



# Department of Transportation

## Division of Planning/Engineering

### Office of Research

700 E Broadway Avenue

Pierre, South Dakota 57501-2586

605.773.3292 FAX: 605.773.4713

#### MEMORANDUM

**To:** Bill Anderson, Pennington County Highway Department  
Kellie Beck, Director, Division of Fiscal & Public Assistance  
Darin Bergquist, Interim Secretary of Transportation  
Joe Feller, Materials & Surfacing Engineer  
John Forman, Pierre Region Engineer  
Greg Fuller, Director, Division of Operations  
Bruce Hunt, Federal Highway Administration  
Cheryl Johnson, City of Spearfish Public Works Director  
Dan Johnston, Transportation Research Engineer  
Scott Meyer, System Vice President for Research, SD Board of Regents  
Loren Schaefer, Director, Division of Planning/Engineering  
Kevin Tveidt, Deputy Secretary of Transportation

**Cc:** Meeting Participants  
Research Staff  
Region Engineers, Area Engineers, Region Operations Engineers, Program Managers

**From:** David Huft, Research Engineer *dlh*

**Date:** August 28, 2007

**Subject:** Research Review Board Agenda for August 30, 2007 Meeting

As previously announced, the Research Review Board will meet on Thursday, August 30, at 8:15 pm in the Materials Laboratory Classroom. The agenda will include presentations on two concluding research projects:

- SD2005-01 *Mechanistic/Empirical Pavement Design Guide Implementation Plan*
- SD2005-12 *Applicability of Paleoflood Surveys to the Black Hills*

Implementation recommendations will be presented for five concluding research projects:

- SD2002-16 *Evaluation of Metallized Stainless Steel Clad Reinforcement*
- SD2004-10 *Upgrade of South Dakota Environmental Sensing Stations*
- SD2004-12 *Mobile Data Collection for Winter Maintenance Vehicles*
- SD2005-07 *Evaluation of Recycled Portland Cement Concrete Pavements for Base Course and Gravel Cushion Material*
- SD2005-14 *Improving Crash Reporting on Nine South Dakota Indian Reservations*

One new research topic will be considered:

- SD2007-\_\_ *SD Highway Patrol & State Radio Personnel Adequacy & Allocation*

Finally, participation in three Transportation Pooled Fund Studies will be considered:

- TPF-5( ) *Precipitation Frequency Estimates for the Midwestern Region*
- TPF-5(068) *Long-Term Maintenance of Load and Resistance Factor Design Specifications*
- TPF-5(145) *Western Maintenance Partnership*

Please call me at 773-3358 if you have any question about this agenda. I look forward to seeing you at the meeting.

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### **Call to Order (8:15)**

Chairman Loren Schaefer will call the meeting to order and introduce new Board member Greg Fuller, Director of Operations.

### **Improving Motor Vehicle Crash Reporting on Nine South Dakota Indian Reservations (8:20) (Attachment A)**

Toni Wells of the Lower Brule Sioux Tribe will present the research implementation recommendations of the technical panel for SD2005-14, *Improving Motor Vehicle Crash Reporting on Nine South Dakota Indian Reservations*. The completed study's objectives were to:

- Describe and evaluate crash reporting practices used on the nine Indian reservations with lands in South Dakota.
- Identify barriers to complete and accurate reporting of crashes on reservations.
- Recommend practical ways to improve the completeness and accuracy of future crash reporting on reservations.
- Improve the completeness and quality of crash data reported to the South Dakota Department of Public Safety from the nine reservations in calendar year 2005.

### **SD Highway Patrol & State Radio Personnel Adequacy & Allocation (8:35) (Attachment B)**

Maj. James Carpenter of the South Dakota Highway Patrol will ask the Board to authorize a new project to assess the statewide level and allocation of staff reporting to the Highway Patrol. The cost of the study would be borne by the South Dakota Department of Public Safety.

If the work is authorized, the Office of Research will convene a technical panel to:

- investigate the background of the subject;
- recommend whether research on the subject would be beneficial; and, if so,
- recommend the scope, duration, and funding for the research.

### **Applicability of Paleoflood Surveys to the Black Hills (8:45)**

Dan Driscoll and Jim O'Conner of the United States Geological Survey will present findings of study SD2005-12, *Applicability of Paleoflood Surveys to the Black Hills*. The objective of the concluding study was to:

- assess the applicability of paleoflood survey techniques to generate better historical records on the magnitude and frequency of peak flood events in the Black Hills area.

### **Precipitation Frequency Estimates for the Midwestern Region (9:10) (Attachment C)**

Kevin Goeden of the Office of Bridge Design will ask the Board to authorize participation in a new Transportation Pooled Fund Study to update precipitation frequency estimates for the Midwestern region of the United States. Estimates were last updated approximately fifty years ago. The proposed pooled fund study would produce estimates for the states of South Dakota, Iowa, Kansas, Minnesota, Missouri,

North Dakota, and Nebraska. The cost for South Dakota's share of the work would be \$176,000, or \$58,667 per year for three years.

**Long-Term Maintenance of Load and Resistance Factor Design (LRFD) Specifications (9:20)  
(Attachment D)**

Kevin Goeden of the Office of Bridge Design will ask the Board to authorize participation in Transportation Pooled Fund Study TPF-5(068) to maintain AASHTO Load and Resistance Factor Design specifications. The Federal Highway Administration has authorized the work to be eligible for funding with 100% State Planning & Research Funding. The requested level of participation is \$20,000 in FY2008 and \$20,000 in FY2010. South Dakota contributed \$20,000 toward the study in 2005.

**Evaluation of Metallized Stainless Steel Clad Reinforcement (9:30)  
(Attachment E)**

Dan Johnston of the Office of Research will present findings of study SD2002-16, *Evaluation of Metallized Stainless Steel Clad Reinforcement*. The objectives of the study were to:

- determine the corrosion-resistance of the SMI-316 SC™ compared to epoxy coated reinforcing steel.
- determine the mechanical properties, quality and suitability of the SMI-316 SC™ for use in bridge decks.
- estimate life expectancy and cost effectiveness of the SMI-316 SC™, epoxy coated reinforcing steel, and mild steel reinforcement in South Dakota.

**Break (9:40)**

**Mechanistic/Empirical Pavement Design Guide Implementation Plan (9:50)**

Katie Zimmerman of Applied Pavement Technology will present findings of SD2005-01, *Mechanistic/Empirical Pavement Design Guide Implementation Plan*. The objectives of the study were to:

- identify the requirements and resources that will be needed for SDDOT to implement the AASHTO M-E Pavement Design Guide;
- develop AASHTO M-E Pavement Design implementation plan for SDDOT.

**Evaluation of Recycled Portland Cement Concrete  
Pavements for Base Course and Gravel Cushion (10:15)  
(Attachment F)**

Tom Grannes of the Office of Materials & Surfacing will present the research implementation recommendations of the technical panel for SD2005-07, *Evaluation of Recycled Portland Cement Concrete Pavements for Base Course and Gravel Cushion*. The objectives of the research were to:

- determine if recycled concrete should be used as a base course or gravel cushion;
- develop materials guidelines and specifications for construction of pavements using recycled concrete for base course or gravel cushion;
- develop laboratory and field material testing requirements for recycled concrete.

On the basis of the research, the panel will recommend that SDDOT allow the use of recycled PCC for base and cushion.

### **Ideas Into Action (10:30)**

David Huft of the Office of Research will show a DVD presentation entitled *Ideas Into Action* relating to innovation and research implementation. The presentation was originally developed for the Federal Highway Administration's Office of Highway Safety.

### **Upgrade of South Dakota Environmental Sensing Stations (10:45) (Attachment G)**

Mark King of the Office of Operations Support will present the research implementation recommendations of the technical panel for SD2004-10, *Upgrade of South Dakota Environmental Sensing Stations*. The objectives of the study were to:

- assess the condition and capability of SDDOT's existing ESS installations.
- develop functional and physical specifications for a baseline ESS field installation.
- define NTCIP-based protocols for exchanging environmental observations and information for monitoring and control functions between the standard ESS field installation and a traffic operations center.
- construct and evaluate a functioning field controller that can acquire and condition environmental observations and communicate with a traffic operations center.
- recommend a cost-effective strategy for upgrading SDDOT's ESS network by the end of calendar year 2006.

### **Mobile Data Collection for Winter Maintenance Vehicles (11:00) (Attachment H)**

John Forman of Pierre Region will present the research implementation recommendations of the technical panel for SD2004-10, *Mobile Data Collection for Winter Maintenance Vehicles*. The objectives of the study were to:

- assess the suitability of SDDOT's winter maintenance fleet to be equipped with mobile data collection systems;
- develop functional and physical specifications for a baseline mobile data collection system for winter maintenance vehicles;
- define NTCIP-based protocols for exchanging observations and information for monitoring and control functions between the standard mobile data collection system and a traffic operations center;
- construct and evaluate a functioning field controller that can acquire and condition mobile observations and communicate with a traffic operations center;
- recommend a cost-effective strategy for upgrading SDDOT's winter maintenance fleet.

**Western Maintenance Partnership (11:15)  
(Attachment I)**

Greg Fuller of the Division of Operations will ask the Board to authorize participation in transportation pooled fund study TPF-5(145), *Western Maintenance Partnership*. The purpose of the partnership is to provide a forum for promoting effective maintenance strategies by:

- funding a multi-day annual workshop for discussion and exchange of information and knowledge about each state's maintenance program;
- providing a means to define, support and share technology of mutual interest;
- funding formal training presentations during the annual workshop;
- funding management support of the partnership;
- funding special studies, investigations, research and training.

An annual contribution of \$5,000 – \$10,000 per state is requested for three years.

**Research Contractor Survey (11:25)**

David Huft of the Office of Research will present findings of a survey recently conducted to assess the Office of Research's management of contract research projects.

**South Dakota School of Mines & Technology Transportation Faculty (11:35)**

Dr. Mel Klasi of the South Dakota School of Mines & Technology will introduce Dr. Joseph Fazio, Associate Professor and Dr. Lance Roberts, Assistant Professor in the Civil and Environmental Engineering Department. Dr. Fazio, whose background is in transportation engineering, will coordinate and develop transportation-related courses at SDSM&T. Dr. Roberts, whose background is in geotechnical engineering, is currently engaged in research on full-depth reclaimed pavements being conducted jointly with the Office of Research.

