STATE OF OHIO
RESEARCH, DEVELOPMENT & TECHNOLOGY TRANSFER PROGRAM
FISCAL YEAR 2012
July 1, 2011 to June 30, 2012

OHIO DEPARTMENT OF TRANSPORTATION
OFFICE OF STATEWIDE PLANNING AND RESEARCH
RESEARCH SECTION

Prepared by the
Ohio Department of Transportation
in cooperation with the
U.S. Department of Transportation,
Ohio Division of the
Federal Highway Administration
MISSION OF THE RESEARCH SECTION

Invest in innovative research that develops, maintains, and assists Ohio in establishing a world class transportation system.

GOALS

The Innovation, Research and Implementation Section will manage a research program that:
- expands and leverages partnerships;
- conducts more policy and innovative research;
- aligns research to promote Department’s goals and objectives;
- promotes transparency of the program;
- improves project management and coordination; and
- increases technology transfer and timely implementation of research findings.

Jennifer Townely, Acting Deputy Director
Division of Planning

Scott Phinney, P.E., Administrator
Office of Statewide Planning & Research

Cynthia Gerst, Section Head
Research Section
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## PART II - RESEARCH

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EXECUTIVE SUMMARY

This document describes the SPR Part 2, Research and Development portion of the State Planning and Research Program. This annual work plan and progress report consists of 73 active projects. The overall value of these projects is $50,621,235.66. Ohio’s financial contribution to these projects through the SPR Part 2 program is $13,473,430.60. Funds for 51 of the active projects were encumbered in previous years and will not require additional funding in State Fiscal Year 2012 (SFY12). The remaining 22 projects will require $662,622.50 during SFY12. This includes Ohio’s contributions to 36 pooled fund studies.

The active projects are listed according to the following funding categories: 100% federal, 80% federal, Pooled Funds (in which Ohio is the lead state), and Pooled Funds (in which Ohio is a participating state). Projects that received funds from more than one source are listed in each of the appropriate funding categories and are cross-referenced to the other funding sources. Detailed descriptions of all active projects are provided in appendix A, which is arranged by State Job Number (SJN). There are twelve (12) active projects awaiting receipt of the draft or final report. The research is essentially complete for these projects and no additional funds are programmed for SFY12. Detailed descriptions for these projects are provided in appendix C.

Twenty-four (24) new projects are proposed for SFY12 at an estimated total cost of $4,660,803. Funding expected for these projects during SFY12 is $3,615,885. Detailed descriptions for these proposed projects are provided in appendix B.
ODOT’S STRATEGIC RESEARCH FOCUS AREAS

Ohio has one of the world’s largest transportation systems, creating opportunities as well as challenges for the state. ODOT uses strategic planning to take advantage of opportunities and meet the state’s challenges in a timely manner. The strategic research focus areas provide the basis for projects included in the SPR Part 2 Program. In 2010, ODOT focused its research efforts on the following eight areas:

**Area 1: Transportation Safety – “Target Zero”**
With a target of ZERO tolerance for any safety hazard - safety is ODOT’s top priority. We are urged to focus on safety each day. This includes safety for our-selves, our peers, and our customers. Advancing re-search in transportation safety to understand the factors and risks and the effective ways to reduce these risks will promote a safer and more reliable transportation experience for all users and make Ohio’s transportation system the safest in the nation.

**Area 2: Transportation Policy and Organizational Transformation**
To continue to be as cost-effective and as innovative as possible, current policies need to be examined. Many design and operational policies have been in existence for a while. With ODOT’s new goals and objectives, we need to assure policies are still relevant and responsive to the needs of all Ohioans.

**Area 3: Innovative Transportation Financing and Business Practices**
ODOT must find the best ways to foster innovation in finance, create and expand public-private partnerships, and leverage our existing resources to continue to improve our entire transportation network. Conducting research that focuses on streamlining decision making and project delivery allows ODOT to leverage those existing resources while we continue to see an increase in service demand.

**Area 4: Infrastructure Preservation and Management**
A large portion of Ohio’s roadway system was constructed during the 1950’s through 1970’s and it needs to be continuously modernized and repaired. ODOT must find ways to apply asset management concepts to maintaining and improving Ohio’s infrastructure to maximize its productivity and performance and lower the overall life cycle costs.

**Area 5: Transportation Shipping and Logistics** National estimates predict a 67% rise in freight movement by 2020. Manufacturers and their suppliers count on a free-flowing transportation network to assure —just in time delivery. For Ohio to stay competitive in the global economy, we must move goods and services quickly, reliably, and cost-effectively. This includes not only our highways, but our railways, waterways and air-ways. Strategies on how/what/where/and when to invest and quantifying these investments will be key to our success.

**Area 6: Livable Communities** Promote transportation solutions that allow Ohioan’s to have access to adequate, affordable and environmentally sustainable travel options. We must continue to make “smart growth” a criteria as we plan additional infrastructure and make effective use of what we have and minimize the need for new capacity. This requires a shift in policies and procedures as we continue to invest in Ohio’s communities.

**Area 7: Public/Mass Transportation** The mobility of all Ohioans, including those without a personal vehicle, needs to be improved. Ohio must determine a way to coordinate transportation services, specifically for those that are transit dependent. We will seek other options for moving people through coordinated efforts with various modes.

**Area 8: Green Energy Technology** Our day to day transportation activities have a large impact on the natural and built environment. ODOT must advance technologies and concepts to mitigate those impacts. It is important to mitigate the transportation contribution to climate change; therefore, we must evaluate how ODOT can contribute to reducing the state’s carbon footprint, promoting energy sustainability and improving Ohioan’s quality of life through alternative fuels, and technology.
State Fiscal Year 2012  
Ohio Department of Transportation  
Research, Development, and Technology Transfer (SP&R Part 2)  
SUMMARY OF ESTIMATED BUDGET

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<th>Description</th>
<th>Federal Funds</th>
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<td>SFY 2012 Estimated SP&amp;R PART 2 (Research) State Funds (B)</td>
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**LESS 100% Federal Funds Committed**

- SFY2011 National Cooperative Highway Research Program  
  Contribution - NCHRP (5 1/2 % HPR) Based on SFY2011  
  $1,440,223
- SFY 2012 Research Correlation Services (TRB-TRIS & RIP)  
  $223,540
- SFY 2012 Pooled Fund Studies Participating Contributions  
  $104,500
- Funding Match for LTAP Funds - Program Calendar Year 2012 (estimate)  
  $140,000

**Total Federal Funds Committed in SFY 2012 (C)**  
$1,908,263

**TOTAL Remaining Federal Funds Anticipated for Research SFY 2012 (A-C)**  
$2,748,594

**Proposed SPR-2(46) Project Funding**

- Federal Funds Anticipated for Research Projects  
  $2,748,594
- LESS Proposed Projects 100% Federally Funded  
  ($95,000)
- LESS Potential Pooled Funds Projects 100% Federally Funded  
  ($400,000)

**SUBTOTAL (80%)**  
$2,253,594

- PLUS Required State Matching Funds (20%) (D)  
  $563,399
- PLUS Estimated Carry Forward Funds  
  $6,609,105

**80% Federal Plus 20% State Funds Anticipated**  
$9,426,098

- LESS Active Projects 80% Federally Funded  
  ($633,123)
- LESS Emergency Projects 80% Federally Funded  
  ($500,000)
- LESS Local Research Initiative Program 80% Federally Funded  
  ($100,000)
- LESS Potential Active Projects 80% Federally Funded Scope/Cost Modifications  
  ($1,000,000)

**80% Federal Plus 20% State Funds Anticipated for New Projects**  
$7,192,975

- PLUS Remaining State Funds Estimated by ODOT Accounting (B-D)  
  $600,816
- LESS SPR Share of Operational Reduction (5% per ODOT Executive Leadership)  
  ($622,660)

**Sub-Total Federal and State Funds**  
$7,171,130

**Additional Research Funding SFY 2012**

- Federal Pass Through Funds for LTAP - Program Calendar Year 2012 (estimate)  
  $140,000

**TOTAL RD&T² PROGRAM**  
$11,947,516
## Active Projects Fiscal Year 2012

### 80/20 Federal/State

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Wednesday, May 18, 2011
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**Funding Subtotal:** $7,408,427.80 $680,842.79 $229,396.72 $117,104.00 $130,830.00 $3,608,074.44

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(For additional information see page #11.)

**Funding Subtotal:** $1,483,545.00 $0.00 $0.00 $0.00 $0.00 $1,377,888.51
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Wednesday, May 18, 2011

http://www.dot.state.oh.us/research

15 of 33
# Fiscal Year 2012 - Pooled Funds

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**Ohio is Participating**

**Totals:**
- Total Project Cost: $36,697,157.00
- Total ODOT Cost: $2,699,765.00
- 2012: $104,500.00
- 2013: $32,000.00
- 2014: $22,000.00
- 2015: $7,000.00
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<p>| 2012-10 | Bicycle Trip Forecasting Model: Cincinnati Metropolitan Case Study               | 80/20 Federal/State | 16 months            | $40,000.00 | $32,000.00 | $8,000.00 | $0.00 | $0.00 |
|         | University of Cincinnati                                                      | SP&amp;R Part 2         |          |          |          |          |          |          |
|         | Heng Wei  Heather Bowden                                                      |          |          |          |          |          |          |          |
| 2012-12 | Evaluation of Biases in Transit On-Board Surveys                              | 80/20 Federal/State | 20 months            | $250,000.00 | $200,000.00 | $50,000.00 | $0.00 | $0.00 |
|         | Ohio State University                                                        | SP&amp;R Part 2         |          |          |          |          |          |          |
|         | Rabi Mishalani  Rebekah Anderson                                              |          |          |          |          |          |          |          |
| 2012-13 | Development of a Standard Specification for Horizontal Direction Drilling     | 80/20 Federal/State | 16 months            | $35,900.00 | $35,900.00 | $0.00 | $0.00 | $0.00 |
|         | Bowling Green State University                                                | SP&amp;R Part 2         |          |          |          |          |          |          |
|         | Alan Atalah  Peter Narsavage                                                  |          |          |          |          |          |          |          |
| 2012-14 | Assessing the Performance of the SpeedInfo Sensor                            | 80/20 Federal/State | 16 months            | $40,000.00 | $40,000.00 | $0.00 | $0.00 | $0.00 |
|         | Ohio State University                                                        | SP&amp;R Part 2         |          |          |          |          |          |          |
|         | Benjamin A. Coifman  George Saylor                                            |          |          |          |          |          |          |          |</p>
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Total: $4,380,803.00 $3,520,885.00 $859,918.00 $0.00 $0.00
## Fiscal Year 2012 - Awaiting Reports

### 100% Federal

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Total: $644,639.00

### 80/20 Federal/State

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**Total:** $2,748,508.80
APPENDIX A

SP&R PART 2

STATE FISCAL YEAR 2012

ACTIVE PROJECTS

DESCRIPTIONS

Includes 100% federally funded and 80% federally funded active research projects
STATEMENT OF NEED:

Flood magnitude and frequency data are not available for many stream sites in Ohio. Floods cause serious damage to private property as well as public buildings and highways every year. Floods also pose a risk of personal injury and death. Further knowledge of the magnitude and frequency of flooding could be used to reduce the risk associated with flooding.

STUDY OBJECTIVES:
The objectives of the Operation and Maintenance of a Statewide Crest-Stage Stream Gauging Network in Ohio study is to collect additional flood data at a selected stream sites throughout Ohio.

