LFRD Specifications

Objective: To update the county "H" standard prestressed beam bridge plans and the abutment details of current three-span prestressed beam bridge secondary road standards (H-24, H-30, H-40 and H-44) to conform to AASHTO LFRD Specifications and to update other various superstructure details.

This project involves updating specifications for abutment piling to conform to the LFRD Specifications, modifying the abutment wings section, revising the F and Open railing end sections, and making other miscellaneous revisions.

Progress: Completed Standard Plans have been delivered to the Iowa DOT for review. Final plans should be available in autumn, 2009.

Reports: None

Implementation: Using a combination of structural, geotechnical and LFRD specialists, this project will update portions of the Three Span Prestressed Concrete Beam Bridge Standards (H24, H30, H40 and H44 Standards). This involves updating the abutment piling to conform to the LFRD Specifications, modifying the abutment wings, revising the F and Open railing end sections, and making other miscellaneous revisions.



Three-span bridge on US 169 over the Des Moines River, Algona, IA
Photo: WHKS & Company

TR-603

Agency:

Foth Infrastructure &
Environmental, LLC

**Principal
Investigator:**

J. Scott Ingersoll

Research Period:

November 26, 2008 –
January 4, 2010

**Research Board
Funding:**

\$274,111

Funding Source:

100 % State -
100 % Secondary
funds

Part II – Updating Portions of H-Standard Three-Span Prestressed Beam Bridges, T-Pier and Pile Bent Pier Update to LFRD Specifications

Objective: To update and revise the following specifications to LFRD Specification:

- H-Standard T-Pier and Pile Bent Pier
- T-pier cantilever to conform to strut and tie model
- T-pier stems
- T-pier footings
- T-pier pile supported footings for SRL-2 pile capacities
- Pile bent Bridge Design Specifications

Progress: The project is currently 90% complete. Final submittals are expected by the end of December, 2009.

Reports: None

Implementation: Plans will be delivered in electronic format to the Iowa DOT. The Bentley MicroStation V8 design files will adhere to the Iowa DOT Office of Bridges and Structures CAD standards for color, leveling, line weight and naming convention. One CAD file will be provided for each roadway width.

The pier sheets will be assembled into a single PDF file for each roadway width. MicroStation design files will also be provided. All files will be sent to the Iowa DOT via electronic mail or the Iowa DOT FTP site. All design computations will be provided in PDF format and submitted to the Iowa DOT. One file for each roadway width will be provided.

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: To 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 Iowa State University (ISU), the United States Department of Agriculture (USDA) Forest Products Laboratory (FPL) and Delaware County Engineering staff.

Progress: Bridge construction was completed this quarter and a field test was immediately performed. The performance of the asphalt wearing surface and how its design may be impacting the overall bridge performance is being examined.

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.



Demonstration timber bridge completed in spring 2009, Delaware County, Iowa, 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 in fully leveraging the FHWA Innovative Bridge Research Construction Program funding made available
- 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: The construction of the bridge is complete and documented using both point-in-time photographs and time-lapse photography. Field load testing of the completed bridge will be conducted early in the 4th quarter of 2009.

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

Leadership Academy (LTAP)

Objective: The Iowa Local Technical Assistance Program (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 will be 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
- Fundamentals of Government
- Resource Management Skills
- Basic Management Skills
- Leadership Skills
- Legal Understanding
- Finance
- Operations and Maintenance

Research Tasks for this Project:

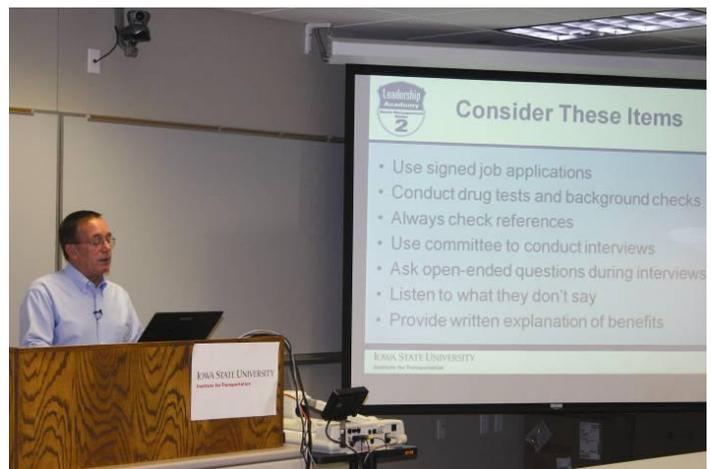
- Coordinate Planning and Development Activities
- Develop Academy Identity or Theme (Branding)
- Establish A Marketing Plan
- Sequence and Schedule Academy Development
- Create Module Content
- Present Academy Modules
- Integrate the Academy into Conferences and Workshops
- Identify Measures of Success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

Progress: The first three modules have been developed. Future modules are being tested and taped at a rate of about three per year.