**Roadway Evaluation Van (11:45)**

Rocky Hook of the Office of Transportation Inventory Management and Rudy Blanco of Pathways Services will briefly inform the Board of the functionality of the new roadway evaluation van, which acquires high-resolution images of roadways and pavement surfaces and measures the roughness, transverse profile, and other attributes of the pavement surface. The van will be available immediately after the meeting to allow Board members to observe it directly.

**Next Meeting Date**

The next meeting of the Board is tentatively scheduled for Tuesday, November 13, from 8:15 am until noon.

**Adjournment**

The meeting is expected to adjourn by noon.

**Technical Panel Evaluation and Recommendations**  
**SD2005-14 Improving Motor Vehicle Crash Reporting on Nine South Dakota Indian Reservations**  
**August 30, 2007**

**Researchers:** Polly Quick, Linda Bailey

**Study Duration:** February 2006—May 2007

**Organization:** ICF International    Interstate Engineering, Inc.  
Washington, DC    Pierre, SD

**Study Cost:** \$120,000

**Study Evaluation:** This project was initiated to assess current practices for reporting highway traffic crashes occurring on tribal lands in South Dakota and to suggest practical ways to improve the completeness and accuracy of crash reports. The study confirmed the existence of underreporting and identified specific barriers to more complete and accurate reporting, but more importantly identified simple but potentially effective improvements. In the opinion of the project's technical panel, the project elevated awareness of crash reporting and its importance to traffic safety improvements among state and tribal officials, and opened doors for collaboration among state and tribal agencies.

In the opinion of the technical panel, the research performed the work professionally and in a manner that was respectful of both tribal and state agency concerns. Site visits were congenial and discussions were constructive. The research team made use of their own experience and that of professional contacts in Native American issues nationally, and was responsive to the direction of the technical panel and SDDOT's project manager.

The technical panel feels that the research was well founded and productive, but emphasizes that the implementation process is critical to realizing the benefits of the work. The panel urges serious consideration and commitment to the implementation recommendations that follow.

**Research Objectives**

- 1) *To describe and evaluate crash reporting practices used on the nine Indian reservations with lands in South Dakota.*
  
- 2) *To identify barriers to complete and accurate reporting of crashes on reservations.*

**Panel Comments**

The research team described and evaluated crash reporting practices based upon information gained from face-to-face and telephone interviews with tribal leaders, law enforcement staff, and transportation officials at each tribe with lands in South Dakota. During their site visits, research team members also reviewed available crash reports. Finally, the research team obtained input from the South Dakota Department of Public Safety. Strengths and opportunities for improvement were identified for each tribe.

On the basis of information collected from interviews and site visits, the research team confirmed many of the potential barriers that had been suggested when the study was first proposed. In addition, the team identified some variations and evaluated the extent to which each barrier applied to each of the nine tribes.

- 3) *To recommend practical ways to improve the completeness and accuracy of future crash reporting on reservations.*
- 4) *To improve the completeness and quality of crash data reported to the South Dakota Department of Public Safety from the nine reservations in calendar year 2005.*

The research team recommended practical improvements to reporting procedures, training, institutional arrangements, and application of crash reports to support safety grant applications.

With partial success, the research team attempted to obtain previously unreported crash reports from tribes and to submit them to the Department of Public Safety's Accident Reporting System. In some cases, a significant number of crash reports were discovered and submitted. In other cases, the occurrence and location of crashes were identifiable from incident reports, but crash reports were not available. In one instance, tribal policy prevented examination of crash reports.

### **Research Tasks**

- 1) *Meet with the project's technical panel to review the project scope and work plan.*
- 2) *Conduct interviews and site visits with staff of tribal offices, the Bureau of Indian Affairs, the Indian Health Service, the South Dakota Office of Highway Safety, and the South Dakota Department of Transportation to identify crash data needs and to describe current crash reporting practices.*
- 3) *From results of the interviews and site visits, make a preliminary assessment of the availability, quality, and usability of crash data from the nine Indian reservations with lands in South Dakota.*
- 4) *From the results of the interviews and site visits, identify best crash reporting practices as well as barriers to complete and accurate crash reporting.*

### **Panel Comments**

The research team met with the project's technical panel on March 9, 2006.

During the course of the project, the research team met with representatives of every tribe at tribal offices, as well as with representatives of the South Dakota Department of Public Safety's Office of Highway Safety, the Indian Health Service, the Aberdeen Area of the Bureau of Indian Affairs, and the South Dakota Department of Transportation. In addition, the researchers conducted telephone interviews with tribal officials in South Dakota and with officials from other state and tribal governments.

Following initial site visits, the research team submitted a preliminary evaluation of the availability and quality of crash reporting data among the nine tribes with lands in South Dakota. The evaluation included recommendations for follow-up work needed to access the available information.

The research team identified and described best practices for crash reporting, not only among South Dakota tribes but also for other notable examples elsewhere in the United States. Best practices ranged throughout the reporting process, beginning with crash investigation and ending with submission of complete crash reports to the South Dakota Department of Public Safety. The research team also identified technical and institutional barriers to complete and accurate reporting, and described the extent to which each identified barrier applied to each tribe.

- 5) *Prepare a technical memorandum and meet with the project's technical panel to review results of tasks 2-4.* The research team submitted a technical memorandum to the project's technical panel on October 18, 2006.
- 6) *From the examination of available crash reports and databases available on each of the nine reservations, develop estimates of current reporting rates and rates that might be achieved through improved procedures.* Through examination of crash reports, incident reports, and databases available at tribal offices and the South Dakota Department of Public Safety, the research team reported the number of documented crashes for each of the nine tribes. In many cases, crashes were documented only in incident reports, which contain insufficient information to satisfy the requirements for crash reports. Anecdotal evidence suggested that a significant number of crashes are not even recorded in incident reports, making accurate estimation of crash frequency impossible. The number of documented crashes agreed approximately with predictions made earlier in SD2003-15, which were based on mathematical models derived for geographically and demographically similar non-reservation counties.
- 7) *From crash reports and databases available on each of the nine reservations, identify calendar year 2005 crash reports that could be, but which have not yet been, submitted to the South Dakota Office of Highway Safety. In cooperation with local authorities, prepare a supplemental submission of that data to the South Dakota Office of Highway Safety.* The research attempted to secure previously unreported crash reports from each tribe and to submit them to the South Dakota Department of Public Safety's Office of Highway Safety. In some cases, a significant number of crash reports were submitted. In many others, the occurrence and location of crashes were established from incident reports, but insufficient information existed to recreate a crash report. In other cases, crashes were recorded in tribal law enforcement databases, but could not be submitted to the Department of Public Safety because not all necessary data fields were available. In one case, current tribal policy prevented the examination of crash reports.
- 8) *Develop recommendations for practical changes in procedures, protocols, cooperative agreements between agencies, staff levels, training, information technology, and any other significant factors to improve the completeness and accuracy of future crash reporting on reservations. Estimate the resource requirements and cost of recommended changes.* In the final report for the project, the research team offered practical recommendations concerning training, reporting procedures, information technology, and institutional arrangements that could improve the consistency and accuracy of crash reporting. The recommendations consider important institutional issues, including tribal sovereignty and privacy concerns. With assistance from staff of the Department of Transportation, the Department of Public Safety, and tribal representatives to the project's technical panel, the research team proposed a base Memorandum of Agreement to help establish a policy for crash reporting between state agencies and each tribal government in South Dakota.

- 9) *In accordance with the Guidelines for Performing Research for the South Dakota Department of Transportation, prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.*
- 10) *Make an executive presentation to the South Dakota Department of Transportation's Research Review Board and the Aberdeen Area Tribal Chairmen's Health Board at the conclusion of the project.*

A final report and executive summary were submitted on May 29, 2007.

A presentation was made to the Department of Transportation's Research Review Board on February 9, 2007. SDDOT's project manager made a presentation to the Aberdeen Area Tribal Chairmen' Health Board on June 14, 2007. In addition, the research team made a presentation to the Transportation Research Board's Subcommittee on Tribal Traffic Safety in January 2007 and submitted a formal paper for presentation at the January 2008 Transportation Research Board Annual Meeting.

### **Researchers' Recommendations**

- 1) *The South Dakota Department of Public Safety should expand its training on crash reports for all tribal and BIA law enforcement officers, tailored to tribal law enforcement.*

*Individual training needs at each tribe should be assessed and the standard state curriculum should be tailored as much as possible to improve tribal and BIA law enforcement officers' knowledge of the South Dakota crash report form. In addition, the state should focus on the details about each crash that are required under the Model Minimum Uniform Crash Criteria (MMUCC). This will help tribes to work with the internal data processes they develop, while producing the crash details that are needed for SDARS.*

*The training may take the form of one-on-one training with South Dakota Highway Patrol officers, or a "train-the-trainer" model for each reservation. The Highway Patrol is currently working with some tribal police officers at Oglala Sioux Tribe, and future training programs should build on this experience. SDDPS could alternatively develop software that would guide law enforcement officers on tribal lands through the crash reporting form.*

*Training needs, including incentives for law enforcement officers, should be discussed individually with each tribe. Training is already available to tribal and BIA law enforcement officers, free of charge, from the SDDPS Department of Criminal Investigation, and promoting awareness of this training for tribal and BIA police could be helpful in itself.*

### **Panel's Recommendations**

The technical panel agrees that providing training to law enforcement staff responsible for crash reporting on tribal lands is essential to improved reporting. Such training is available to any law enforcement office in South Dakota from the South Dakota Law Enforcement Training Academy in Pierre and could be offered by the South Dakota Highway Patrol at locations throughout the state. Strategies that would make the training more attractive to tribal and Bureau of Indian Affairs law enforcement agencies include publicizing its availability and establishing a certification program, preferably one that would satisfy BIA requirements. Including use of the TraCS (Traffic & Criminal Software) system and elements of crash investigation would also increase the value of the training.

The panel therefore recommends that the Department of Public Safety, in collaboration with the Office of the Attorney General, should establish and market a Crash Reporting Course that could be offered separately or in conjunction with more general training at the South Dakota Law Enforcement Training Academy and that could certify course graduates in crash reporting, crash investigation, and use of TraCS.