RESEARCH TASKS:
1. Systematically operate 18 gage sites and collect flood flow data for a period of at least 20 years.
2. If only flood data is needed, crest stages can be used in an efficient way by using the following methods:
   A) Use Method A for sites with drainage area of 7 square miles or less with a suitable culvert.
   B) Use Method B for sites with drainage area of 45 to 100 square miles or less with channels that are not suitable for a theoretical channel rating.
   C) Use Method B for sites with drainage area of 5 to 45 square miles or less with channels that are suitable for a theoretical channel rating.
3. Install and operate a network of 18 crest stage gages (6 of Method A, 6 of Method B, 6 of Method C) for a period of 20 years.

PROJECT DELIVERABLES:
- Annually published the instantaneous stream-flows above the base-peak flow in the Ohio District Water Resources Data Report.
- Published and released within 12 months of the initiation of operation of the gages a USGS Fact Sheet identifying each of the 18 stream sites with crest-stage installed and the method of operation of the gages will be.
- The Final report will be written to summarize the entire project at the completion of 20 years of data collection.
STATEMENT OF NEED:
Mechanistic-empirical (ME) based pavement design procedures are being used by some DOTs to determine the adequacy of layer thicknesses in new and existing AC and PCC pavements and to verify pavement designs with expected material properties, traffic loading, and climatic conditions. Similarly, the influences of weather related factors and construction practices on pavement response and performance have not been sufficiently examined. Harsh weather conditions and/or improper construction techniques may lead to the development of premature functional and structural types of distress that may ultimately affect pavement serviceability. Thus, the need exists to review and verify ME design methods, along with accompanying climatic models, and to document construction processes for perpetual AC pavements, long-lasting PCC pavements, as well as for several types of rehabilitation applied to existing rigid pavement.

STUDY OBJECTIVES:
The primary objectives of the Monitoring and Modeling of Pavement Response and Performance research are to: (1) monitor the new perpetual AC and long-lasting PCC pavements in Ohio, the rehabilitated PCC pavements in New York State, and other existing instrumented pavements in both states; (2) verify ME design procedures for all pavements in the study; (3) calibrate ME procedures presented in the NCHRP 1-37A AASHTO Pavement Guide for Ohio and New York State. Develop calibration factors for the distress models in the NCHRP 1-37A software; and (4) controlled testing of perpetual pavement systems.

RESEARCH TASKS:
The project includes the following tasks:

Group A - Ohio:
A1. Data collection, field sampling, and pavement surveys will be performed using SHRP protocols. A2. Strain histories will be reconstructed. A3. Forensic investigations will be performed on test sections that fail. A4. Laboratory tests will be performed on samples collected in forensic investigations. A5. Annual reports will be provided. A6. A data summary and an environmental data analysis related to pavement distress will be generated. A7. Input parameters for the EICM will be determined. Results from the model will be compared with actual field data. A8. Replacement SPS-2 test sections on the SHRP test road on US 23 in Delaware County will be instrumented and monitored.

Group B - New York State:
B1. Instrumentation installed on Interstate 86 in New York State will be monitored. B2. Construction practices will be reviewed. B3. Data collection, field sampling, and pavement surveys will be performed for six years. B4. Strain histories on test sections will be reconstructed. B5. Forensic investigations of test sections will be performed. B6. Laboratory testing will be performed. B7. Annual reports will be provided. B8. A data summary and an environmental data analysis will be generated.

Group C - Optional:

PROJECT DELIVERABLES:
Reports as required.

As per FMIS, participating states include: NY($700,000), OH($785,129)
PROBLEM STATEMENT:
A goal of the Ohio Department of Transportation is to achieve steady state system condition. The amount of funding required to achieve and to maintain steady state level of service is dependent upon the selection of an optimal mix of treatment categories (new construction, major rehabilitation, minor rehabilitation, and preventive maintenance) and timing. A pavement management process is necessary to assess system condition and determine cost effective strategies. Under previous research projects, researchers have developed, and ODOT has populated, a pavement management information system (PMIS) which consists of pavement design history, rehabilitation actions, costs, and performance in terms of pavement condition and ride quality. Tools in the PMIS provide decision makers with the ability to predict future pavement condition. These tools provide decision makers with the ability to perform "what-if" analysis of both the financial impact and level of service to the public. However, the financial analysis must consider costs of future maintenance and rehabilitation in addition to current spending. Given the size of the pavement network and the number of competing project candidates, the number of feasible alternatives will be very large. Therefore, it is desirable to have a procedure to quickly narrow down the alternatives, and assist ODOT decision makers with choosing among the "near optimal" plans. A research study to develop such a procedure is warranted.

STUDY OBJECTIVES:
The objective of this study is to enhance PMIS by developing and incorporating procedures and routines to (1) investigate and quantify the mid to long term financial impact of selecting alternative projects; (2) define and determine the optimal multi-year work plan according to ODOT specified criteria such as maximizing statewide pavement network condition, subject to budgetary and other constraints; and (3) determine the required multi-year budget, by treatment category, to preserve the existing system at a specific steady-state condition.

RESEARCH TASKS:
Task 1: Perform a literature review and conduct a survey to identify benefit cost and budget optimization and allocation models and procedures used by other state and foreign transportation agencies.
Task 2: Review ODOT’s PMIS to determine the availability of data.
Task 3: Summarize and report the results of the literature search and survey. Summarize the pros and cons of each benefit cost and budget optimization model and procedure identified. Identify any deficiencies in the PMIS data for the various procedures. Recommend a procedure for use by ODOT.
Task 4: Modify ODOT’s PMIS application or develop an application compatible with ODOT’s PMIS to perform the analysis/procedures identified in Task 2 and selected by ODOT for use.
Task 5: Validate the modified PMIS by using historic distress and cost data to predict current conditions.
Task 6: Prepare and submit a final report detailing the work performed for this project.

PROJECT DELIVERABLES:
Standard reports as required by the RD&T2 Manual of Procedures; and updated PMIS.
STATE FISCAL YEAR 2012

Project Title: Structural Evaluation of LIC-310-0396 Box Beams with Advanced Strand Deterioration

State Job Number: 134381

Project Type: Structures

Research Agency: Ohio University

Funding Type: 80/20 Federal/State

Total Project Cost: $556,429.00

Start Date: 5/1/2008

End Date: 10/1/2011

Researchers: Eric Steinberg
Technical Liaisons: Mike Loeffler
Curtis Zigan
Waseem Khalifa

STATEMENT OF NEED:
A box beam structure recently collapsed in Pennsylvania. This structure type represents approximately 10% of the total square footage of the Department's bridge inventory. More information is needed to inspect, rate and manage the Department's inventory of precast box beam structures.

STUDY OBJECTIVES:
The objective of this study is to obtain field samples, perform material and strength testing as described below to create a proportional relationship between visual observations, inspection rating, and structural analysis modeling for load capacity.

RESEARCH TASKS:
1) Document and measure visual observations.
2) Transport, test, and dispose of seven beams.
3) Perform full scale load testing to failure on four beams.
4) Test six more cross sectional beam sections from beams not load tested.
5) Collate deterioration data and full scale test information to develop a structural analysis model for load capacity.
6) Recommend changes to the Department's current inspection practices.

DELIVERABLES:
Recommendations of changes to inspection practices and reports as required.
STATEMENT OF NEED:
ODOT is required by the Ohio Environmental Protection Agency (OEPA) to implement post-construction storm water Best Management Practices (BMPs) for linear transportation systems that are sold after March 10, 2006. Several BMPs are candidates for this application (Vegetated Bio-filters Devices, Infiltration Devices, and Detention Devices). Of these the Exfiltration Trench Infiltration Device appear to be an attractive choice due to manageable construction costs and constructability and ease of maintenance and operation but, design optimization and performance verification are needed.

STUDY OBJECTIVES:
The objectives of this research will include:
1) examining the design, durability, and construction of the Exfiltration Trench;
2) proposing revisions to the Exfiltration Trench to provide an optimum filter medium design to capture the first flush;
3) developing a maintenance manual; and
4) examining any and all possible safety concerns.

RESEARCH TASKS:
Task 1: Perform literature review and prepare a synthesis of the gathered information.
Task 2: Develop a research plan for ODOT approval to test the first flush ability of the Exfiltration Trench, implement the approved research plan, make recommendations to revise the Exfiltration Trench accordingly, and then test this revised Exfiltration Trench.
Task 3: Develop a research plan for ODOT approval to test the filter media of the Exfiltration Trench for removing runoff constituent (pollutants) during the first flush, implement the approved research plan, make recommendations, revise the Exfiltration Trench filter media, and then then test this revised Exfiltration Trench filter media.
Task 4: Draft the Exfiltration Trench design, durability, construction, maintenance manual, and address safety concerns.
Task 5: Develop a research plan for ODOT approval to investigate and evaluate the performance assessment/verification of an existing Exfiltration Trench, and implement the approved research plan.

PROJECT DELIVERABLES:
The deliverables of this project will include: literature review, the research plans mentioned in the above tasks, final report to include revisions to the following: 1) design recommendations to ODOT’s Location and Design Manual (Volume Two); 2) Standard Construction Drawing WQ-1.2 for the Exfiltration Trench; 3) Supplemental Specification SS 835 for the Exfiltration Trench; 4) A durability document on the Exfiltration Trench. Finally, a maintenance manual based on traffic and environment.
PROBLEM STATEMENT:
The use of steel dowel bars to transfer forces across sawed or formed transverse joints from one concrete pavement slab to another while permitting expansion and contraction movements of the concrete has been a basic design practice in most U.S. state departments of transportation for many decades.

A common problem is the corrosion of the steel dowels, especially in states which use salt for snow and ice control. Corrosion can lead to a reduction in the diameter of the dowel bar in the joint area to the point where the dowel bar will fail in shear when loaded, resulting in faulting of the pavement slab. The corrosion can also "lock" the dowel bar into the concrete, preventing movement of the concrete during expansion and contraction, resulting in the transfer of stress to the concrete which cause the slab to crack. In the mid 1970's, state DOT began to require steel dowel bars be coated with epoxy or other materials to prevent corrosion. Epoxy coated dowels have become the standard for most states. Recently, alternative materials have been used to manufacture dowel bars. While the resistance of some alternative materials have been well documented in laboratory examinations, other performance characteristics affecting service life remain to be fully evaluated, particularly in representative field installations and over meaningful time periods.

A program to evaluate two alternative dowel bar materials, stainless steel and fiber reinforced polymer (FRP), was initiated in 1998 by the Highway Innovative Technology Evaluation Center (HITEC). Initial field installations of FRP and stainless steel dowel bars began in 1996 in conjunction with the FHWA High Performance Concrete Pavement (TE-30) project. Projects were completed in 4 States; Iowa, Illinois, Ohio, and Wisconsin, over a period of 4 years. The last project was completed in 2000. The projects were being evaluated under the May 9, 1998 HITEC evaluation plan. A draft interim report detailing the construction and early performance of the test sections was submitted March, 2005. However, prior to completion of the evaluation, the contract was terminated with the now defunct HITEC. This research shall complete the work initiated by HITEC.

STUDY OBJECTIVES:
The objectives of "Evaluation of Fiber Reinforced Composite Dowel Bars and Stainless Steel Dowel Bars" are as follows: 1) assess the constructability, placement verification, environmental qualities and performance capabilities of RFP dowels and stainless steel dowels to perform the load transfer and joint movement requirements in concrete pavement joints for the full service life of the pavement without detrimental corrosion or deterioration; and 2) consider the comparative performance and service life costs of these alternative materials and epoxy coated mild steel for use in dowel bars.

RESEARCH TASKS:
Task 1: Revise draft interim report to incorporate review comments and revise evaluation plan to reflect recommendations in the draft interim report. Update annotated literature review.
Task 2: Host initial Technical Panel Meeting in Chicago. Discuss the current status of the evaluation and the approach to close out the project.
Task 3: Execute the revised evaluation plan. Participating states with evaluation sites will be responsible for collecting data and cores identified in the revised evaluation plan.
Task 4: Provide quarterly progress reports until the completion of the evaluation.
Task 5: Prepare draft final report
Task 6: Host final technical panel meeting in Chicago. Present results of evaluation and discuss draft final report.
Task 7: Prepare final report

PROJECT DELIVERABLES:
Quarterly, interim, and final reports.