Reports: None

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.

Dr. Duane Smith teaches a module of the LTAP Leadership Academy in October, 2009, at Iowa State University
Photo: Mina Shin, Iowa State University



TR-607

Agency:
Snyder and
Associates

**Principal
Investigator:**
Steve Klocke

Research Period:
March 9, 2009 –
March 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: To 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

Progress: The first regular review meeting was held in July 2009 to review the patching specifications and associated figures which have been completed and reviewed by the SUDAS District committees. It is anticipated that the SUDAS Board of Directors will approve the patching specifications in March. This would make the revised patching specifications available as a possible supplemental specification.

Work has begun on establishing a landscaping subcommittee to review those specifications and provide recommended changes over the winter 2009 – 2010. Remaining specification sections will be revised for incorporation into the 2011 Edition of SUDAS.

Reports: None

Implementation: The revised specifications and figures developed as a 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 –
July 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: To develop a conceptual model that facilitates accurate forecasting, yet simple enough to be presented and explained in public presentations. In addition:

- After the conceptual model has been defined, physical and financial data will be gathered from both the public and private sectors and reviewed in order to identify and quantify interrelationships between the road network, the vehicles that operate upon it, and the land parcels that adjoin it.
- A data structure and data processing engine will be defined to represent the road, traffic and land use entities relationship to and affect on each other.

Progress:

- Gathered data on roads, bridges, land use and costs and a joint GIS/SQL database built to contain and relate the information
- Developed a correlation between acres of land and miles of roadway
- Developed a model for associating rural land use attributes, (population, acres of crop ground, total grain harvest quantities, number of farmsteads and animal counts), with overall VMT in each county

This information will be used in agri-business contact sessions to frame questions on how farming is evolving, and as a tool for predicting future traffic levels based upon likely trends in rural land use. All process variables and tables needed to assemble the ‘analysis engine’ proposed in this project have been identified.

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, 2010

**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 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. Objectives are to:

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

Progress: Contract signed June 2009

Reports: None

Implementation: This study 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.

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 Crisis

Objective: To develop and assess the 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 assisting bridge inspectors in their endeavors.

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

Progress: Contract signed July 2009

Reports: None

Implementation: This research will provide 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 –
July 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

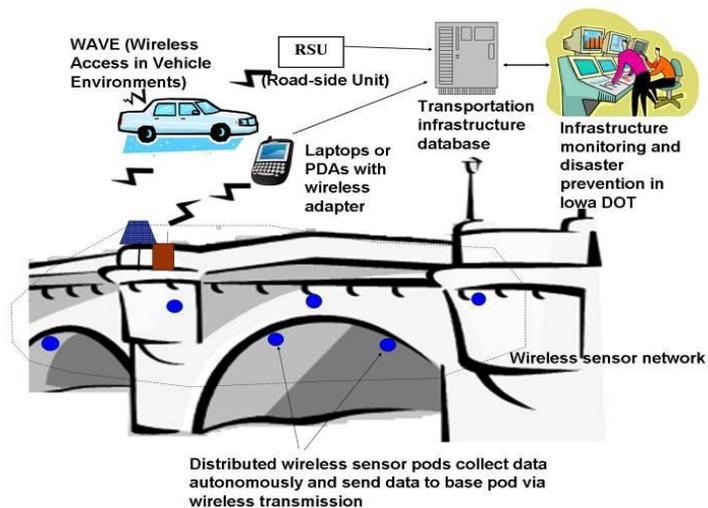
Objective: To evaluate the use of distributed wireless sensor networks instead of PC-based systems for transportation infrastructure monitoring. This research will:

- 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 a 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

Progress: Contract signed July 2009

Reports: None

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

HR-1027

Agency:

Iowa Department of
Transportation

**Principal
Investigator:**

Edward J. Engle

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: To maintain research liaison with all county engineers and solicit new, innovative and progressive ideas; To actively promote secondary research for solutions to problems and ideas that will improve quality and reduce costs.

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

At present, there are approximately 40 active research projects involving counties, including secondary projects with consultants. The coordinator assists these counties with special testing, evaluation and writing of construction and final reports necessary to the research and keeps county engineers updated on the changes in the IHRB operating procedures.

Reports: None

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