2) *The South Dakota Department of Transportation should work directly with tribal councils to establish crash reporting as a priority for law enforcement on tribal lands.*

*The state should meet with tribal councils to establish Memoranda of Agreement with tribes describing the crash data that should be submitted, and the limits on its use once it reaches the state. Staff at the SDDOT have already prepared a draft MOA that commits tribes to sharing crash reports with the state in a compatible format to be agreed on. In return, the state would commit to providing technical support and training for the use of the crash report forms, and to maintaining the confidentiality of the data insofar as possible. The MOA covers a five-year period as currently drafted.*

*The MOA should be signed with notification to the tribal or BIA law enforcement agency, with the awareness that tribal councils set policy for law enforcement on reservations. While only a few tribes have explicit policies against reporting crash data to the state, data collection on crashes tends to have a low priority, even for internal uses. Passing a tribal resolution that crash data should be collected at the tribe would improve the reporting process.*

*A major concern for tribes has been double jeopardy, whereby an offender could be cited both by tribal or BIA police, and by State police after a crash report is submitted. This concern should be addressed directly in the MOA to assure tribal members that they will not be cited both in tribal and in the state criminal system.*

*SDDOT should pursue MOAs with tribes within the larger context of transportation improvements, emphasizing the fact that crash data will bolster the case for making roadways safer. SDDOT is currently conducting consultation meetings with each tribe on transportation issues and crash reporting could be woven into those meetings. Alternatively, SDDOT staff could visit tribal governments specifically to address crash data sharing agreements. However, putting the crash data agreements in a larger framework of transportation issues is still important in this context.*

3) *The South Dakota Department of Public Safety should encourage and facilitate grant applications from tribes to support tribal efforts to institute more effective internal processes to record and track crash data.*

*The state data system will benefit from a better internal data collection system at each tribe. Improvements should be explicitly encouraged under a grant program administered by the SDDPS. The grants could be provided for each tribe to institute or improve its own crash data processing system including procedures, staffing, and a tracking system, potentially using software. It could also be a thorough filing system for*

The panel feels this recommendation is fundamental to any improvement in crash reporting and to the success of all other offered recommendations. Establishing formal Memoranda of Agreement with tribes will help clarify how crash data are used and allay fears about possible misuse. In addition, MOAs will help reinforce the joint commitments of tribal and state agencies to crash reporting and traffic safety in general. Finally, establishing Memoranda of Agreement can heighten awareness of the benefits of reporting crash data to the Department of Public Safety, which can provide tribes with summary reports, analysis, and mapping of crash information for tribes' use.

The panel recommends that the South Dakota Department of Transportation should negotiate with the South Dakota Department of Public Safety and the tribal councils of the several tribes with lands in South Dakota to establish and maintain individual Memoranda of Agreement that clearly define tribal crash reporting commitments and specify the allowable uses and protections that the Department of Public Safety will apply to crash report data.

It is important that other local jurisdictions, whose highways abut and intersperse with tribal lands, be aware of the Memoranda of Agreement that are established to minimize possible confusion about reporting responsibilities. The panel recommends that the South Dakota Department of Transportation should inform county and municipal agencies of Memoranda of Agreement that are established through their respective local government associations and law enforcement associations.

The technical panel agrees that the South Dakota Department of Public Safety can significantly affect tribal crash reporting by providing opportunities for grant applications. Currently, the Department of Public Safety, through its administration of the National Highway Traffic Safety Administration's Section 408 Safety Data Improvement Program, is funding improvements for hardware, TraCS crash reporting software, and establishing rural addressing in unaddressed counties. The Section 408 program, and other NHTSA programs that may be applicable, require measurable improvements in reporting

paper with records kept in a ledger or well-maintained spreadsheet. Some reservations already use software for this purpose, as discussed above, and others may benefit from instituting software or improving their training on it. The SDDPS grant program would support the development of an action plan at each tribe that will achieve specific goals for its data processing system, starting from the current status of crash reporting on that reservation.

NHTSA provides funds through its 408 program specifically to improve traffic records. This is a possible funding source for this recommendation. A successful application for 408 funding would require a 20 percent match from the tribe or the Indian Highway Safety office, and buy-in from BIA and FHWA. This funding has been approved only for the purpose of improving state data systems, so tribal improvements would have to be tied to SDARS. SDDPS may be able to locate other funding sources for this recommendation as well.

4) *The South Dakota Department of Public Safety should make reporting as easy as possible for tribes.*

The SDDPS can ease the transfer of data by implementing various technological and personnel measures. For example, if a tribe has a complete data processing system on site, such as the Cisco system, the SDDPS can work to accept electronic data exported from those files. In the course of the research, Cisco expressed an interest in developing a report that would essentially mirror the SD crash report form. The state may also benefit from devoting information technology staff time to working with law enforcement assistants and other staff at tribes who work with crash data systems.

For tribes with privacy concerns, accepting crash reports without personal identifiers will be vital to the data submission process. Crash reports would still contain all other details about the people involved in the crash (date of birth, sex, etc.), and could simply use a generic name ("Jane/John Doe"). Tribal concerns about privacy are a significant barrier for some tribes, and SDDPS can build trust with those tribes by focusing on the safety issues and relaxing personal identifier requirements.

5) *The South Dakota Department of Transportation should motivate crash reporting by actively facilitating the identification of rural hazards on tribal lands and by funding improvements.*

By focusing on rural roadway hazards on tribal lands, the South Dakota DOT can strengthen the motivation for tribes to improve their crash reporting systems. The Hazard Elimination Program, part of the federal Highway

accuracy, completeness, timeliness, uniformity, accessibility, or data integration.

The technical panel recommends that the Department of Public Safety's Office of Highway Safety should annually market the Section 408 Safety Data Improvement Program and other applicable NHSTA programs to the nine tribes with lands in South Dakota to identify and support productive and sustainable improvements in crash reporting on tribal lands.

The panel emphasizes the need for improvements and funding plans to be sustainable, to avoid establishing programs that can only be temporarily maintained.

The technical panel agrees that, in the interest of promoting complete crash reporting, barriers to reporting should be minimized. Accepting crash reports from tribal data processing systems could significantly reduce the time and effort required from tribes to report crashes to the South Dakota Accident Reporting System. Likewise, providing TraCS to tribal law enforcement agencies could make reporting more efficient for agencies that maintain their own crash records databases as well as agencies that might choose to report crashes directly to the South Dakota Accident Reporting System.

At the same time, the panel recognizes that some proposed changes—such as omitting names from crash reports, could reduce the value of the reports to tribal members, who need identified crash reports to resolve insurance claims.

The technical panel recommends that the South Dakota Department of Public Safety's Office of Highway Safety should work with each tribe to identify a feasible method for acquiring electronic crash records and transferring them into the South Dakota Accident Reporting System.

At the outset of this project, the technical panel identified the location and remediation of hazardous locations as a valuable application of complete and reliable crash reports. The panel believes that making funding available for demonstrated physical improvement needs would indeed motivate crash reporting. Finally, the panel agrees that Road Safety Audits, which in South Dakota are often coordinated through the SD Local Transportation Assistance

*Safety Improvement Program, is a potential source of funding for this. A requirement for the application process for these funds would be a crash analysis of the location where the safety measure will be implemented. The DOT can clarify the process of applying for this set-aside by outlining clearly the type of information required in the application.*

*Road safety audits should be conducted to supplement crash data in identifying roadway hazards, since low traffic can mask serious safety problems on rural roads. As a model for this type of program, the Thurston Regional Planning Council (Washington) created a set-aside for rural areas from their federal Surface Transportation Program funds. In this program, smaller places were not matched up against large cities in competing for roadway improvement funds.*

Program (SDLTAP), SDDOT, and the Federal Highway Administration, provide another sound method for identifying locations in need of physical improvements.

The panel recommends that in annual consultation meetings, the South Dakota Department of Transportation should advise tribal governments in South Dakota of the existence and mechanics of its Roadway Safety Improvement (RSI) Program and of the Road Safety Audit Program, and encourage the submission of grant applications for improving locations with demonstrated need.

The panel does not believe that specific dedication of funding to rural roads will be necessary. Instead, the panel believes that hazardous locations in tribal lands will merit attention on the basis of crash data and the findings of Road Safety Audits.

## Technical Panel

Zane Arpan.....Cheyenne River Sioux Tribe  
Myrna Buckles .....Indian Health Service  
Roger Campbell .... Tourism & State Development  
Maj. J. C. Carpenter ..... SD Highway Patrol  
Gina Espinosa ...NHTSA Rocky Mountain Region  
Gerry Foell..... Bureau of Indian Affairs  
Elmer Four Dance ..... Bureau of Indian Affairs  
Gary Gaikowski .....Sisseton-Wahpeton Oyate  
June Hansen .....SDDOT Office of Legal Counsel  
Paula Hill .....Cheyenne River Sioux Tribe  
David Huft ..... SDDOT Office of Research  
Dennis Johnson ..... SDDOT Office of Research  
Sharon Johnson ..Federal Highway Administration

Robert Long ..... Rosebud Sioux Tribe  
Roy Meyer.....SD Dept. of Public Safety  
Col. Dan Mosteller ..... SD Highway Patrol  
Ben Orsbon..... SDDOT Office of the Secretary  
Pete Red Tomahawk....Standing Rock Sioux Tribe  
Ray Red Wing .....Flandreau Santee Sioux Tribe  
Genevieve Ribitsch .....Oglala Sioux Tribe  
Scott Shields..... Crow Creek Sioux Tribe  
Sam Sully .....Yankton Sioux Tribe  
Dennis Trusty ..... Northern Plains TTAP  
John Weaver..... Indian Health Service  
Toni Wells..... Lower Brule Sioux Tribe  
Patsy Winters .....SD Dept. of Public Safety

**South Dakota Department of Transportation  
Suggestion for Research  
2007 Program**

**Research Project Title:** Highway Patrol/State Radio Personnel Adequacy and Allocation

**Problem Statement:** *(What problem or need currently exists? What knowledge is needed to solve the problem or meet the need?)* The Patrol is under an ever increasing demand for its services. Does the Patrol have enough Troopers and/or dispatchers, and are they assigned in the appropriate locations to adequately fulfill its mission? The numbers for Troopers has fluctuated ever so slightly over the past 30 years, and the number of dispatch operators has been dramatically reduced. How has this change affected our level of service?