This is a pooled fund study for which Ohio will act as the lead state. Participating states include IL ($10,800), KS ($10,800), OH ($21,600), and WI ($10,800).
STATEMENT OF NEED:
Currently ODOT has no test method at the start of a project to ensure aggregate combinations used in HMA pavement will provide adequate friction as expected over the life of the pavement. Field skid testing is performed on old pavements to address possible low friction/ high polish pavements by replacing or grinding the pavement. Friction reduction can occur at any time during the life of the pavement. Ensuring adequate materials to provide friction over the pavement life expectancy is a desirable goal. No practical, small HMA sample polishing test exists currently. In addition, lab friction measures used in other DOT specs are not state of the art. This work will built on previous work conducted at the University of Akron, "Continuing Investigation of Polishing and Friction Characteristics of Limestone Aggregate in Ohio" (SJN: 134219), which examined new and practical methods and equipment to conduct appropriate testing during the mix design phase by the contractor. This study will extend the existing ODOT field study to validate long term correlation of field and lab polishing.

STUDY OBJECTIVES:
The objective of "Long Term Validation of an Accelerated Polishing Test Procedure for HMA Pavements" is to validate the applicability of the developed laboratory testing protocol and acceptance criteria associated with the newly developed accelerated polishing equipment through a correlation and comparison study with field performance data.

RESEARCH TASKS:
Task 1 - Laboratory Work
Task 2 - Field Work
Task 3 - Correlation Study
Task 4 - Supplemental Specifications
Task 5 - Laboratory Equipment Demonstration
Task 6 - Submission of Required Reports

PROJECT DELIVERABLES:
1) Polishing tester standard
2) Friction tester standard
3) Mix design criteria with discussion with the liaison to look at variation in criteria based on traffic level as a possibility.
4) Well correlated database of field history and new test standards.
5) Reports as required
STATEMENT OF NEED:
ODOT’s Office of Aerial Engineering produces approximately 50 project specific orthophotos annually which are used for many types of planning and design purposes. Many projects are planning and analysis related where traffic and safety issues govern the time sensitive nature of the requested orthophoto products needed to resolve an issue. Current project specific orthophoto generation processes are tedious and time consuming to achieve the image quality and geometric accuracy necessary to meet our current transportation needs. There is a need for a rapid orthophoto system that is capable of producing high quality, high accuracy orthophotos.

STUDY OBJECTIVES:
The objective of “Rapid Orthophoto Development System” is to recommend and update, including hardware and software components, the Office of Aerial Engineering mapping system to provide a significant improvement in orthophoto production. The proposed digital mapping system should allow for 1) the elimination of time-consuming and labor-intensive tasks that are associated with analog system components, 2) fast data transfer between the major processing units, and 3) high level automation of various processes, all needed to achieve an efficient orthophoto production.

RESEARCH TASKS:
1) Assess current practices of orthophoto production in OAE.
2) Digital camera procurement.
3) GPS/IMU-based georeferencing.
4) Digital camera configuration.
5) Ortho production workflow development
6) Limitation of the occlusion effect in orthoimagery.
7) Treatment of bridges.
8) QA/QC processes.

PROJECT DELIVERABLES:
A large format digital aerial camera; algorithmic developments for improved orthophoto generation sequence that is less sensitive to occlusions and to improve the ortho creation process for bridges; software suite of tools for integration into OAE’s existing workflow; all source code; and required reports.
PROBLEM STATEMENT:
Mechanical properties of pavement materials have always played a primary role in pavement engineering. They are of importance in designing new pavement, estimating pavement remaining life, and helping decision-makers select the optimal reconstruction and/or rehabilitation strategy. Moreover, in the newly released Mechanistic Empirical Pavement Design Guide (MEPDG), material properties, i.e. modulus and Poisson's ratio, form the basic inputs in the forward calculation of pavement responses, i.e. displacement, strain and stress. Therefore, it is obvious that the accuracy of modulus input will directly influence the pavement performance, and thus the safety of travelers on the highway. Backcalculation has been a challenging and yet urgent topic and has gained much attention from engineers and researchers. Conventionally, various backcalculation programs were proposed. However, as is well known, the solutions from most programs are not unique due to certain intrinsic drawbacks in their programs where either the search algorithms are not universal or the fitness function is not suitably defined. Consequently, there are many sets of pavement moduli satisfying the same level of fitness; however, most of them are local optimization except for one genuine solution. The genetic algorithm (GA) has the unique advantage of global searching and has been gaining more and more attention in backcalculation. However, the backcalculation program based on GA needs tens of thousands of computation trials before achieving satisfactory results, which usually implies unbearable running time. In backcalculation, every computation trial is a forward calculation, thus the speed of forward calculation plays a decisive role in the speed of a backcalculation program. Because of the large amount of computation tasks, the backcalculation programs based on GA are currently still limited to theoretical investigation. Furthermore, most available programs are only able to analyze pavement with very few homogeneous layers, e.g. four layers in MODULUS and five layers in BACKGA-ANN. However, it is well-known that asphalt material is very sensitive to time and temperature, and the aging- and temperature-related functional graded moduli (FGM) need to be included in asphalt concrete. Such stiffness gradient will consequently affect pavement responses significantly, thus functionally graded stiffness should be considered in backcalculation.

STUDY OBJECTIVES:
The objective of "An Efficient and Accurate Genetic Algorithm for Backcalculation of Flexible Pavement Layer Moduli" is to investigate how the stiffness gradient (FGM) affects backcalculation of flexible pavement. Stiffness gradient (FGM) profiles of pavements have been extensively reported in pavement engineering; however, no work has been conducted to investigate the influence of the FGM on pavement backcalculation.

RESEARCH TASKS:
- Task 1 - Study of laboratory and in-situ data and develop empirical FGM models
- Task 2 - Develop backcalculation algorithm utilizing genetic algorithm as the search tool
- Task 3 - Validate program with real data
- Task 4 - Provide recommendations on the suitable way of incorporating stiffness gradients
- Task 5 - Reporting

PROJECT DELIVERABLES:
1) Analytical model for stiffness profile for backcalculation
2) Quarterly progress reports
3) Draft and approved versions of a final report and executive summary (including electronic versions)
4) Participation in required meetings (i.e. start-up, review, results presentation)
5) Article for R&D newsletter.
STATEMENT OF NEED:
Ruts are longitudinal deformations in the surface of asphalt pavements. Rutting is caused by compaction or lateral movement of any or all pavement layers, including subgrade, under traffic (ODOT Pavement Condition Rating System, May 1999). Water can accumulate in the ruts during wet weather. If the ruts are sufficiently deep, the water can cause hydroplaning, increasing the potential for an accident. Therefore it is important to monitor the extent and severity of ruts on the pavement network.

System wide rut depth measurements have been collected manually by ODOT pavement condition raters since 1985. The rut depth is measured using a straight edge and dial gauge. However, this procedure is time consuming and exposes the rater to the hazards of traffic. Recently, the ODOT Office of Pavement Engineering (OPE) purchased an inertial road profiler with an INO laser rut measuring system. This system allows the collection of rut depth at highway speeds with a stated accuracy of 1mm. As ODOT transitions from manual measurement of ruts to automated measurements, there is a need to ensure there is a correlation with the manually measured data. In addition, the newly collected rut measurements may be used for research, including the calibration of the newly released mechanistic-empirical pavement design guide (MEPDG). There is a need to validate the accuracy of the INO data and develop correlations with the manually collected data.

STUDY OBJECTIVES:
The objective of “Verification of Rut Depth Collected with the INO Laser Rut Measurement System (LRMS)” are to (1) determine the accuracy, precision and repeatability of the INO Laser Rut Measurement System (LRMS) depth measurement system, and (2) develop and validate the correlation between the manually measured rut depth and rut depth as measured with the INO.

RESEARCH TASKS:
Task 1 - Locate one or more section(s) of asphalt concrete pavement having a range of rut depths. Measure rut depth using a recognized, accurate method. Measure the rut depth using straight edge and dial gauge (S&G) and the INO LRMS. Evaluate the S&G and INO data with respect to variance within measurement types and examine the correlation of measurements between types.
Task 2 - Correlate INO rut measurements collected by ODOT in 2008 (or other agreed upon time period) with manual rut data collected during the same period by ODOT raters. Develop procedures for extracting rutting distress scores from the INO data that correspond with ODOT’s existing pavement condition rating (PCR) criteria. Determine the impact of using INO measurements in lieu of the manual measurements for rutting distress for PCR. Develop an implementation plan to use the INO measured rut depth in lieu of manually measured rut depth.
Task 3 - Recommend other parameters (maximum, minimum, etc.) that may be suggested by the data for the use and interpretation of INO rut depth measurements.
Task 4 - Prepare and submit a final report detailing the work performed for this project.

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Draft and approved versions of a final report and executive summary (including electronic versions)
3) Participation in required meetings (i.e. start-up, review, results presentation)
4) Article for R&D newsletter
STATEMENT OF NEED:
This research seeks to evaluate the performance and accuracy of ODOT vehicle classification stations in terms of the 13 standard FHWA vehicle classes. The study will use manual data reduction from concurrent video to evaluate how well the ODOT stations sort vehicles into these 13 classes and identify any chronic problems in the automated classification performance. From the manually reduced ground truth data, we will also evaluate how well the 13 classes map to ODOT's length based vehicle classification scheme that uses three bins.

Previous research sponsored by the Region V University Transportation Center and supported by ODOT has already demonstrated an earlier version of this procedure. The past work, however, only considered a single station, over a few hours, under strictly moderate flow at free flow speeds. This project will extend the effort to many stations, and seek out conditions that are more likely to challenge the classification station- higher flow and congestion. The former condition could confound stations due to detectors sticking on or the controller erroneously segmenting vehicles. While the latter could lead to inaccurate speed and length measurements since most classification stations (whether weigh in motion or axle-counter) rely on some form of a dual detector "speed trap" to measure speed. At low speeds acceleration becomes non-negligible, impacting the speed-trap measurements and potentially causing any conventional classification station to misclassify vehicles.

STUDY OBJECTIVES:
The objectives of "Validating the Performance of Vehicle Classification Stations" are to (1) use manual data reduction from concurrent video to evaluate how well ODOT classification stations sort vehicles into the 13 FHWA classes, and establish the final division of desired traffic conditions and the set of test locations working with ODOT; (2), identify any chronic problems in the automated classification performance so that ODOT can ensure accurate vehicle classification; (3) evaluate how well the 13 classes map to ODOT's length based vehicle classification scheme and vice versa; and (4) investigate and develop non-labor intensive means to conduct these evaluations, to allow for on-going calibrations of classification stations.

RESEARCH TASKS:
Task 1 - Identify study stations and plan the data collection.
Task 2 - Collect concurrent classification data and LIDAR data.
Task 3 - Manually generate ground truth data for each of the stations.
Task 4 - Compare and analyze data. Identify trends.
Task 5 - Compare FHWA classes from the LIDAR data against manually generated ground truth data.
Task 6 - Compare the FHWA based classifications against the LIDAR based measurements. Identify trends. Investigate the feasibility of using a temporary deployment of the LIDAR system for automatically validating the performance of the ODOT classification stations.
Tasks 7-9 - Reporting

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Draft and approved versions of a final report and executive summary (including electronic versions)
3) Participation in required meetings (i.e. start-up, review, results presentation)
4) Article for R&D newsletter
STATEMENT OF NEED:
Licking County, Ohio has experienced flooding numerous times with the majority of flood damage occurring in the central and south-central areas of the county along four streams: the Licking River, North Fork Licking River, South Fork Licking River, and Raccoon Creek. Flooding from these four streams affect communities including: Village of Granville, City of Newark, City of Heath, Village of Hebron, and the Village of Buckeye Lake. Flood plains within these communities are moderately to highly developed, with a mix of residential and commercial structures. In addition, flooding has resulted in the closure of Interstate Route 70 (I-70) in the vicinity of the Village of Buckeye Lake and the interchange of I-70 and State Route 79 (SR-79). In order to address this issue, a communication plan with local entities and emergency responders along with permanent detour scenarios have been established. The closure of major routes results not only in traffic congestion, but a loss of commerce and safety concerns within the detour area. Although these detours are designed to redirect traffic around the flooded area while reducing adverse affects to the local residents, a flood warning system would provide an advanced and consistent method of estimating when the highway and surrounding area may be inundated allowing for a concerted effort to mitigate loss. This proposed research focuses on developing a flood warning system for Licking County with specific attention given to the I-70/SR-79 region.

STUDY OBJECTIVES:
The objectives of "Development of a Flood-Warning System and Flood-Inundation Mapping in Licking County" are to: (1) enhance the ability of the National Weather Service (NWS) to develop flood forecasts, (2) facilitate advanced flood warning to the public and emergency managers by developing static flood-inundation boundaries for a range of stages along selected reach of the four streams, and (3) facilitate advanced flood warning to the area of Buckeye Lake and the I-70/SR-79 interchange by developing a dynamic unsteady-flow hydraulic model.

RESEARCH TASKS:
Task 1 - Develop and Manage Project
Task 2 - Gage Equipment Purchase and Installation
Task 3 - Gage Operation and Maintenance
Task 4 - Data Collection
Task 5 - Data Reduction
Task 6 - Hydrology
Task 7 - Hydraulics
Task 8 - Flood-Inundation Mapping
Task 9 - NWS Review Process
Task 10 - Technical Documentation

PROJECT DELIVERABLES:
1) An accurate and advanced flood warning system for Licking County.
2) Hydraulic models and associated map libraries for incorporation into flood-stage prediction calculations and use on future hydraulic design projects.
3) Quarterly reports.
4) Draft and approved versions of a final report and executive summary (including electronic versions).
5) Participation in required meetings (i.e.: start-up, review, results).
6) Article for IRIS newsletter (upon request).
STATEMENT OF NEED:
ODOT is required to consider noise abatement for projects funded through FHWA and ODOT has developed a noise abatement policy. Executive Leadership has charged the Department with incorporating green alternatives in construction, design, and mitigation of impacts to roadway projects in accordance with ODOT’s 2010-2011 Business Plan, Initiative 6, “Go with Green.” With regard to the environmental mitigation of highway projects, a green noise wall was selected for evaluation and assessment as a pilot/experimental option to reduce traffic noise.

STUDY OBJECTIVES:
The objective of “Green Noise Wall Construction and Evaluation” is to evaluate the feasibility of construction of this type of wall in terms of structural integrity, plant sustainability, acoustic protection, geotechnical stability, construction costs, and maintenance costs and concerns.

RESEARCH TASKS:
This research is divided into two phases. ODOT will review the findings and recommendations at the conclusion of Phase 1 and determine whether or not to proceed with Phase 2.
Phase 1 - Preliminary Research and Analysis
Task 1: Extensive literature search for available green noise wall products
Task 2: Laboratory and field testing including plant studies, prototype wall, stability testing, and anticipated traffic noise reduction analysis
Task 3: Reassessment of site location for full wall construction
Task 4: Analysis of carbon sequestration credit potential
Task 5: Develop engineered shop drawings and specifications

Phase 2 - Construction and Evaluation of Green Noise Wall
Task 1: Pre-Construction meeting
Task 2: Construction of green noise wall
Task 3: Evaluation and monitoring of green noise wall
Task 4: Comparison of green noise wall to conventional noise barriers
Task 5: If wall performs SUCCESSFULLY, develop engineering shop drawings and specifications including a cost/benefit analysis. If all performs UNSUCCESSFULLY, remove green noise wall.
Task 6: Prepare and submit final report and present findings.

PROJECT DELIVERABLES:
1) Bi-monthly technical memos
2) Draft and approved versions of a final report and executive summary (including electronic versions). Report must include: (a) policy recommendations and/or strategies for adoption or policy changes and (b) a cost/benefit analysis and recommendations for future development of green noise walls.
3) Standard drawings and construction specifications for the Green Noise Wall if findings are supportive.
4) Submission of all project data.
5) Participation in required meetings (i.e.: start-up, review, results).
6) Article for IRIS newsletter (upon request).
STATE FISCAL YEAR 2012

Project Title: Improved Characterization of Truck Traffic Volumes and Axle Loads for Mechanistic Empirical Pavement Design

State Job Number: 134557

Project Type: Pavement

Research Agency: University of Akron

Funding Type: 80/20 Federal/State

Total Project Cost: $74,773.94

Start Date: 11/26/2010

End Date: 11/26/2012

STATEMENT OF NEED:
The recently introduced Mechanistic-Empirical Pavement Design Guide (MEPDG) and related software provide capabilities for the analysis and performance prediction of different types of flexible and rigid pavements. In order to utilize MEPDG, project specific data must be entered into the application. In some instances, all of the required data may not be available. To advance the implementation of the MEPDG in Ohio, there is an urgent need for an automated tool to assemble traffic volume and axle load information from operational traffic monitoring systems within the state. This tool should be capable of accounting for missing information and summarizing traffic inputs in a format that can be directly imported into the MEPDG.

STUDY OBJECTIVES:
The objectives of "Improved Characterization of Truck Traffic Volumes and Axle Loads for Mechanistic Empirical Pavement Design" is to (1) develop a methodology to obtain the required MEPDG traffic inputs using available project-specific and regional traffic data and then (2) implement the developed methodology into user-friendly software.

RESEARCH TASKS:
Task 1 - Conduct a synthesis of literature review
Task 2 - Compile traffic data from AVC and WIM systems operating in the State of Ohio
Task 3 - Develop a methodology to assemble the required traffic data
Task 4 - Develop a methodology to obtain the required traffic inputs for the MEPDG
Task 5 - Develop a user-friendly software implementing the approved methodology
Task 6 - Assess the variability in regional default traffic inputs generated based on functional and truck traffic classifications
Task 7 - Deliver final report, software and manual, and conduct training
Task 8 - Present findings

PROJECT DELIVERABLES:
1) User-friendly software to generate the required traffic inputs for MEPDG using available traffic data
2) Software manual
3) Half-day training session on software
4) Quarterly progress reports
5) Draft and approved versions of a final report and executive summary
6) Article for Research newsletter (upon request)
7) Participation in required meeting

Monday, May 16, 2011
STATEMENT OF NEED:
For several years, ODOT has been refining its system for managing the vast assets of Ohio’s transportation infrastructure. Advances in technology, awareness on environmental impacts, and a renewed focus on statewide economic development have greatly affected the manner in which government agencies approach business. This sentiment is echoed in ODOT’s 2010-2011 Business Plan, which charges the department to: (1) promote a multi-modal approach to transportation, (2) ignite Ohio’s economic development engine (3) embrace environmental stewardship (4) and (5) identify mechanisms for reducing operating costs and/or generating revenue. Historically, ODOT has utilized a roadway centric management approach and the entire transportation system was not incorporated into the project selection process. To provide an efficient and world class 21st century transportation network, ODOT needs to move to a Transportation Asset Management approach which is a scenario based model that can be used to compare assets in regions and corridors around Ohio and identify the impacts associated with transportation asset investments. This research project will identify opportunity zones in an effort to support the management of those assets important to the viability of Ohio’s transportation system.

STUDY OBJECTIVES:
The objective of "Development of Opportunity Zones Utilizing Transportation Assets” is to develop an infrastructure management framework that will enable ODOT to compare and contrast transportation assets across the state and identify the corridors régions that offer the highest return on investment identifying what we call "opportunity zones.”

RESEARCH TASKS:
Task 1 - Conduct a literature search to determine if any other organizations have conducted studies or projects with a similar proposed problem statement and provide an annotated bibliography of such.
Task 2 - Conduct a gap analysis on the datasets provided and determine if additional information is required.
Task 3 - Develop a geospatially enabled representation of all datasets with each resource residing on a separate layer.
Task 4 - Develop a framework that will describe how ODOT can develop opportunity zones related to the departments’ assets.

PROJECT DELIVERABLES:
1. Geospatial map and shape file in the following file format (.shp)
2. Geospatial logic and associated methodology in the following file format (.shp)
3. Model/Framework that can be used to aid ODOT in making transportation investment decisions
4. Draft and approved versions of a final report and executive summary (including electronic versions)
5. High quality PowerPoint slides that will be presented, by the researcher, to the ODOT Executive Management Team at the conclusion of the project
6. Participation in required meetings (i.e. start-up, review, results presentation)
7. Article for R&D newsletter (upon request)
STATEMENT OF NEED:
ODOT uses a number of materials for longitudinal pavement marking applications, including traffic paint, polyester, thermoplastic, epoxy, and preformed tapes. In general, satisfactory results have been obtained from these materials under dry conditions. However, under wet conditions, a noticeable drop in visibility has been observed. Such reduction in visibility is critical under night conditions when the pavement markings are needed most. To address this issue, current delineation practices in Ohio involve using raised pavement markers (RPMs) along the lane lines to help guide motorist regarding their location within the roadway. In several instances, however, the RPMs did not last as intended until the next resurfacing after about 8 years, leaving the roadway without the necessary delineation. For that reason, ODOT is interested in identifying alternative technologies that may provide better performance under wet-night conditions.

STUDY OBJECTIVES:
The objective of the student study "Nighttime Visibility of 3M All Weather Paint (AWP) and 3M 380WR ES Durable Tape Under Dry, Wet, and Rainy Conditions" is to analyze data to make recommendations regarding the future use of the evaluated materials in Ohio. The outcome of this study is expected to improve safety on ODOT’s highway network and to reduce cost by providing better alternatives to RPMs.

RESEARCH TASKS:
Task 1 - Prepare a synthesis of literature review
Task 2 - Document existing site conditions
Task 3 - Document the conduct of the performance evaluation
Task 4 - Collect and analyze performance evaluation data
Task 5 - Prepare reports and present findings

PROJECT DELIVERABLES:
1) Quarterly reports.
2) Draft and approved versions of a final report and executive summary (including electronic versions).
3) Participation in required meetings (i.e.: start-up, review, results).
4) Article for IRIS newsletter (upon request).
**Project Title:** Quantification of Cracks in Concrete Bridge Decks in Ohio District 3  

**State Job Number:** 134564  

**Project Type:** Structures  

**Research Agency:** University of Akron  

**Funding Type:** 80/20 Federal/State  

**Total Project Cost:** $20,000.00  

**Start Date:** 2/13/2011  

**End Date:** 6/13/2012  

**Researchers:** Anil Patnaik  

**Technical Liasons:** Perry Ricciardi, John Adamski

### STATEMENT OF NEED:
Cracking of bridge decks is a serious problem throughout the United States. While cracks may develop in concrete bridge decks for a variety of reasons, cracks are primarily caused due to low tensile strength of concrete, intrinsic volumetric instability or the potential for deleterious chemical reactions. Cracks provide a means for diffusion of aggressive agents into the interior of the concrete and initiate corrosion of internal reinforcing steel. There is a need to study the cracking behavior of bridge decks, and document the extent and pattern of cracking for typical bridges in Ohio so that the causes for cracking can be identified and remedial measures developed to minimize such cracks in new bridge decks in future construction. Several concrete bridge decks in District 3 (I-71, Route 30, Route 2 and I-90) have shown numerous cracks. The ages of these bridge decks range from over ten years to less than two years. There is an urgent need to investigate the source, causes and extent of cracking of the referred bridge decks and to develop methodologies and strategies to minimize cracking in future bridge decks.