**Research Proposed:** *(What research do you propose to solve the problem?)* It is our hope as an outcome to have a more scientific basis to rely upon for the positioning of personnel within the State, as well as a firm understanding of the needs of the State as it relates to the number of HP & SRC personnel necessary to fulfill our mission for the State.

**Anticipated Benefits:** *(If this research is successfully completed, what benefits will the Department realize? What is their potential value?)* Initially the Patrol will be better positioned in its assessment for personnel assignment based upon identified need. Secondly, the agency will have more than just anecdotal information regarding the number of personnel necessary to perform the mission assigned.

**Urgency:** *(How soon must this research be started and completed to meet the identified need? Why?)* We would like to have this accomplished by mid fall of 2007. This time frame would allow the agency to make the necessary contacts in the event an increase in FTE is the identified solution.

**Submitted By:**

Major James Carpenter  
Assistant Superintendent  
South Dakota Highway Patrol  
118 W. Capitol Avenue  
South Dakota 57501  
605.773.3105/605.773.6046

## **Transportation Pooled Fund Study Solicitation Updating U.S. Precipitation Frequency Estimates for the Midwestern Region**

**Lead Agency:** Federal Highway Administration

**Technical Liaison:** Sterling Jones (sterling.jones@fhwa.dot.gov)

**Partners:** MN

**Duration:** 36 months

**100% SP&R Approval:** Approved

**Commitments Required:** \$1,349,000

**Commitments Received:** \$176,001

**Background:** In some parts of the country, rainfall maps have not been updated for approximately 50 years. That means we are ignoring the last 50 years of rainfall data in our basic hydrologic estimates for drainage structures. NOAA has updated parts of the country in various volumes of NOAA Atlas 14 with funding through regional climatic centers and other pooled funding arrangements. NOAA's National Weather Service (NWS) proposes updating precipitation frequency estimates for the states not included in NOAA Atlas 14 Volume 1 (AZ, southeast CA, NM, NV, UT), Volume 2 (DE, DC, IL, IN, KY, MD, NC, NJ, OH, PA, SC, TN, VA, WV), and Volume 3 (PR, VI). The proposal includes updating estimates for the Pacific Island dependencies. The updates will be published as subsequent Volumes of NOAA Atlas 14 "Precipitation-Frequency Atlas of the United States" on the web at "[www.nws.noaa.gov/ohd/hdsc](http://www.nws.noaa.gov/ohd/hdsc)". The solicitations are by climatic regions. This particular solicitation is for the Midwestern and will involve the following States: IA, KS, MN, MO, ND, NE, and SD

**Objectives:** The purpose of this study is to determine annual exceedance probabilities (AEP) and average recurrence intervals (ARI) for durations ranging from 5 minutes to 60 days and for ARIs from 1 to 1,000 years. The point estimates will be spatially interpolated to a spatial resolution of approximately 4km x 4 km. The study results will be published as volumes of NOAA Atlas 14, a wholly web based publication available at [www.nws.noaa.gov/ohd/hdsc](http://www.nws.noaa.gov/ohd/hdsc). The publication will include the artifacts provided in Volumes 1 and 2 including access through the Precipitation Frequency Data Server, base grids in standard formats, electronic copies of maps, results of trend analyses, charts of seasonal distributions and probabilistic temporal distributions, and detailed documentation. Updated areal reduction factors are being developed as a separate appendix to NOAA Atlas 14 for the entire U.S. including Alaska.

The project will review and process all reasonably available rainfall data. It is recognized that the rainfall data archived by NOAA's National Climatic Data Center (NCDC) may not be sufficient to accomplish the objectives of this project. Therefore, other data available from sources such as State Climatologists and other Federal, State and local agencies will be examined and included if appropriate. The state of the art techniques and processes developed and applied for NOAA Atlas 14 Volumes 1 and 2 will be applied. They include regional frequency analysis based on L-moments including error estimates, a combination of PRISM based techniques and CRAB for spatial interpolation, techniques for the analysis of climatic trend, temporal distribution and seasonality, internal consistency checks and variety of automated processes designed to enhance productivity. Intermediate results in the form of hourly and daily estimates at several ARIs will be distributed for peer review as will the final documentation.

**Scope of Work:** The attached proposed Statement of Work by NOAA provides detailed information on the following:

- Task 1 - Data Collection and Quality Control
- Task 2 - Regionalization
- Task 3 - Frequency Distribution Selection and Fitting Studies
- Task 4 - Frequency Calculations
- Task 5 - Short Duration Estimates
- Task 6 - Internal Consistency at Observing Locations
- Task 7 - Spatial Interpolation and Consistency
- Task 8 - Mapping and other Spatial Artifacts
- Task 9 - Temporal Distributions
- Task 10 - Peer Reviews
- Task 11 - Documentation
- Task 12 - Final Deliverables
- Task 13 - Status Reporting

**Comments:** Commitments required: \$1,349,000 with the following estimate by States: IA (\$174K), KS (\$236K), MN (\$176K), MO(\$205K), ND(\$162K), NE (\$208K), **SD (\$176K)**

**Documents:** <http://www.pooledfund.org/documents/solicitations/980-994.pdf>

**Subjects:** Energy and Environment, Bridges, Other Structures, and Hydraulics and Hydrology



VICTOR MENDEZ, PRESIDENT  
DIRECTOR, ARIZONA DEPARTMENT OF TRANSPORTATION

JOHN HORSLEY, EXECUTIVE DIRECTOR

444 NORTH CAPITOL STREET NW, SUITE 249, WASHINGTON, DC 20001  
(202) 624-5800 FAX: (202) 624-5806 • WWW.TRANSPORTATION.ORG



July 30, 2007

**RC-07-02, BR-07-01**

On April 21, 2002, the American Association of State Highway and Transportation Officials (AASHTO) Board of Directors approved policy resolution PR-4-02 endorsing the project "Long-Term Maintenance of Load and Resistance Factor Design (LRFD) Specifications". Since this resolution was approved, an LRFD Oversight Committee was formed, a Statement of Work was written, there was a Request for Proposal and a Contract Negotiation has taken place. The Contract was signed in May 2003 allowing the firm of Modjeski and Masters to take on the tasks of the long term Maintenance of the LRFD Specifications. Also in relation to the past Resolution PR-4-02, AASHTO asked FHWA for approval of a waiver of the match for the use of State Planning and Research (SP&R) funds for the project. FHWA determined that the proposed study meets the criteria for the use of Federal-aid funds used for Research and Development studies without State matching. States are authorized to proceed with the study using 100% State Planning and Research (SP&R) funding. Information on the accomplishments of this pooled fund project can be found on the AASHTO website at <http://bridges.transportation.org/?siteid=34&pageid=229>. Quarterly reports from Modjeski and Masters can also be found online at [www.pooledfund.org](http://www.pooledfund.org).

This pooled fund has been successfully in place since 2003. The AASHTO Highway Subcommittee on Bridge and Structures unanimously approved of the need for continuing funding of this program at their annual meeting in May of 2006. On July 21, 2006 a letter was sent asking for a recommitment of funds for this program. Now, we are sending this letter as a follow-up, asking you again to consider participating in this valuable program. At this time there are 28 states participating in this pooled fund. We would appreciate your help in increasing that number. To participate in funding the Long Term Maintenance of LRFD pooled fund project, States can log on to the website [www.pooledfund.org](http://www.pooledfund.org). There they can look for project number TPF-5(068), and make their commitments for fiscal year 2008, 2009 or 2010 electronically. At this time, the Subcommittee on Bridges and Structures would like to ask states to commit \$20,000 for 2008 and \$20,000 for 2010. This level of funding will keep the program in place through 2010 and contribute to great strides in research on and maintenance of bridge design specifications. If states do not wish to make their pooled fund commitment online, they may make their commitment via mailed letter to Ms. Sandra Larson at Iowa DOT, 800 Lincoln Way, Ames, IA, 50010, or fax it to (515) 239-1766.

If anyone has questions concerning further technical clarification of this project, they may contact Ms. Sandra Larson, Research and Technology Bureau Director for the Iowa Department of Transportation, by e-mail to [Sandra.Larson@dot.state.ia.us](mailto:Sandra.Larson@dot.state.ia.us) or telephone at (515) 239-1205 or they may contact Ms. Kelley Rehm, Contract Manager for AASHTO at [krehm@aaashto.org](mailto:krehm@aaashto.org) or telephone at (859) 433-9623.

Sincerely,

John Horsley  
Executive Director

JH:KR

**Technical Panel Evaluation and Implementation Recommendations  
SD2002-16 Evaluation of Metallized Stainless Steel Clad Reinforcement**

**Researchers:** David Darwin

**Study Duration:** December 2002 – June 2007

**Organization:** University of Kansas

**Study Cost:** \$70,000

Department of Civil and Environmental Engineering

**Study Evaluation:**

The Department initiated this study as an adjunct to an Innovative Bridge Research Project involving the proposed use of SMI 316-SC clad stainless steel in a bridge deck. Delivery and cost issues related to the manufacturer's inability to sustain usable production levels prompted the abandonment of the clad steel in actual bridge construction. Expensive 2405 duplex stainless steel was substituted in the bridge but the research project was continued in the hope that the clad steel would eventually become routinely available at a substantially lower cost as soon as production issues. The research was designed to establish the physical and chemical properties of the 316L clad A615 steel and develop recommendations for its future use in critical bridge decks where at least 75 years of maintenance free service were desirable.

The researcher did an excellent job on the project resulting in a comprehensive and favorable evaluation of the clad steel. Although the original duration of the study was to be limited due to construction scheduling constraints, when the use of the clad steel on a bridge deck became problematic, the study period was extended to allow time for complete corrosion testing. Additionally, the study involved a refinement of earlier work done as part of SD2001-05 Evaluation of Corrosion-Resistant Reinforcing Steel which evaluated MMFX steel as a corrosion-resistant alternative. In that study, the preliminary determination of the chloride corrosion threshold had been criticized by the manufacturer of the steel, primarily because the researcher recommended that MMFX steel not be used in bridge decks in South Dakota without some type of corrosion protection. The refined testing of MMFX steel accomplished in this study did not substantively change the original recommendation from the prior study although it did raise the critical chloride concentration for corrosion onset slightly.