### STUDY OBJECTIVES:
The objective of the student study "Cracking in Concrete Bridge Decks in Ohio District 3" is to determine if there is a higher propensity for cracking on structural slabs as opposed to stringer type structures. Further, if it is determined that there is a higher propensity the researcher will identify general areas to consider further investigation. The results of this research will provide insight into the cracking of bridge decks. By understanding the potential causes of cracking in Ohio, ODOT can adopt measures designed to lessen or prevent cracking and improve the quality of bridge decks to increase their overall life which ultimately could result in cost savings.

### RESEARCH TASKS:
- Task 1 - Review literature on development of cracks in reinforced concrete bridge decks  
- Task 2 - Study ODOT District 3 bridge deck inventory and classify bridge decks  
- Task 3 - Selection of typical and representative bridge decks  
- Task 4 - Study the extent and pattern of cracking of select bridge decks  
- Task 5 - Establish potential correlation between the extent of cracking and bridge deck classification  
- Task 6 - Establish crack minimization strategies for new bridge decks  
- Task 7 - Summarize the findings

### PROJECT DELIVERABLES:
1) Quarterly reports.  
2) Draft and approved versions of a final report and executive summary (including electronic versions).  
3) Participation in required meetings (i.e.: start-up, review, results).  
4) Article for IRIS newsletter (upon request).
Project Title: Application of Bluetooth Technology to Rural Freeway Speed Data Collection

State Job Number: 134567

Project Type: Traffic

Research Agency: University of Akron

Funding Type: 80/20 Federal/State

Total Project Cost: $99,019.07

Start Date: 3/25/2011

End Date: 7/25/2012

STATEMENT OF NEED:

ODOT is developing and operating real-time freeway management systems in six urbanized areas. A critical component of these systems is real-time speed data. The speed data is purchased from a vendor and ODOT converts the data into travel time for use on Dynamic Message Signs (DMS), Highway Advisory Radio (HAR), and BuckeyeTraffic.org, the department’s website for travel conditions. The speed data covers the urban regions. Monitoring of traffic flow between regions on the major highway system may be proposed if a viable solution can be found. This monitoring of rural freeway speeds will facilitate inter-regional travel and also provide incident detection. Due to the expanse of the rural freeways, the current system of collecting spot speeds every mile may not be practical. Spot speeds are normally collected at one mile intervals to provide accurate travel times. A new system which can accurately monitor speeds and travel times over longer segment distances is needed.

Prior research to validate spot speed data and travel times developed a methodology using Bluetooth. This method captures unique signatures from Bluetooth-enabled devices in a vehicle. Signatures are matched between the stationary Bluetooth reader device locations and the result is an actual travel time. Since the distance between devices is also known, an accurate average speed can be determined. It is anticipated that all regional freeway management systems will be operational in Ohio in just over two years. With Columbus and Cincinnati already on line, the need exists for inter-regional traffic flow data in real-time.

STUDY OBJECTIVES:
The objective of "Application of Bluetooth Technology to Rural Freeway Speed Data Collection" is to develop a framework by which accurate travel time and speed data can be collected utilizing Bluetooth technology.

RESEARCH TASKS:
The researcher will: a) develop a system which uses Bluetooth technology in roadside devices to capture and match signals from vehicle-based Bluetooth signals; b) determine maximum spacing of devices to produce accurate (95%) travel times, and; c) deploy sensors along a designated roadway and collect data in real time.

PROJECT DELIVERABLES:
1) Devices deployed for data collection, left insitu.
2) Non-exclusive, irrevocable license to all software developed to process data and communicate with the devices. Copies of all software developed and corresponding source code must be provided.
3) Quarterly reports
4) Draft and approved versions of a final report and executive summary (including electronic versions)
5) Participation in required meetings (i.e. start-up, review sessions, results presentation)
6) Article for R&D newsletter (upon request)
STATEMENT OF NEED:
Many Ohioans are dependent on a third-party source for their transportation needs (i.e.: senior citizens, disabled, veterans, and limited income households). Nationally, there are 64 separate programs that fund and/or arrange what is referred to as health and human services transportation (HHST). In 2002, approximately $3 billion was allocated nationally for client transportation services among such programs. Ohio spends millions of dollars each year for HHST. In addition to the national programs, Ohio has multiple state programs that also provide transportation assistance to our residents. These programs are administered through individual agencies with little to no coordination. As a result, Ohio is at risk of duplicating services and/or underutilizing our HHST resources. An all-inclusive, coordinated process that takes into account all assets, funding, time, location, demands, and clients is needed. The Governor's 21st Century Transportation Priorities Task Force recognized this issue and challenged ODOT to address the topic.

Making an effort to ensure efficient mobility for all users is a critical component to managing a transportation system. Simply maintaining pavements and structures is not enough. The notion that we can no longer “build our way out of congestion” is widely accepted. While improved system operations offers some respite, a better method for efficiently utilizing the existing infrastructure and available assets is needed. A potential key to lessening congestion could lie in better utilization of high occupancy vehicles (i.e.: transit). Higher occupancy equates to less vehicle miles traveled, which results in fewer vehicles on the roadways which results in less wear and tear on the current infrastructure. Addressing the issues concerning coordination of HHST may lead to better utilization of higher occupancy vehicles, thereby aiding ODOT’s goal of improved mobility.

STUDY OBJECTIVES:
ODOT’s ultimate goal is to develop a statewide system that integrates all HHST services and enables the efficient and effective allocation of resources to meet the needs of the traveling public while being fiscally responsible. This research project is considered the initial step towards meeting this goal.

RESEARCH TASKS:
Task 1 - Best Practices Study
Task 2 - Develop Three Ohio Specific Solutions
Task 3 - Refinement of Ohio’s HHST Coordination Solution

PROJECT DELIVERABLES:
1. Quarterly progress reports (provided electronically).
2. Interim report
3. One original and five copies of a comprehensive draft final report and draft executive summary shall be submitted 120 days prior to the contract completion date.
4. Ten copies of an approved final report, 10 color copies of an approved executive summary, and a PDF and MS DOC version of both documents shall be submitted by the contract completion date.
5. High quality PowerPoint slides that will be presented, by the researcher, to the ODOT Executive Management Team at the conclusion of the project (25 slide max)
6. An article for the IRIS newsletter (to be provided upon request).
7. Participation in the following meetings: project start-up, research review session (1 per year), and project wrap-up.
STATEMENT OF NEED:
The formation of queues on a highway facility is a sign of the presence of operationally inefficient sections of the facility. Queueing occurs at signalized and unsignalized intersections mostly due to overflow or inadequacy of turn bays. The ODOT Location and Design (L&D) Manual provides storage requirements at signalized and unsignalized intersections. However, there are currently no records whether storage lengths given in this manual are valid and accurately represent the actual conditions at intersections. Therefore, the collection of traffic and queue storage data at some intersections and analysis of data is needed in order to validate and/or update the model ODOT is currently using.

STUDY OBJECTIVES:
The objective of the student study "L&D Manual Turn Lane Storage Validation/Update" is to (1) collect traffic, signal and geometry data at signalized and unsignalized intersections; (2) use these data to validate and/or update the current ODOT model used for queue storage length calculations; and (3) compare queue storage length calculations by other models available such as the McTrans’ Highway Capacity Software (HCS), Synchro, etc., using the same datasets for validity purposes. This research will focus on left-turn and right-turn lanes encompassing both signalized and unsignalized intersections.

RESEARCH TASKS:
Task 1 - Literature Review
Task 2 - Data Collection
Task 3 - Model Evaluation and Validation
Task 4 - Final Research Report

PROJECT DELIVERABLES:
1) Quarterly reports.
2) Draft and approved versions of a final report and executive summary (including electronic versions).
3) Participation in required meetings (i.e.: start-up, review, results).
4) Article for IRIS newsletter (upon request).
STATEMENT OF NEED:
Over the last three years, the use of Warm Mix Asphalt (WMA) in the United States has rapidly expanded due to its multiple benefits. Director Beasley directed ODOT to implement the use of WMA in 2008/2009. In 2009, ODOT initiated a student study, "Mechanical Properties of Warm Mix Asphalts Prepared Using Foamed Asphalt Binders" (SJN: 134476) with the University of Akron. The objective of this study is to investigate a laboratory foaming method for mix design and look at preliminary performance results of foaming based on lab made mixes. Several assumptions were made at that time to allow specifying the methods and criteria to be used in Ohio. From what is being learned in the study and from some of the unanswered assumptions significant questions remain, such as: (1) the effect of aggregate moisture on foaming extent, binder adhesion and moisture damage and (2) field compaction temperature range for quality control samples and mat placement. Current WMA methods and specifications need validated or changed to better promote and properly use WMA in Ohio.

STUDY OBJECTIVES:
The objective of "Determining the Limitations of Warm Mix Asphalt by Water Injection in Mix Design, Quality Control and Placement" is to develop reasonable and implementable requirements for the use of WMA in Ohio.

RESEARCH TASKS:
The work will primarily consist of in lab efforts, defined by the researcher, to address the aforementioned problems.
Task 1 - Develop a research methodology that, at a minimum, includes: recreating multiple asphalt mix types with various aggregates under hot and warm mix design methods using applicable and accepted mix design practices.
Task 2 - Create a matrix of study efforts to isolate and define the variables affecting lab moisture sensitivity and field compaction such as binder content, temperature ranges, aggregate moisture and aggregate type.
Task 3 - Validate design requirements for WMA mixes and the working temperature range in the field within which WMA mixes can be properly produced and placed and what issues can be expected to arise when the above variables are out of range.
Task 4 - Reporting findings.

PROJECT DELIVERABLES:
1) Quarterly reports
2) Draft and approved versions of a final report and executive summary (including electronic versions)
3) Recommendations to revise existing specifications
4) Recommendations to revise mix design or testing methods
5) Recommendations, if necessary, for contractors to control asphalt plant operations and WMA placement
6) Participation in required meetings (i.e. start-up, review sessions, results presentation)
7) Article for R&D newsletter (upon request)
PROBLEM STATEMENT
ODOT administers a Safe Routes to School (SRTS) program funded by the Federal Highway Administration (FHWA). The program provides assistance to school districts for infrastructure projects, non-infrastructure projects, and program development that enables and encourages active transportation such as walking and bicycling while promoting roadway safety. The current ODOT program is administered as a "One Agency/One Application" process. ODOT permits school districts to request development funds for up to four school facilities at a time. As part of this request, ODOT requires applicants to provide a school travel plan for each facility. The four school application limit is not a regulatory requirement, but was established as a control measure to establish equitable distribution of funds. This limitation tends to put large school districts, those with more than 15 Kindergarten through 8th grade (K-8) facilities, at a disadvantage. In an effort to ensure equitable distribution of FHWA funds across the state, a process that allows for and aids in the development of district wide school travel plans is needed.

STUDY OBJECTIVES
The objective of "Developing a Methodology for School Travel Plan Development for Large School Districts" is to create a methodology or process that can better serve school districts that have more than 15 K-8 facilities. The desired outcome is a process and program information that ODOT can easily convert to an online guide/toolkit to assist SRTS applicants at larger school districts.