**Research Objectives**

**Panel Comments**

- |  |   |
|--|---|
| 1) <i>Determine the corrosion-resistance of the SMI-316 SC™ compared to ECR reinforcement..</i>  | <i>The research team achieved this objective.</i>   |
| 2) <i>Determine the mechanical properties, quality and suitability of the SMI-316 SC™ for use in bridge decks.</i>   | <i>The research team achieved this objective.</i>   |
| 3) <i>Estimate life expectancy and cost effectiveness of the SMI-316 SC™, ECR and mild steel reinforcement in South Dakota.</i>  | <i>The researchers developed a useful and rational comparison of life expectancy and cost effectiveness.</i>  |
| 4) <i>Obtain additional data on the corrosion performance of MMFX Microcomposite steel and formulate changes in Conclusions and Recommendations to SDDOT as appropriate.</i> | <i>The researchers refined the chloride corrosion threshold for MMFX steel but did not have to alter their earlier recommendation not to use MMFX as the revised results were essentially the same.</i> |

## Research Tasks

- 1) *Perform a literature search on the SMI-316 SC<sup>TM</sup> and its use as reinforcement including a survey of any identified users.*
- 2) *Conduct a series of laboratory tests consisting at a minimum of elongation, yield strength, tensile strength, ASTM bend properties, composition, and corrosion rate on #4, #5, and #6 SMI-316 SC<sup>TM</sup>, and mild steel including end treatment effectiveness and provide recommendation for end treatment.*
- 3) *Provide evaluation of cladding uniformity, thickness variability, effects due to deformation profile and bond with the base metal on #4, #5 and #6 reinforcement.*
- 4) *Conduct a series of statistically valid comparative tests of corrosion resistance on the SMI-316 SC<sup>TM</sup>, ECR and mild steel reinforcement to determine general corrosion properties both inside and outside concrete, stress and pitting corrosion properties.*
- 5) *Analyze corrosion effects on the SMI-316 SC<sup>TM</sup> using scanning electron microscopy (SEM).*
- 6) *Submit an interim report no later than November 30, 2002 estimating SMI-316 SC<sup>TM</sup> service life and providing a recommendation of whether SMI-316 SC<sup>TM</sup> should be incorporated into a bridge deck including any necessary modifications to design or construction procedures.*
- 7) *Estimate life expectancy and cost effectiveness of the SMI-316 SC<sup>TM</sup>, ECR and mild steel reinforcement in South Dakota.*
- 8) *Prepare a final report and executive summary of the literature review, research methodology, findings, conclusions, estimated life for each steel type, evaluation plan and recommendations.*
- 9) *Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project*

## Panel Comments

A literature search was attempted though very few citations were available as the material was proprietary and first manufactured in 2002.

Yield strength, tensile strength and elongation tests were conducted on #5 and #6 bars. SMI did not manufacture any #4 bars for testing. Bending was not a problem as long as procedures for bending epoxy-coated steel were followed. The epoxy-bonded plastic cap end treatment proposed by SMI was shown to be effective.

Cladding bond was evaluated by observing the nature of the damage imparted during mechanical testing. The bars were also inspected for cracks and disbondment between the cladding and core metal. Results indicated a metallurgical bond exists between the 316 and mild steel.

Macrocell and bench-scale corrosion testing was conducted on the SMI-316 SC<sup>TM</sup>, ECR and mild steel reinforcement. The 316 SC<sup>TM</sup> was shown to have excellent corrosion resistance and the ECR was shown to have extremely good corrosion resistance.

A thorough examination of the SMI clad steel subjected to corrosion testing using macrocell and bench-scale specimens showed no indications of corrosion being an issue.

This task became moot when the decision was made not to use 316 SC<sup>TM</sup> in a bridge deck due to production and delivery issues. This task was withdrawn as a result.

Life expectancy estimates were produced for SMI-316 SC<sup>TM</sup>, ECR and mild steel reinforcement in South Dakota.

A final report was submitted for review and revised.

The principal investigator gave a presentation to the Research Review Board on May 15, 2007.

- 10) Compare the corrosion potential of conventional and MMFX Microcomposite steel in simulated concrete pore solution at NaCl molal ion concentrations ranging from 0.4 to 6.04.
- 11) Determine the chloride content at the corrosion threshold for conventional and MMFX Microcomposite steel.
- 12) Use the new data to modify life expectancy and cost effectiveness calculations for bridge decks containing MMFX Microcomposite steel.

The researchers accomplished this task.

The researchers provided a revised chloride content at the corrosion threshold slightly higher than an earlier value.

The new data was used to modify estimates of life expectancy and cost effectiveness calculations for bridge decks containing MMFX Microcomposite steel but did not substantively change an earlier recommendation indicating that MMFX steel was less cost effective than epoxy-coated steel.

**Researchers' Recommendations**

- 1) SMI-316 SC stainless steel clad reinforcement is recommended as a cost-effective direct replacement for epoxy-coated reinforcement. Cut ends of the bars should be protected with a system such as plastic caps filled with epoxy and the bars should be protected from damage to the cladding during bending operations.
- 2) MMFX Microcomposite reinforcing steel should not be used as a direct replacement for epoxy-coated reinforcement without the use of a supplementary corrosion protection system. Use of the material in its current form is not recommended for reinforced concrete bridge decks in South Dakota.

**Panel Recommendations**

The panel agrees and recommends that the Office of Bridge Design consider the use of SMI-316 SC as an alternative in critical bridge structures where the increase in materials cost is warranted. This would only be feasible if SMI begins actual commercial production of stainless clad reinforcement.

The panel agrees and recommends that the Office of Bridge Design not utilize MMFX steel in any structural applications in South Dakota.

**Technical Panel**

Mark Clausen .....FHWA  
Tom Gilsrud ..... Bridge Design  
Todd Hertel ..... Aberdeen Region  
Darin Hodges .....Materials & Surfacing

Dan Johnston ..... Research  
Darin Larson ..... Operations Support  
Paul Nelson ..... Pierre Region

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**Technical Panel Evaluation and Recommendations**  
**SD2005-07 Evaluation of Recycled Portland Cement Concrete Pavements**  
**for Base Course and Gravel Cushion Material**  
**August 30, 2007**

**Researchers:** L. Allen Cooley, Jr., Jimmy Brumfield,  
Jonathan Easterling and Prithvi S. Kandhal

**Study Duration:** May 2005 – June 2007

**Organization:** Burns Cooley Dennis, Inc.  
278 Commerce Drive  
Ridgeland, MS 39157

**Study Cost:** \$99,953.74

**Study Evaluation:**

The researchers satisfactorily achieved the objectives of this study. The researchers interviewed a number of SDDOT personnel to learn about their experiences and concerns with the use of recycled concrete aggregate (RCA). Phone interviews were used to collect information about the use of RCA in other states. This proved very valuable as the researcher was able to not only ask the interview questions but also continue a line of questions based on the response obtained from the interviewee. They also conducted a comprehensive literature search of published reports and articles. SDDOT provided samples of RCA collected from six sites across South Dakota. The researchers conducted classification, strength and durability tests on these samples and used the results to address the project's objectives. Testing and construction issues were addressed and appropriate recommendations were developed. The results of the testing conclude the use of RCA is a viable alternative as a base course or gravel cushion. Results from this study as well as the experiences of other agencies suggest that recycled portland cement concrete pavements are an acceptable alternative for granular pavement layers. The recycled concrete aggregates should meet the requirements of the Revised Sections 260 and 882 of the South Dakota Standard Specifications.

**Research Objectives**

- 1) *Determine if recycled concrete should be used as a base course or gravel cushion.*
- 2) *Develop materials guidelines and specifications for construction of pavements using recycled concrete for base course or gravel cushion.*
- 3) *Develop laboratory and field material testing requirements for recycled concrete.*

**Panel Comments**

The researcher recommends the use of recycled concrete as a base course or gravel cushion. Additional recommendations were provided regarding testing and construction.

Materials guidelines and recommendations for construction were provided.

Laboratory and field material testing requirements were developed to aid in determining if the recycled concrete is appropriate for use as a base course or gravel cushion. During the course of this study, there was one issue that arose that could have an impact on construction activities. It was found that in order to maintain consistent compaction the moisture content should be maintained at or near a saturated surface dry (SSD) condition.

## Research Tasks

- 1) *Meet with the project's technical panel to review project scope and work plan.*
- 2) *Review current literature, including other state's experiences, regarding use of recycled concrete as a base course or gravel cushion.*
- 3) *Interview other states to evaluate their experiences using recycled concrete to include laboratory and field tests, pavement performance, training, costs etc. Prepare the interview questions to be approved by the technical panel.*
- 4) *Propose an accelerated testing protocol to determine freeze-thaw and leaching performance of recycled concrete base materials in pavement sections for panel approval.*
- 5) *Conduct accelerated laboratory testing to determine durability of recycled concrete as a base material.*
- 6) *Evaluate existing, at least 3, SDDOT pavement sections utilizing recycled concrete using field survey and sampling and laboratory tests.*
- 7) *Determine materials guidelines and specifications for construction of pavement sections using recycled concrete for base course and gravel cushion, if appropriate.*

## Panel Comments

The researchers met with the project panel June 15, 2005. The project scope and work plan were discussed at the meeting. The researchers met with other SDDOT personnel to collect background information for the project.

The researcher conducted a comprehensive literature review of published reports and articles on the use of RCA.

The researcher conducted a phone survey of seven state DOT's regarding their use of recycled concrete aggregates.

Based upon the literature review and survey of states conducted in Tasks 2 and 3, respectively, a number of tests were identified to evaluate durability. The Micro-Deval test was selected because it includes the introduction of water, the New York Freeze/Thaw test and Micro-Deval test were combined since this test was considered a harsh test to evaluate durability. The final durability test selected was the resilient modulus test.

The researcher conducted laboratory testing on material collected from six sites in South Dakota.

Pavement sections utilizing RCA as a base course or gravel cushion were identified in South Dakota. However, the department was reluctant to excavate a large pit in a pavement that was not in distress or scheduled for replacement and did not complete this task.

The researcher evaluated current materials guidelines and specifications for construction and recommended we follow current guidelines and procedures. The current specifications for gravel cushion and base course are adequate with appropriate changes to durability testing. It was recommended to use the Micro-Deval test, the combined New York Freeze/Thaw test and Micro-Deval tests and the resilient modulus test to evaluate durability.