RESEARCH TASKS
Task 1 - Evaluation and Methodology Identification
Task 2 - Development of District Wide Travel Plan Methodologies
Task 3 - Evaluate Selected School District
Task 4 - Analysis and Reevaluation
Task 5 - Findings and Evaluation

PROJECT DELIVERABLES
1. Interim report following Task 1
2. Quarterly progress reports
3. Draft and approved versions of a final report and executive summary (including electronic versions)
4. Participation in required meetings (i.e.: start-up, interim, review session, results presentation)
5. Potential presentation at ODOT’s Health Communities Annual Conference and/or the Ohio Transportation Engineering Conference (OTEC).
6. Article for IRIS newsletter (upon request).
STATE FISCAL YEAR 2012

Project Title: Instrumentation of the US Grant Bridge for Monitoring of Fabrication, Erection, In-Service Behavior, and to Support Management, Maintenance, and Inspection

State Job Number: 148050

Project Type: Structures

Research Agency: University of Cincinnati

Funding Type: 80/20 Federal/State

Total Project Cost: $903,100.00

Start Date: 6/1/2002

End Date: 12/31/2013

Researchers: Arthur Helmicki

Victor Hunt

Technical Liasons: Greg Baird

Tim Keller

Bret Boothe

Mike Loeffler

STATEMENT OF NEED:
The behavior of cable-stayed bridges has not fully been understood yet, especially dealing with the three dimensional vibrations which lead to fatigue and the issue with inspection dealing with the epoxy coated, grout filled stays. An effective bridge monitoring system is needed for bridge management and maintenance purposes.

STUDY OBJECTIVES:
The objectives of Instrumentation of the US Grant Bridge for Monitoring of Fabrication, Erection, In-Service Behavior, and to Support Management, Maintenance, and Inspection study are to: identify, install, and implement an appropriate instrumentation and field-testing program to support management of the US Grant Bridge (SCI-23-0.00). This program will augment the traditional visual inspection program to provide objective, quantitative data for use by ODOT in assessing the status of the structure; capture key static and dynamic aspects of the behavior of the bridge during both construction and in-service use; including dead-loads, controlled truck-loads, traffic, wind, thermal, and other load responses; create finite element and other models and calibrate them with the measured data, in order to assess the condition and capacity of the structure; develop field-ready monitoring strategies aimed at supporting inspection, maintenance and management activities and reducing life-cycle costs; develop a database of all field test data obtained on the US Grant Bridge including baseline and a regular regimen of truck-load tests, ambient vibration tests, and long-term environmental monitoring; and provide a detailed written report of all activities and findings obtained while conducting this research.

RESEARCH TASKS:
1. Work with ODOT and contractor to secure needed support for field instrumentation installation and construction event monitoring.
2. Obtain a copy of all design and construction drawings, calculations, manuals, etc.
3. Develop 3-D analytical model of the bridge.
4. Determine which members, connections, and stay cable to instrument.
5. Establish test schedule.
6. Establish Sensor and cable layouts
7. Monitor construction event and ambient vibrations.
8. Field test for baseline and service condition assessment.

PROJECT DELIVERABLES:
1. An analytical finite element model.
2. A detailed instrumentation of the US Grant Bridge for the most critical members of the bridge.
3. A database of all field tests performed on the bridge.
4. A detailed analysis of the obtained data.
5. The Final Report of research findings.
6. A development of a full scale and dynamic health monitor incorporating the hardware and software.
STATEMENT OF NEED:
There are significant amounts of land in the state of Ohio under the control of ODOT, even in urban areas where open space is scarce and energy needs are greatest. Solar energy needs are greatest. Solar energy generation usually requires significant amounts of land and is best suited to areas where energy doesn't have to travel far to access the grid, which is most common in urban areas. Thus, using highway right-of-way in an urban area to investigate the generation of solar energy by ODOT is the next step in moving the solar green initiative forward.

STUDY OBJECTIVES:
The study "Veteran's Glass City Skyway (VGCS) bridge" will determine the viability of a solar array erected in the I-280 right-of-way near the VGCS in Toledo, Ohio. The electricity generated will be equivalent to the amount needed to light the pylon of the bridge plus additional roadway lighting.

RESEARCH TASKS:
Specific tasks included the following:
Task 1: Identify problems which are unique to the highway right-of-way project.
Task 2: Provide data that will assist ODOT in the evaluation, selection and procurement of equipment and design, construction and maintenance services for future permanent solar installations within the highway right of way.
Task 3: Document the generation of energy using ODOT highway right-of-way by a solar array including energy output, efficiency, and reliability.
Task 4: Document the site selection
Task 5: Document the procedures associated with the electrical grid connection.
Task 6: Make a cost analysis of the project with recommendations of future investment in similar installations.
Task 7: Create a web site that has real time monitoring.

PROJECT DELIVERABLES:
1. A final report documenting all of the work performed for this project.
2. A spreadsheet tool that will evaluate the variable factors associated with a solar plan including development, procurement, production and installation.
3. Draft document summarizing the recommendations of contractor pre-qualifications, work types, and specifications for future solar projects.
**Project Title:** Administrative Category  
Includes: General Expenses: Marketing/Communication/ Implementation/Materials Testing/Brushfires

**State Job Number:** ADMIN-A  

**Project Type:** Administration  

**Research Agency:**

**Funding Type:** 80/20 Federal/State  

**Total Project Cost:** $200,000.00  

**Start Date:** 7/1/2011  
**End Date:** 6/30/2015

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**STATEMENT OF NEED:**
Administrative funding category to cover general program expenses including, but not limited to: salaries, travel, meetings, report printing, marketing, communication, implementation, materials testing, and brushfire projects.

**STUDY OBJECTIVES:**
To be defined as needs arise.

**RESEARCH TASKS:**
To be defined as needs arise.

**PROJECT DELIVERABLES:**
To be defined as needs arise.
STATEMENT OF NEED:
Administrative funding category to cover expenses associated with hosting the Cooperative Research Seminar.

STUDY OBJECTIVES:
Representatives from ODOT, FHWA, academia, private corporations, industry, county engineers, and various professional organizations are invited to the seminar to exchange ideas on ODOT’s strategic research plan. The department’s focus is on enhancing organizational maturity by defining measures and creating systems to guarantee success of the department’s Vision. Consistent methodical concentration on the department’s core business using the tools of research, technology and innovation will continue to be the strategy for improvement.

RESEARCH TASKS:
During the seminar the Department’s strategic research focus areas will be presented along with the 5-year project matrices for each of the divisions/offices. At the conclusion of the seminar, we hope to have identified any major gaps in our long-term focus areas. Problem statements for the 5-year matrices will be modified or supplemented as needed to address these gaps. We also hope to examine the relevancy, potential payoff and partnership opportunities for accomplishing our research goals. This seminar will allow us to gain valuable input from the research community to help refine our research efforts.

PROJECT DELIVERABLES:
Identification of the following:
1. Gaps between Long-Term Focus Areas and Proposed Projects;
2. Potential Overlaps Between Projects;
3. Suggested Modifications to Current 5-year Matrix;
4. Potential Modifications to Draft Problem Statements;
5. Partnership Opportunities;
6. Potential Payoffs; and
7. Relevancy.
STATEMENT OF NEED:
Administrative funding category to cover expenses associated with hosting the Research Peer Exchange.

STUDY OBJECTIVES:
A peer exchange is conducted every three years to gather feedback on the performance of the department’s research program. Areas of excellence as well as potential improvements are identified.

RESEARCH TASKS:
Representatives from other state DOT’s are invited to the department to participate in two to three days of panel interviews with various individuals in the department. The department identifies specific areas of focus for the exchange.

PROJECT DELIVERABLES:
The panel participants provide a summary of their observations relative to focus of the exchange as well as recommendations for improvements and ideas they plan to take back to their agencies for consideration.
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Mid-West States Crash Testing Program
TPF Number: SPR-3(017)
Project Type: Safety
Lead Agency: Nebraska Department of Roads

TPF Number: SPR-3(017)
Project Type: Safety

Funding Type: 100% Federal
Total Project Cost: $8,064,549.00
Total ODOT Cost: $685,071.00
Contract Start Date: 7/1/1997
End Date: 6/30/2009

Technical Liaisons: Michael Bline

STATEMENT OF NEED:
The need for continuous research to improve roadside safety and to reduce injuries and fatalities associated with ran-off-road crashes was recognized in the early 1990s by various states. In an effort to address this concern, the concept of a State Department of Transportation, annually-funded, research program was conceived. In 1991, the Mid-West States Crash Testing Program was established to coordinate and conduct crash testing of appurtenances that are of mutual interest among the participating states. The Midwest Roadside Safety Facility (MwRSF) of the University of Nebraska-Lincoln was chosen to administer the work of the program.

STUDY OBJECTIVES:
MwRSF is a research organization with a main focus of researching all aspects of highway design and safety. MwRSF conducts safety performance evaluations of various roadside appurtenances, developing new and innovative design concepts and technologies in the area of highway safety to assure that nationally established criteria is met.

RESEARCH TASKS:
To share information concerning the crash testing of bridge rail, guardrail, sign supports, traffic control devices, and other highway appurtenances. Specific goals of MwRSF include the following:

1. Improve highway safety by making the roadside less hazardous for motorists;
2. Design, develop, and crash test roadside hardware;
3. Conduct safety performance evaluations of existing roadside features; and
4. Perform computer simulation modeling of vehicle impacts with roadside hardware.

PROJECT DELIVERABLES:
Reports as required

For more information visit: http://www.mwrsf.unl.edu/
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Aurora Program
TPF Number: SPR-3(042)
Project Type: Maintenance

Lead Agency: Iowa Department of Transportation

Funding Type: 100% Federal

Total Project Cost: $3,122,500.00
Total ODOT Cost: $75,000.00
Contract Start Date: 10/1/2003
End Date: 1/1/3000

Technical Liaisons: Diana Clonch

STATEMENT OF NEED:
Aurora is an international program collaborative research, development and deployment in the field of road and weather information systems (RWIS), serving the interest and needs of public agencies. The Aurora vision is to deploy RWIS to integrate state-of-the-art road and weather forecasting technologies with coordinated, multi-agency weather monitoring infrastructures. It is hoped this will facilitate advanced road conditions and weather monitoring and forecasting capabilities for efficient highway maintenance, and provision of real-time information to travelers. This program is an ongoing study and will continue for the foreseeable future. Members contribute funds annually; propose research projects on RWIS-related projects (Road Weather Information Systems); manage contracts for the research; and prepare reports/submit results for publication. One of Aurora’s goals is to provide guidelines for RWIS implementation and usage.

STUDY OBJECTIVES:
The objectives of the Aurora Program pooled fund study are: 1) provide and/or improve RWIS information dissemination to both transportation providers and end users; 2) improve the efficiency of maintenance operations, primarily costly winter maintenance activities; 3) support and enhance information dissemination activities in the rural environment; 4) reduce traffic congestion delays in urban areas due to adverse weather-related conditions; 5) aid in the development of seamless maintenance operations and information dissemination RWIS programs; 6) develop initiatives which assist public agencies in deploying road and weather information systems technologies; 7) encourage greater cooperation and information exchange between transportation agencies and the meteorological community; and 8) support development of alternative uses of RWIS.

RESEARCH TASKS:
Projects currently underway within Aurora include: Benchmarking the Performance of RWIS Forecasts; Development of an RWIS Quality Assurance Monitoring System; Guidelines for Testing, Installation, Maintenance, and Calibration of Pavement Sensors; Hot Plate Snow Gauge Demonstration; Improved Frost Forecast Model - Phase II; Intelligent Image-Based Winter Road Condition Sensor - Phase III; Investigation of the Variability of Snow Cover Conditions; Laser Road Surface Sensor; Mobile Weather and Road Condition Reporting; New Road Condition Sensor; Off-the-Shelf Component RWIS; Promoting Development of Road Weather ESS Observation Systems; RWIS Equipment Monitoring System; RWIS Leverage Opportunities; RWIS Telecommunication Issues and Options; Support of the MDSS Pooled Fund Study; Technology Transfer of Swedish RWIS to North America; Using RWIS to Trigger Spring Load Restrictions; and Winter Weather Severity Index Enhancements.