- 8) *Recommend construction specifications and testing necessary to construct pavement sections utilizing recycled concrete.* The researcher evaluated current construction specifications and testing. The researcher found our current specification for gravel cushion and base course are adequate with a recommendation to ensure adequate moisture is maintained in the material before placement. It was found that in order to maintain consistent compaction the moisture content should be maintained at or near a saturated surface dry (SSD) condition to ensure uniform compaction in the field.
- 9) *Recommend practical guidelines and specification changes for panel approval which will optimize the use of recycled concrete materials as base course or gravel cushion.* The researcher recommended guidelines and specification changes for *Resistance of Coarse Aggregates to Degradation by Freeze/Thaw*, Section 260 –Part B Granular Bases & Surfacing and Section 882 – Aggregates for Granular Bases and Surfacing for the Standard Specifications for Roads and Bridges.
- 10) *Prepare a final report and executive summary of the research methodology, findings, conclusions, and recommendations.* The researcher submitted a final report and executive summary July 27,2007
- 11) *Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project.* A executive presentation was presented to the SDDOT Research Review Board on May 15, 2007.

#### **Researchers' Recommendations**

- 1) *Recycled portland cement concrete pavements should be allowed within gravel cushion and aggregate base course layers.*
- 2) *Only recycled portland cement concrete pavements owned by the Department should be allowed on new Department projects.*
- 3) *Recycled concrete aggregates crushed from Department owned pavements can be blended with conventional aggregates.*
- 4) *The cleanliness of recycled concrete aggregates should be specified. It is recommended that the Department maintain the requirements of a maximum liquid limit of 25 and maximum plasticity index of 6.*

#### **Panel's Recommendations**

- The panel agrees and recommends that Materials & Surfacing and Operations Support review current specifications and make appropriate changes.
- The panel agrees and recommends that Materials & Surfacing and Operations Support should prepare plan notes and specifications to allow the use of recycled Portland cement concrete as a base course or gravel cushion. They will also consider specifications regarding the use of recycled concrete from sources other than from pavements owned by the department.
- The panel agrees and recommends that Materials & Surfacing and Operations Support will develop specifications to allow blending of natural or crushed aggregates with recycled concrete aggregates.
- The panel agrees with this recommendation. This is already covered in current specifications and no change is necessary.

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| <p>5) <i>In order to minimize any potential effects of sulfate attack on recycled concrete aggregate layers, the Department should test nearby subgrade soils and surface water for sulfates. ASTM C1580, Standard Test Method for Water Soluble Sulfate in Soil, and ASTM D516, Standard Test Method for Sulfate Ion in Water, should be used. Requirements within Table 2 should be followed.</i></p> | <p>The panel disagrees with this recommendation. Materials &amp; Surfacing currently provides recommendations on concrete materials that may come in contact with soils that pose a sulfate threat. The panel feels this is sufficient to cover any issues when using recycled concrete from department owned pavement. If recycled concrete from a source other than department owned pavement is proposed to be used then it may be necessary to test for potential sulfate attack. This will be addressed in recommendation #2.</p> |
| <p>6) <i>The sodium sulfate soundness test should be used to evaluate the durability of potential recycled concrete aggregates for gravel cushion and aggregate base course. A maximum value of 15 percent is recommended.</i></p>  | <p>The panel disagrees with this recommendation. Department-owned pavements will be evaluated by Materials &amp; Surfacing on a case-by-case basis depending on the pavements aggregate source. The aggregate will be tested if it is from a source other than department-owned pavement.</p>  |
| <p>7) <i>The “Resistance of Coarse Aggregates to Degradation by Freeze/Thaw” test contained in Appendix B should be utilized if the results of the sodium sulfate soundness test is greater than 30 percent. A maximum value of 15 percent for this freeze/thaw test is recommended.</i></p>  | <p>The panel disagrees with this recommendation. Department-owned pavements will be evaluated by Materials &amp; Surfacing on a case-by-case basis depending on the pavements aggregate source. The aggregate will be tested if it is from a source other than department-owned pavement.</p>  |
| <p>8) <i>The Los Angeles Abrasion test is recommended to evaluate the toughness and durability of recycled concrete aggregates. A maximum percent loss of 40 percent is recommended.</i></p>  | <p>The panel agrees with this recommendation. This is covered by our standard specifications. No changes are necessary.</p>  |
| <p>9) <i>No changes are recommended to the current gradation requirements for gravel cushion or aggregate base course.</i></p>  | <p>The panel agrees with this recommendation. This is covered by our standard specifications. No changes are necessary.</p>  |
| <p>10) <i>Recycled concrete aggregate stockpiles should be maintained at a moisture content representative of a saturated surface-dry condition.</i></p>  | <p>The panel agrees that the moisture content should be maintained at a saturated surface-dry condition, and recommends Materials &amp; Surfacing and Operations Support evaluate the most appropriate method and develop specifications to ensure the proper moisture content is maintained.</p>  |

**Technical Panel**

- |                      |                       |                       |                         |
|----------------------|-----------------------|-----------------------|-------------------------|
| Joe Feller .....     | Materials & Surfacing | Daris Ormesher .....  | Research                |
| Tom Grannes.....     | Materials & Surfacing | Jay Peppel.....       | Winner Area             |
| Marc Hoelscher.....  | FHWA                  | Carl Weatherton ..... | Weatherton Construction |
| Jason Humphrey ..... | Operations Support    | Steve Zandstra .....  | Zandstra Construction   |
| Paul Oien.....       | Research              |                       |                         |

**Technical Panel Evaluation and Recommendations**  
**SD2004-10 Upgrade of South Dakota Environmental Sensor Station Installations**  
**August 30, 2007**

**Researchers:** Bob Hart, Leon Osborne, Jeff Fearon      **Study Duration:** October 2004 – August 2007  
**Organization:** Meridian Environmental Technology, Grand Forks, ND      **Study Cost:** \$112,543  
 Intelligent Devices, Inc., Atlanta, GA

**Study Evaluation:** This project was initiated to address the SDDOT’s aging environmental sensor stations (ESS). Many of the Road Weather Information Systems (RWIS), as they were called when originally installed 15 to 20 years ago, had become inoperable as meteorological and pavement sensors wore out and the computers at the installations and at regional collection points had become obsolete. The work assessed the condition of the existing sites, and then proposed an updated specification for a generic ESS that made use of new sensor technology, additionally obtained video images and traffic data, and supplied data in National Transportation Communications for ITS Protocol (NTCIP) format. Four pilot sites were successfully installed.

The work was accomplished by a team comprising Meridian Environmental Technology (which provides weather forecasting and 511 Traveler Information System operations to SDDOT), Intelligent Devices Inc. (a firm specializing in NTCIP-compliant systems), and staff of the Offices of Operations Support and Research. The research team was innovative and responsive to the needs of the Department. Acquisition of hardware necessary for the pilot installations posed a challenge, as did providing reliable Internet communications to the pilot sites. The project completed a year later than originally planned.

<b>Research Objectives</b>	<b>Panel Comments</b>
1) <i>Assess the condition and capability of SDDOT’s existing ESS installations.</i>	The research team compiled an inventory of existing sites and documented which components functioned and which did not. In addition, the team identified gaps in the geographic coverage of the existing network of ESSs.
2) <i>Develop functional and physical specifications for a baseline ESS field installation.</i>	The research team developed functional requirements and specifications for a baseline ESS that provided the functions important to SDDOT. The design included new capabilities of traffic monitoring and video image capture.
3) <i>Define NTCIP-based protocols for exchanging environmental observations and information for monitoring and control functions between the standard ESS field installation and a traffic operations center.</i>	The research team adopted protocols defined in NTCIP 1204 Object Definitions for Environmental Sensor Stations and related NTCIP standards to define all of the data objects collected by the baseline ESS.
4) <i>Construct and evaluate a functioning field controller that can acquire and condition environmental observations and communicate with a traffic operations center.</i>	With assistance of the Division of Operations and the Office of Research, the research team integrated four operational pilot ESS systems at Edgemont, Belle Fourche, Silver City, and Wasta.

<p>5) <i>To recommend a cost-effective strategy for upgrading SDDOT's ESS network by the end of calendar year 2006.</i></p>	<p>The research team recommended a two-year installation schedule to upgrade SDDOT's existing ESS installations. In addition, the team recommended installing up to eighteen more sites to fill gaps in statewide geographic coverage.</p>
<p><b>Research Tasks</b></p>	<p><b>Panel Comments</b></p>
<p>1) <i>Conduct a statewide inventory and assessment of SDDOT's existing ESS installations to determine their location, configuration, and operating condition.</i></p>	<p>The research team compiled an inventory of ESS locations, instruments, and computer systems and documented the extent to which the systems functioned.</p>
<p>2) <i>Define the needed functionality and geographical coverage of ESS installations necessary to support the Department's winter maintenance, traveler information, and load limit activities and assess the current ESS installations' capability to satisfy them.</i></p>	<p>The research team confirmed the need for the functionality originally provided by SDDOT's existing ESS systems, and suggested improvements in precipitation detection and the addition of traffic speed and volume monitoring, video image detection, and snow depth measurement. Because of the condition and technical obsolescence of the existing ESS systems, they were deemed incapable of providing the needed functionality.</p>
<p>3) <i>Develop and submit for approval by the project's technical panel a concept of operations and a high-level design for a baseline ESS that can collect meteorological, pavement, traffic, and video image data to support SDDOT's maintenance, traveler information, load restriction, and traffic management needs.</i></p>	<p>The research team proposed a concept of operations that would restore the original functionality of SDDOT's ESS installations and, in addition, provide video images, traffic speed and volume monitoring, and improvements in meteorological observations. The concept of operations also specified that ESS sites be non-proprietary and that they be accessible through Internet access—specifically, via NTCIP-compliant communication.</p>
<p>4) <i>Upon approval of the concept of operations and high-level design, develop and submit a detailed design and equipment specification for meteorological, pavement, traffic, and video instrumentation to enable SDDOT to acquire and install commercial off-the-shelf components during the summer of 2006.</i></p>	<p>The research team provided a list of suitable commercial off-the-shelf instrumentation and communications equipment necessary to satisfy the defined concept of operations. The specified equipment was acquired through a combination of purchases made by the Office of Research and the research contractors.</p>
<p>5) <i>Define NTCIP-based protocols for communicating observed data from the ESS to a traffic operations center and for performing necessary monitoring and control functions at the ESS.</i></p>	<p>The research team proposed and documented a complete set of protocols based on NTCIP 1204 Object Definitions for Environmental Sensor Stations. The protocol defines the function of SDDOT's baseline ESS configuration.</p>

<p>6) <i>Develop and submit a detailed design and equipment specification for a field controller that will interface to all of the ESS instruments, apply necessary algorithms, and communicate with a traffic operations center using the defined protocols over available communications media.</i></p>	<p>The research team a design to successfully integrate meteorological and pavement instrumentation, video cameras, and traffic sensors and generate NTCIP-compliant communications suitable for a traffic operations center.</p>
<p>7) <i>Develop and submit for approval a testing plan for evaluating the performance of four pilot operational ESS installations, including instrumentation and field controllers.</i></p>	<p>The research team developed a testing plan for the four pilot installations. It became necessary to modify the plan after the pilot ESS systems were actually installed.</p>
<p>8) <i>Construct and install field controllers at four ESS installations and execute the approved testing plan.</i></p>	<p>The research team supplied field controllers and integrated instrumentation for four ESS installations at Edgemont, Belle Fourche, Silver City, and Wasta.</p>
<p>9) <i>After successful completion of the testing plan, incorporate any necessary revisions into design and specification documents.</i></p>	<p>The research team evaluated the performance of the four pilot sites and suggested improvements to the communications employed. At two of the pilot sites, cellular communications provided unreliable communications.</p>
<p>10) <i>Prepare a final report summarizing methodology, findings, conclusions and recommendations.</i></p>	<p>The research team submitted a final report in August 2007.</p>
<p>11) <i>Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project.</i></p>	<p>Members of the research team made an executive presentation to the SDDOT Research Review Board in February 2007.</p>
<p><b>Researchers' Recommendations</b></p>	<p><b>Panel's Recommendations</b></p>
<p>1) <i>Upgrade SDDOT's existing Environmental sensor Stations in calendar years 2007 and 2008 to be NTCIP-compliant, to be equipped with cellular or other Internet-compatible communications, and to be equipped with meteorological, traffic, and video sensors appropriate to each site.</i></p>	<p>The technical panel agrees, and recommends that <u>the Offices of Research and Operations Support should replace SDDOT's existing ESS sites in the fall of 2007 and spring of 2008.</u> Funding for these installations is available from a 2002 ITS Deployment earmark provided to SDDOT.</p>
<p>2) <i>Expand SDDOT's network of Environmental sensor Stations by 18 sites to fill gaps in geographic coverage across the state.</i></p>	<p>The technical panel agrees that additional sites are needed, particularly in the northwest and north central regions of the state, but is unsure how many sites are warranted. The panel is also aware that the South Dakota State Climatologist has expressed interest in cooperatively locating new ESS to provide broader benefit from the required investment. The panel therefore recommends that <u>the Offices of Research and Operations Support should confer with South Dakota State Climatologist to develop a recommendation to SDDOT executive management for installation of</u></p>

	<p><u>additional ESS in late 2008 or early 2009. Funding sources for these additional sites are not yet identified.</u></p>
<p>3) <i>Verify the accuracy and quality of the data transferred by the NTCIP objects. The verification process requires system conformance at three levels:</i></p> <ul style="list-style-type: none"> <li>▪ <i>Confirmation that the instruments are measuring and outputting values commensurate with the conditions they are sensing.</i></li> <li>▪ <i>Confirmation that the field controller is properly reading the output from the sensors to the correct NTCIP object using the vendor-prescribed algorithms.</i></li> <li>▪ <i>Confirmation that the field controller is properly transposing the output from the sensors to the correct NTCIP object using the vendor-prescribed algorithms.</i></li> </ul>	<p>The technical panel agrees that the substantial investment in ESS warrants attention to their proper calibration, operation, and maintenance. Much of the basic operation—including NTCIP translation and communication—can be verified on site during installation and regular inspection. In addition, the reasonableness of meteorological measurements can be checked by SDDOT’s participation in <i>Clarus</i>, a federally operated system to collect and validate ESS data from all states. The panel recommends that <u>the Offices of Operations Support and Research should develop a procedure for annual inspection of ESS system based upon inspection guidelines published by the Federal Highway Administration.</u> Inspections could be performed by technicians or engineering interns on a seasonal basis.</p>
<p>4) <i>Review the explicit requirement for the installation of a snow depth sensor and/or develop an evaluation process to determine whether each of the sites yields a representative snow depth value that will aid maintenance, weather, and climatological uses.</i></p>	<p>Based on the experience gained at the four pilot sites, the technical panel believes that snow depth sensors have limited value in locations that experience wind. The panel recommends that <u>the Office of Research should install snow depth sensors only at ESS locations specifically identified as being representative locations.</u></p>
<p>5) <i>It is recommended that modifications or alternatives to the Alltel cellular communications subsystem be investigated with the view to implementing a communications subsystem that is able to improve the reliability of connectivity to ESS sites to more than 90%.</i></p>	<p>The panel agrees that reliable communication is necessary to every site. Although cellular data coverage has improved significantly in recent years, some locations still lie outside of adequate coverage. The panel recommends that <u>the Office of Research should work with the Bureau of Information &amp; Telecommunications to acquire reliable Internet communications through cellular, DSL, satellite, spread spectrum radio, or wireless Internet Service Provider on a site-by-site basis.</u></p>

**Technical Panel**

Jon Becker..... Research  
 John Forman..... Pierre Region  
 David Huft ..... Research  
 Bruce Hunt..... FHWA  
 Amanda Jost..... BIT

Mark King ..... Operations Support  
 Emily Noem ..... Research  
 Ed Rodgers ..... Operations Support  
 Pat Sendelweck ..... Research

**Technical Panel Evaluation and Recommendations  
 SD2004-12 Mobile Data Collection for Winter Maintenance Vehicles  
 August 30, 2007**

**Researchers:** John Mewes, Leon Osborne, Jeff Fearon      **Study Duration:** July 2006 – August 2007

**Organization:** Meridian Environmental Technology, Grand Forks, ND      **Study Cost:** \$79,357  
 Intelligent Devices, Inc., Atlanta, GA

**Study Evaluation:** The purpose of this project was to develop a practical way to collect information directly from winter maintenance vehicles about the condition of the roads they travel and the nature of the maintenance treatments they apply. This information is needed by the winter Maintenance Decision Support System (MDSS), a sophisticated system being developed and refined in a transportation pooled fund study led by South Dakota and involving twelve other states.

The work was accomplished by a team comprising Meridian Environmental Technology (which provides weather forecasting and 511 Traveler Information System operations to SDDOT), Intelligent Devices Inc. (a firm specializing in NTCIP-compliant systems), and staff of the Offices of Operations Support and Research. Equipment fabricators at the Rapid City and Mitchell Region shops contributed significantly to the equipment installation and Force America, the manufacturer of the hydraulic controls in SDDOT's newest snowplows, contributed technical assistance and hardware for testing purposes.

Working prototypes were installed in four vehicles—two in Custer Area and two in Yankton Area—involved in MDSS operational trials. Various technical, user interface, and communications issues were resolved in the course of the testing of these pilot units. Based on the results of the testing, the research team modified the design to provide full functionality at lower cost and with less installation effort.

Research Objectives	Panel Comments
1) <i>Assess the suitability of SDDOT's winter maintenance fleet to be equipped with mobile data collection systems.</i>	The research team evaluated information available from SDDOT's equipment management system and determined that the newer equipment fitted with Force America hydraulic controllers would be most suitable for installation of mobile data collection.
2) <i>Develop functional and physical specifications for a baseline mobile data collection system for winter maintenance vehicles.</i>	The research team developed logical and physical designs for equipment that could acquire and report vehicles' location, the position (up or down) of plows, rates of solid and liquid material application, pavement and air temperature, and operators' observations. The designs also provided for communicating information on current and forecast weather conditions and treatment recommendations from a Maintenance Decision Support System to the vehicle operator.

<p>3) <i>Define NTCIP-based protocols for exchanging observations and information for monitoring and control functions between the standard mobile data collection system and a traffic operations center.</i></p>	<p>The research team used existing protocols—specifically NTCIP 1204 <i>Object Definitions for Environment Sensor Stations</i>—to report weather and surface conditions. The research team developed new NTCIP objects for those attributes for which no standard already existed. The new objects belong to a “South Dakota node” within the NTCIP standards structure.</p>
<p>4) <i>Construct and evaluate a functioning field controller that can acquire and condition mobile observations and communicate with a traffic operations center.</i></p>	<p>The research team assembled four prototype controllers and, with the assistance of SDDOT region shop staff, installed them in snowplows at Custer and Yankton areas. The controllers communicate via cellular modem.</p>
<p>5) <i>To recommend a cost-effective strategy for upgrading SDDOT’s winter maintenance fleet.</i></p>	<p>Following tests of the prototype units, the research team modified the design to reduce unit cost and decrease the complexity of the installation. The revised design is suitable for broad deployment in SDDOT’s equipment fleet.</p>
<p><b>Research Tasks</b></p>	<p><b>Panel Comments</b></p>
<p>1) <i>Conduct a statewide inventory and assessment of SDDOT’s winter maintenance fleet to determine its suitability for automated mobile data collection.</i></p>	<p>The research team reviewed information from SDDOT’s equipment management system and determined that recently purchased snowplows equipped with Force America hydraulic controllers would be most prevalent and suitable for mobile data collection.</p>
<p>2) <i>Define the needed mobile data collection functionality necessary to support the Department’s winter maintenance, traveler information, and traffic operations activities.</i></p>	<p>In consideration of the reporting requirements of the Maintenance Decision Support System, the research team defined the data objects needed from winter maintenance vehicles.</p>
<p>3) <i>Develop and submit for approval by the project’s technical panel a concept of operations and a high-level design for a baseline mobile data collection system that can collect data relating to road condition and maintenance treatments to support SDDOT’s maintenance, traveler information, and traffic management needs.</i></p>	<p>The research team proposed a concept of operations that included collection of information regarding vehicle location, road surface and air temperatures, plow positions, solid and liquid application rates, and operators’ visual observations. Data would be transmitted from the snowplow via cellular communication and using NTCIP-compliant format.</p>
<p>4) <i>Upon approval of the concept of operations and high-level design, develop and submit a detailed design and equipment specification for vehicle-mounted instrumentation to enable SDDOT to acquire and install commercial off-the-shelf components during the summer of 2006.</i></p>	<p>With concurrence of the project’s technical panel, the research team developed a detailed logical and physical design and component specifications.</p>