Projects completed by Aurora include: Adaptation of the Local Climatological Model in New Areas; Compilation of RWIS Specifications; Computer-Based Training Development; Expert System for Maintenance Decision Support; Improved Frost Forecast Model - Phase I; Institutional Issues Committee; Integration of Road Weather Information with Traffic Data; Intelligent Image-Based Winter Road Condition Sensor - Phase I; Intelligent Image-Based Winter Road Condition Sensor - Phase II; Interjurisdictional Traveler Information Exchange; Pavement Temperature Sensor Accuracy; Road Weather Roadshow; and Road Weather Training Program for Improved Winter Response RWIS Communications Standards; RWIS Data Integration and Sharing Guidelines; Standardized Testing Methodologies for Pavement Sensors; Standardized Weather and Road Condition Information Presentation; and Synthesis of National Road Weather Forecasting.

For more information regarding project specifics, use the following internet link: http://www.aurora-program.org/

PROJECT DELIVERABLES:
The final report of different research project

Monday, May 16, 2011
STATE FISCAL YEAR 2012

Project Title: Long Term Pavement Performance (LTPP) Specific Pavements Study (SPS) Traffic Data Collection

TPF Number: TPF-5(004)  Lead Agency: FHWA/NHTSA National Crash Analysis Center
Project Type: Planning
Funding Type: 100% Federal
Total Project Cost: $14,676,285.00
Total ODOT Cost: $154,594.00
Contract Start Date: 8/7/2003
End Date: 8/7/2009

Technical Liasons: Lindsey Pflum

STATEMENT OF NEED:
A core objective of this study is to quantify relationships between pavement performance and truck volumes and axle loadings. It is essential to quantify these relationships if we are to make progress in improving the ability to predict long-term performance of pavements on Interstate and other major highways. Unfortunately, the states have fallen behind in collecting the required traffic data and successful achievement of this goal is in serious jeopardy. If the data shortfall is not corrected immediately, we will lose the opportunity to understand and quantify the relationship between truck loadings and pavement performance.

STUDY OBJECTIVES:
The objective of the Long Term Pavement Performance (LTPP) Specific Pavements Study (SPS) Traffic Data Collection pooled fund study is to quantify relationships between pavement performance and truck volumes and axle loadings.

RESEARCH TASKS:
This project is broken into three major tasks:
1. Assessment;
2. WIM performance evaluation and calibration; and
3. VC performance evaluation.

All tasks are ordered for sites at which equipment is installed and capable of collecting data. The sites can be existing installations or those recently installed or upgraded for the collection of traffic loading data at LTPP SPS sites.

PROJECT DELIVERABLES:
This project was initiated to provide the highway community with the information needed to design, build, and maintain cost-effective and long lived pavements.

For more information, visit: http://www.tfhrc.gov/pavement/ltpp/spstraffic/index.htm
STATEMENT OF NEED:
There is an increasing need for State Highway Agencies to purchase and upgrade profiling equipment to provide network level and project specific smoothness information. This includes profilers operated at close to posted speed limits that are most often used to determine ride quality on a network level and smaller units, such as lightweight profilers. Quality profile data is a key element in evaluating the long-term performance of pavements. The LTPP effort has identified a need for the calibration and for the verification of the accuracy of these devices. Currently, calibration methods only exist for LTPP equipment and are not available to all highway agencies.

STUDY OBJECTIVES:
The objectives of the Improving the Quality of Pavement Profiler Measurement pooled fund study are to:

1. Deliver sample procurement specification, maintenance guidelines, and a profile analysis software program.
2. Establish criteria for verification centers and assist with the development of these locations.
3. Develop and deploy a traceable verification center.
4. Provide technical review of software.

RESEARCH TASKS:
1. Profiler Acquisition Specifications and Maintenance Guidelines.
2. Profiler Calibration Centers.
3. Profiler Calibration Equipment Production and Delivery.

PROJECT DELIVERABLES:
1. Profiler acquisition specifications.
3. Analysis software.
4. Training.
STATEMENT OF NEED:
It has been five years since there was an international update on Accelerated Pavement Testing (APT). No single agency working in APT can afford to sponsor a conference of this size. The proliferation of APT programs almost demands an update to facilitate building on one another's experience instead of duplicating it.

STUDY OBJECTIVES:
The objective of the Second International Conference on Accelerated Pavement Testing pooled fund study is to provide a forum for the exchange of technical information on accelerated pavement testing and associated topics.

RESEARCH TASKS:
The scope of this conference is to provide a forum for the exchange of technical information on accelerated pavement testing and associated topics. The participants will be updated on information available for improving the use of accelerated pavement testing equipment, test tracks, and the use of the data in structural performance models of highway pavements.

PROJECT DELIVERABLES:
The conference will be held in the Radisson Metro Dome, near Minneapolis and will include a field trip to the MnROAD facility and firms such as APT, MTS, and Interlocken.
PROJECT TITLE: NDE/NDT for Highways and Bridges

TPF Number: TPF-5(088)
Project Type: Structures

Lead Agency: New York DOT

Funding Type: 100% Federal
Total Project Cost: $75,000.00
Total ODOT Cost: $10,000.00

Technical Liasons: Mike Loeffler

STATEMENT OF NEED:
The aging highway and bridge infrastructure presents a significant challenge to effectively maintain their operational level and safety. Effective and reliable condition assessment of aging infrastructure, new materials, and new processes is critical to meet the needs and demands of the traveling public. Nondestructive evaluation technologies have an increasingly important role in this arena. Continuous exchange of information among researchers and practitioners on the application of NDE technologies for infrastructure condition assessment is necessary to develop these technologies and optimize their usage. Coordination and mobilization of experts to address this issue and establishing standards and certification programs is required to accomplish this goal.

STUDY OBJECTIVES:
The objective of the NDE/NDT for Highways and Bridges pooled fund study is to improve the state-of-the-practice for infrastructure condition assessment through the application of nondestructive evaluation (NDE) technologies. The study will investigate and develop standards and certification procedures to enable the widespread application of NDE by State highway agencies. The study will also examine the common needs of State highway agencies and identify critical condition assessment challenges. The study will promote interaction among highway agencies to share best practices, cross-train engineers and develop knowledge, and form working groups to examine critical issues.

RESEARCH TASKS:
1. Identify the common problems facing the infrastructure owners.
2. Identify available resources from all the states, transportation organizations, professional societies, and FHWA to assess the problems identified in Task 1.
3. Develop appropriate partnerships to address the issues.
4. Identify and prioritize NDT/NDE methods to address the critical issues.
5. Develop basis for evaluation of the selected technologies in field applications
6. Demonstrate and evaluate field performance of selected technologies based on the standards set in Task 5.
7. Develop appropriate standards and certification programs.
8. Evaluate the success of the program.

PROJECT DELIVERABLES:
Report documents along with standards and certification programs.
STATEMENT OF NEED:
Over the past several decades both the FHWA and State highway departments of transportation (DOT’s) have invested heavily in the development of mechanistic performance prediction-lifecycle costing models and also in the collection and analysis of data associated with the performance of selected highway pavement test sections. Numerous mathematical models have been developed in order to address all sorts of pavement behavioral issues. For instance, NCHRP Project 1-37A provided both primary response and performance predictive models (rigid and flexible) intended primarily for use in designing pavements as part of the 2002 Guide for the Design of New and Rehabilitated Pavement Structures. Also other agencies, including state DOT’s, FHWA and universities nationwide have been working on developing mechanistic and mechanistic-empirical predictive models for use in addressing high focus issues e.g., NAFTA overloading or problems dealing with truck size and weight (TS&W) regulation. Two national Pooled Fund Studies (PFS) 2(203) and 2(205) with lead States Ohio and Texas respectively supported programs with these aspects in mind. Work in PFS 2(203) has provided a second-generation version of the VESYS mechanistic flexible pavement performance prediction model KB VESYS. This model will be linked to FHWA’s lifecycle costing model EAROMAR and the VSIM heavy vehicle dynamics model to form an integrated set of models called the KB Suite of Models. This same study further supported the development of FHWA’s 2d FE primary response (PR) program JSLAB and conducted evaluations on the EVERFEE 3-d finite element model and selected parts of the 1-37A flexible pavement PR model JULEA. Work in PFS 2(205) will provide a revised version of VESYS 5 using a front end specially designed by the Texas A&M University.

RESEARCH TASKS:
Delineation between new and exclusive TRUCK routes, distribution hubs, and intermediate truck/auto routes and exclusive light vehicle carriageways are foreseeable as effective means for meeting transportation needs well into the 2000’s. Exclusive heavy truck routes may not look at all like we envision a typical highway to be. Such routes may coincide more on the order of airfield pavement designs in order to carry trucks that could be double in size of today’s heavy vehicles. Current arteries will need to be strengthened to meet such needs or to enable their existence to continue carrying today’s traffic streams well into the future. Heavy vehicles, especially those designated as being overload vehicles must be classified with respect to the level of damage they impose and restrictions for their use must be equitably postulated. Exclusive light vehicular traffic roads will necessitate more care in their design for environmental effects. Allocating user charges will certainly differ given such scenarios. The trend toward ownership of selected highways is inevitable and this certainly will require the use of sophisticated formulations and procedures that provide reliable estimates of the future wear out, performance and repair costs.

PROJECT DELIVERABLES:
The most suitable models will be selected for implementation in developing strategies and procedures that address the objective for this PFS. Appropriate training in the use of the models will also be included.
Statement of Need:
Traffic counts, traffic mixes and site geometry combine to influence the probability of a collision and the magnitude of the consequences of a collision and are not included in the Specification. A probabilistic risk analysis for determining the design requirements should be considered/developed for designing piers and abutments for vehicle collisions.

Magnitude of the design force (400 KIP) was established from data available at the time the LRFD Specification was prepared. Additional data/information are now available and more are needed to address whether the magnitude of the 400 KIP design force should be changed. Recent tests with single unit trucks colliding with fixed bollards and concrete walls have yielded data that will be applicable. More information for heavily loaded articulated vehicles is still needed. Some helpful information might be obtained from reconstruction of recent collisions of such vehicles that have occurred in the field.

Study Objectives:
The AASHTO LRFD Bridge Design Specifications require that "abutments and piers located within a distance of 30.0 FT of the edge of the roadway, or within a distance of 50.0 FT to the centerline of a railway track, shall be designed for an equivalent static force of 400 KIP" Supporting documentation for this design requirement, both its applicability and the magnitude of the design force, is not extensive. Further detailed guidance for the design engineer is not available.

The objectives of the Guidelines for Designing Bridge Piers and Abutments for Vehicle Collisions pooled fund study are to address the following:

1. What risks warrant application of this requirement? And,
2. Is the magnitude of design force (400 KIP) appropriate?

Research Tasks:
This project will be conducted in two phases, as listed below. All Phase 1 work shall be completed, and recommendations for Phase 2 work (if any) approved by the project sponsors, prior to commencement of any Phase 2 research activities.

Project Phasing and Suggested Tasks:
Phase 1 (18 months, $300,000 estimated) will include the following tasks:
1a. Literature review.
1b. Computer simulations of vehicle/bridge column and abutment collisions.
1c. Accident survey and analysis study.
1d. Development of a risk analysis methodology for vehicle/bridge column and abutment collisions (analogous to AASHTO LRFD vessel impact requirements).
1e. Detailed justification and work plan for research (if any) to be conducted under Phase 2 of the project.
1f. Provide facilities and host a meeting to present Phase 1 results to project sponsors, including pooled fund project participants from other state DOTs. Include $20,000 line item in project budget for reimbursement of travel expenses for out-of-state participants.

Phase 2 (6 months, $125,000 estimated) may include the following tasks:
2a. Crash testing with a single unit truck to verify loading from Phase 1 literature survey and computer simulations.
2b. Crash testing of a 5-axle tractor trailer rig to verify loading from Phase 1 literature survey and computer simulations.