<p>5) <i>Define NTCIP-based protocols for communicating observed data from the mobile data collection system to a traffic operations center and for performing necessary monitoring and control functions.</i></p>	<p>When possible, the research team selected data objects from NTCIP 1204 <i>Object Definitions for Environmental Sensor Stations</i>. For attributes not covered by NTCIP 1204, the research team defined new objects that are now included in the “South Dakota Node” within the NTCIP standards structure.</p>
<p>6) <i>Develop and submit a detailed design and equipment specification for a field controller that will interface to all of the vehicle-mounted instruments, apply necessary algorithms, and communicate with a traffic operations center using the defined protocols over available communications media.</i></p>	<p>The research team developed a design and specifications for a vehicle-mounted field controller that interfaces to all instruments, performs necessary conversions, and generates NTCIP-complaint data streams.</p>
<p>7) <i>Develop and submit for approval a testing plan for evaluating the performance of four pilot operational mobile data collection systems, including instrumentation and field controllers.</i></p>	<p>The research team proposed and performed tests to validate the operation of the field controller and communication of data.</p>
<p>8) <i>Construct and install field controllers on four instrumented maintenance vehicles and execute the approved testing plan.</i></p>	<p>The research team built and supplied four prototype field controllers for installation on vehicles at Custer and Yankton Areas.</p>
<p>9) <i>After successful completion of the testing plan, incorporate any necessary revisions into design and specification documents.</i></p>	<p>After testing of the four prototype controllers was complete, the research team modified the design to maintain full functionality but reduce cost and installation complexity. The result is a controller suitable for installation in the SDDOT fleet.</p>
<p>10) <i>Prepare a final report summarizing methodology, findings, conclusions and recommendations.</i></p>	<p>The research team submitted its final report in August 2007.</p>
<p>11) <i>Make an executive presentation to the SDDOT Research Review Board at the conclusion of the project.</i></p>	<p>Representatives of the research team made an executive presentation to SDDOT’s Research Review Board in February 2007.</p>

<b>Researchers' Recommendations</b>	<b>Panel's Recommendations</b>
<p>1) <i>A budget estimate of the cost to upgrade ninety (90) vehicles in the SDDOT winter maintenance fleet is shown in Table 10. It is recommended that the SDDOT select the vehicles in the fleet for upgrading.</i></p>	<p>The panel agrees that the mobile data collection system developed in this project is suitable for wide scale deployment in SDDOT's winter maintenance fleet. Installation would provide the greatest benefit in locations that are actively using the Maintenance Decision Support System and where winter maintenance activities are most critical. The panel therefore recommends that <u>the Office of Research should work with the Division of Operations to deploy mobile data collection systems in stages, beginning with current MDSS participants in Custer Area, Yankton Area (Menno Shop), and Winner Area and continuing with other routes involved in the new Extended Hours of Snowplow Operation effort.</u> Sufficient funding is available from the SAFETEA-LU designation to South Dakota for MDSS deployment to equip at least 100 vehicles. To ensure that new trucks purchased by SDDOT are capable of mobile data collection, the technical panel recommends that <u>the Office of Operations Support should specify that new vehicles be equipped with air and pavement surface temperature probes and with Force America Model 5100 controllers enabled with event logging.</u></p>
<p>2) <i>It was noted during the pilot tests that configuration issues with the FA 5100 led to erroneous data being received by the MDC system. In particular, the values of air temperature, surface temperature, and vehicle speed as recorded from the FA 5100 appeared to be sensitive to configuration issues. Likewise, it is understood that calibration of the FA 5100 is necessary to ensure application rates being received from the unit are reliable. Defining a process for ensuring the FA 5100 units on each vehicle are properly configured and calibrated is therefore a vital step in broader scale MDC system deployment.</i></p>	<p>The panel recommends that <u>the Office of Research should work with Force America and Intelligent Devices Inc. to resolve equipment configuration issues affecting the reporting of air temperature, surface temperature, and vehicle speed.</u> Force America has been very cooperative regarding mobile data collection, not only for South Dakota's vehicles but also for the broader subject of Maintenance Decision Support.</p>

<p>3) <i>When the trucks (around Mitchell) were out on the roads, it was found that the connection to the pilot plows was achieved some 70% of the time when polled. If this level of communications success is not acceptable to SDDOT then it is recommended that alternatives to the communications subsystem used in this study be investigated with the view to implementing a communication subsystem that is able to improve the reliability of connectivity to the MDCs.</i></p>	<p>Although the panel agrees that higher communication reliability would be desirable, it does not believe viable alternatives to cellular communications exist. The use of 801.11 “Wi-Fi” is feasible, but would only work when trucks return to a suitably equipped shop or maintenance yard. In many cases, this would happen too infrequently to be useful.</p> <p>The panel further believes that cellular coverage will improve with the future addition of towers and deployment of Evolution-Data Optimized (EVDO), a telecommunications standard for the wireless transmission of data for broadband Internet access.</p> <p>The panel therefore recommends that <u>the Office of Research should equip deployed mobile data collection units with EVDO-capable cellular modems.</u></p>
<p>4) <i>Revisit lane selection and identification methodologies so the specific location and lanes impacted by vehicle activities (not limited to winter maintenance) can be clearly identifiable from the data.</i></p>	<p>The panel agrees that the lane identification scheme deployed in the prototype mobile data collection units can be improved, and recommends that <u>prior to issuing a requisition for mobile data collection units, the Office of Research should revise the lane identification specifications in consultation with the Office of Operations Support and the operators who used the prototype units in Custer and Yankton Areas.</u></p>
<p>5) <i>The field testing process revealed that the NTCIP objects initially deemed suitable for communication of some menu items, most notably road and weather condition selections, were found to have unclear mappings for certain selections. It may be advisable for the menus to be modified to more clearly fit existing NTCIP objects, or to define new NTCIP objects in the southdakotaDOT NTCIP node that more clearly fit the SDDOT menu choices.</i></p>	<p>The panel agrees and recommends that <u>prior to issuing a requisition for mobile data collection units, the Office of Research should review and, if necessary, revise the NTCIP object definitions in consultation with Meridian Environmental Technology and Intelligent Devices Inc.</u></p>

<p>6) <i>As illustrated by the issues encountered during this pilot study, the installation, calibration and testing of MDC systems can be an intensive process. It is recommended that SDDOT consider either appointing a qualified (temporary) full-time person within the department to organize and manage this deployment process or contracting with an outside entity that can be tasked with this effort.</i></p>	<p>The panel agrees that deployment of mobile data collection equipment and winter Maintenance Decision Support System technology will require a significant level of effort as well as coordination with winter maintenance policies. The panel recommends that <u>the Office of Operations Support should appoint a full-time Winter Maintenance Coordinator to support field units in winter maintenance activities.</u> The Office of Research plans to engage at least one seasonal employee to assist with the physical deployment of Environmental Sensor Stations and Mobile Data Collection equipment, but that assistance will not address winter maintenance policy and procedures.</p>
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## Transportation Pooled Fund Study Solicitation TPF-5(145) Western Maintenance Partnership

**Lead Agency:** Utah Department of Transportation

**Sponsor Solicitation Contact:** Michael Fazio (mfazio@utah.gov)

**Study Number:** TPF-5(145)

**Partners:** AK, AZ, CA, CO, FHWA, ID, MT, NV, OK, TX, UT, WA, WYDOT

**Duration:** 36 months

**Commitments Required:** \$405,000

**Commitments Received:** \$218,000

**Background:** In the 1980's the Rocky Mountain Maintenance Tour established a highly effective forum for the exchange of information, techniques, policies and strategies for the maintenance of the Highway System. Since that time the role of Maintenance as a critical element in the overall management of the State Highway infrastructure has increased. Most Maintenance managers have been completely replaced since the discontinuance of the Rocky Mountain Maintenance Tour. The primary focus has also shifted from new construction and major rehabilitation to more attention to infrastructure preservation and asset management via cost effective maintenance. Reactive maintenance alone is not adequate to overcome the challenges of rapid deterioration of roads, considering aging of the infrastructure and growing economic constraints.

The Western Maintenance Partnership (WMP) will pool the efforts of the participating agencies to provide a focused look at Maintenance, and will partner with WAASHTO states to share experiences, innovations, expertise and solutions to the complex management of highway assets. Maintenance issues include policies, practices, specifications, field investigations, applied research, materials, and training. It is expected that a roundtable and sharing of field experience via hands on demonstration of features will be key elements of the annual meetings.

**Objectives:** The purpose of the Western Maintenance Partnership (WMP) is to provide a partnering forum for promoting effective maintenance strategies through the following objectives:

- Provide funds for a multi-day annual workshop for discussion and exchange of information and knowledge about each state's maintenance program.
- Provide a means to define, support and share technology of mutual interest.
- Provide funds for formal training presentations during the annual workshop.
- Provide funds for management support of WMP.
- Provide funds for special studies, investigations, research and training.

**Scope of Work:** While some of the WMPP states have developed pavement preservation programs as a key step in preserving their pavement investment and extending their serviceability with cost effective preservation treatments, other states could benefit from sharing the knowledge gained from this experience. Such a partnership would develop sound preservation practices by sharing of information on maintenance policy, specifications, design, construction practices, field investigations, applied research, materials, training and research. The minimum funding contribution is needed to:

- Provide funds for a multi-day annual workshop for discussion and exchange of information and knowledge about each state maintenance program.
- Provide funds for formal training presentations during the annual workshop.
- Provide a forum to define, support and share technology of mutual interest.
- Implement task orders, as designated by the WMP members.

- Provide funds to manage the WPPP's operations and to maintain a web site that would display meeting reports, state guidelines and specifications.

**Comments:** This will be a 3-year project with likely renewal. Additional meetings, besides the annual workshop and task groups, are possible. The proposed budget will cover the cost of meeting arrangements, state travel, and a meeting report. Each state will provide funding of a minimum of \$5,000 to \$10,000 each year for a 3-year renewable period. The 3-year commitment/obligation of funds can be split over the 3 years or the full amount can be committed in the first year of the program. Most of the WAASHTO states (18) have expressed interest in the program. Proceedings from the annual workshop and task group meetings will be documented by a report.