Project Deliverables:
Reports as required.
STATEMENT OF NEED:
For state transportation agencies, location is an integral part of most data collected and utilized. When data has a location referencing element (e.g. address, route/milepost) it can be used with a Geographic Information System (GIS) and placed on the roadway or other parts of the transportation system. Much of the useable data about transportation is not maintained at the state DOT level, but at the local level or with other agencies. For planning, project scoping, environmental management, emergency management and other integral DOT functions there is a significant need to collect and combine this data to create a complete statewide transportation network and associated location referencing systems.

STUDY OBJECTIVES:
The Washington Department of Transportation (WSDOT) in partnership with the Oregon Department of Transportation (ODOT) are establishing a consortium of public and private entities for the purpose of developing computer based tools that facilitate geo-spatial transportation data sharing and integration for a variety of purposes and uses. The goals of the consortium are to continue developing, implementing and providing a variety of Software tools for sharing and integrating GIS data.

RESEARCH TASKS:
Data to be managed includes: 1) roads: location, number of lanes, federal functional classification, address ranges, zip codes, local road identifier, route number, road name(s), location along roadway (milepost), and their geographic representation; 2) railroads: location, type of track (mainline, siding, etc.), train station location, classification, line identifier, type of crossing, and their geographic representation; 3) ferries: route location, terminal location, route name, federal functional class, staging areas, route length, international or domestic route, average sailing duration, etc.; 4) aviation: Airport identifier, surface type. Instrument landing approach, arc code, runway width, use, elevation, FAA Classification, Airport name, terminal location, etc.; 5) non-motorized: includes bikes, foot, horses, etc. Include location, name, type of usage, etc.; 6) ports: location, routes for water transportation (particularly river and Puget Sound); and 7) other data as yet not defined.

PROJECT DELIVERABLES:
The following steps are planned to implement the transportation network data sharing: 1) flexible Translator ; 2) data Provider Internet Interface; 3) data User Internet Interface; 4) data Integration ; 5) quality Control and Quality Assurance; 6) security; and 7) location Referencing Integration.
Project Title: Midwest States Pooled Fund Pavement Preservation Partnership

TPF Number: TPF-5(112)  Lead Agency: Michigan Department of Transportation
Project Type: Pavement  Funding Type: 100% Federal

Total Project Cost: $220,000.00  Total ODOT Cost: $15,000.00
Contract Start Date: 1/1/2006  End Date: 8/24/2008

Technical Liaisons:  
David Humphrey
Aric Morse
Roger Green

STATEMENT OF NEED:
Public infrastructure, such as highways, streets, and bridges has not been traditionally regarded as assets in a formal accounting sense. The public operators of these facilities have been more concerned with physical conditions and capabilities than with book cost and replacement value, and they reported their financial information using fund and modified accrual accounting methods. But in the future, these operators will be required to treat such capital infrastructure as assets, the value of which they must periodically report using full accrual accounting methods as is presently required for vehicles and equipment. Developing national protocols for pavement preservation and publishing them as AASHTO standards would improve overall quality and treatment performance. But developing such standards will take time. Meanwhile many state, county and local highway agencies are building experience and developing knowledge in design, materials, specifications, and performance criteria in the area of preservation. Exchanging this information is invaluable to highway agencies.

STUDY OBJECTIVES:
The objectives of the Midwest States Pooled Fund Pavement Preservation Partnership pooled fund study are:

1. Provide funds for a multi-day annual workshop for discussion and exchange of information and knowledge about each state’s pavement preservation program.
2. Provide a means to define, support and share technology of mutual interest.
3. Establish and maintain MPPP’s web site.
4. Provide funds for formal training presentations during the annual workshop.
5. Provide funds for management support of MPPP through the National Center for Pavement Preservation at Michigan State University.

RESEARCH TASKS:
Specific funding is needed to: 1) assure participation and collaboration among the states at an annual workshop meeting; 2) implement task operations, as designated by MPPP’s Steering Committee; and 3) managing the MPPP’s operations to include an annual meeting, reporting, and developing and maintaining an informational web-site.

PROJECT DELIVERABLES:
Proceedings from the annual workshop and task group meetings will be documented by a report. An annual report of MPPP’s affairs and events will be prepared by the National Center for Pavement Preservation (NCPP). NCPP will provide oversight and a web-site for MPPP as determined by MPPP’s Steering Committee and its by-laws.
STATEMENT OF NEED:
A significant amount of money has been spent on the implementation and study of deer-vehicle crash (DVC) countermeasures in the last several decades, but their expected crash reduction effectiveness is still largely unknown. The complexity and interdisciplinary requirements of implementation and long-term study of the correct potential DVC countermeasure(s) in the appropriate locations has limited the usefulness and transferability of past studies. A need exists to create a focal point for the definition and implementation of DVC-related research. This pooled fund would allow for the creation of a DVC Information and Research Center (DVCIR Center) to more properly address issues related to the DVC problem.

STUDY OBJECTIVES:
The objectives of the Deer Vehicle Crash Information and Research (DVCIR) Center pooled fund study are to:

1. Expand on the critical evaluation of past and current research in the DVC problem area, and become the repository for safety-focused summaries of this work. Critically evaluate the validity of past and current DVC-related research. Summarize and disseminate the relevant study details, implementation issues, and safety results.
2. Expand on the existing DVCIC activities as a repository for deer population estimates, vehicle-travel amounts, reported DVC or animal-vehicle crash data, and roadside carcass (if available) information from participating states. Summarize and disseminate data by state and region and, as appropriate, define relevant trends.
3. Identify and prioritize gaps in DVC-related research, define a strategy, and create requests for proposal (RFPs) for projects to evaluate the DVC questions identified by participating states. Provide funding for properly designed DVC-related research. Potential research areas include: Identification and definition of DVC-related data sources, collection, estimation, and management techniques; Definition and/or prediction of the magnitude and locations of DVC problem segments;
4. Evaluation of existing and potential DVC countermeasure crash reduction capabilities and their implementation issues; and
5. Investigation of and options to DVC-related roadway development programming, planning, design, operations, and maintenance decision-making approaches and policies.

RESEARCH TASKS:
This pooled fund will create a focal point (and/or location of first consideration) for the collection of DVC-related data/information (e.g., deer populations, vehicle travel, reported DVCs, and roadside carcasses). It will also guide, define, and fund an organized strategy of well-designed and properly staffed DVC-related research. The focus of this pooled fund does not overlap with any other existing projects (e.g., the Animal-Vehicle Crash Mitigation pooled-fund), and should assist with the dissemination of the results from ongoing projects. The center created by this pooled fund is expected to become the primary resource for well-defined DVC-related data/information and research results and an entity where only those projects that meet minimum scope, experimental design, staffing, and documentation requirements are funded.

PROJECT DELIVERABLES:
Reports as required.
## POOLED FUND PROJECT - OHIO IS PARTICIPATING
### SPR - PART 2 WORK PROGRAM
#### RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER

**STATE FISCAL YEAR 2012**

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<tr>
<th>Project Title:</th>
<th>Consortium of Accelerated Pavement Testing (CAPT) and Technical Exchange Partnership</th>
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<tr>
<td>TPF Number:</td>
<td>TPF-5(127)</td>
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<td>6/28/2008</td>
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<tr>
<td>Technical Liasons:</td>
<td>Roger Green</td>
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</tbody>
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**STATEMENT OF NEED:**
FHWA and a group of state departments of transportation from 9 of the 15 US facilities have proposed creation of a joint or pooled funded program to encourage coordination among the various facilities and provide resources and management for collaborative studies.

**STUDY OBJECTIVES:**
The main objective of the Consortium of Accelerated Pavement Testing (CAPT) and Technical Exchange Partnership pooled fund study is to develop technical deliverables unique to APT facilities and to accelerate technology transfer among APT owners.

**RESEARCH TASKS:**
1. Organize and structure a program that identifies and produces key technical deliverables.
2. Provide a means to define, support and share APT technology of mutual interest.
3. Develop a longer-range plan of collaboration (strategic plan), including potential cooperation with international community.
4. Provide for special studies, investigations, research and training.

**PROJECT DELIVERABLES:**
Reports as required.
POOLED FUND PROJECT - OHIO IS PARTICIPATING  
SPR - PART 2 WORK PROGRAM  
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER  
STATE FISCAL YEAR 2012

Project Title: Recycled Unbound Pavement Materials  
TPF Number: TPF-5(129)  
Project Type: Materials  
Lead Agency: Minnesota DOT

Funding Type: 100% Federal  
Total Project Cost: $375,000.00  
Total ODOT Cost: $75,000.00  
Contract Start Date: 5/1/2008  
End Date: 5/1/2013

Technical Liasons: Lloyd Welker

STATEMENT OF NEED:
Most of the current and former research projects using recycled materials are based on laboratory material characterization and mix design. The research proposed in this pooled fund study seeks to validate many of the previous findings with field performance data. The design guide modeling performed at Texas A&M is also in need of field validation. There is some anecdotal evidence of existing recycled base materials, but this research would provide a controlled field experiment in which quantifiable results could be obtained. This research would also provide a good opportunity to revisit some of the environmental concerns and address ways to mitigate the ill effects of effluent from the recycled concrete base layer. This research will help broaden the application of mechanistic-empirical pavement design methods to the use of recycled materials.

STUDY OBJECTIVES:
The objective of the Recycled Unbound Pavement Materials pooled fund study is to monitor the performance of several test cells at the Minnesota Road Research Facility (MnROAD) constructed using recycled materials in the granular base layers, including blended with virgin materials and 100% recycled asphalt and concrete pavement materials. The material properties will be monitored during construction and throughout the pavement life in order to determine their effects on pavement performance. The properties will be used to verify mechanistic-empirical design inputs, especially their variation with changing seasons and moisture regimes.

This pooled fund study is strictly to perform the recycled materials research on newly built test sections at MnROAD, and its funding will come from Mn/DOT and other participating states. The funding for initial construction of the test sections will be obtained separately from Mn/DOT and other partners.

RESEARCH TASKS:
This project is expected to consist of the following activities:
Work Plan: The work plan for this pooled fund study will be developed by the participating organizations. This will include selecting recycled materials to construct the base layer for 3 cells at MnROAD. Possibilities include:
1. 100% crushed concrete.
2. Crushed concrete blended with virgin aggregate.
3. RAP blended with virgin aggregate.

The pavement surface must also be carefully selected for these sections. Ideally, the same pavement will cover all three cells so as to minimize variables in the experiment.
1. Instrumentation Design: Thermocouples, TDRs (moisture), strain gages, etc.
2. General Testing & Monitoring: Monitor the pavement performance over time on each test section. Monitoring activities will include FWD tests, rutting measurements, distress surveys, ride measurements, and analysis of pavement sensor data.
3. Special Testing & Monitoring: Unsaturated soil properties, resilient modulus, seasonal variation of material properties, etc.
4. Design Guide Modeling & Validation: The material properties for recycled unbound layers will be modeled in the new mechanistic-empirical design procedure.
5. Pooled Fund Travel: Money for each state to travel to discuss the progress of the study.

PROJECT DELIVERABLES:
Work done under a research contract will develop interim and final reports that document the findings of this study.
STATE FISCAL YEAR 2012

POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER

Project Title: Tire/Pavement Noise Research Consortium
TPF Number: TPF-5(135)
Project Type: Environmental
Lead Agency: Washington Department of Transportation

Funding Type: 100% Federal
Total Project Cost: $150,000.00
Total ODOT Cost: $10,000.00
Contract Start Date: 7/1/2006
End Date: 6/30/2011

Technical Liaisons: Noel Alcala

STATEMENT OF NEED:
Minimizing the impact of traffic noise on the public is a priority for state highway agencies and the FHWA. As tire-pavement noise is the single largest contributor to traffic noise on many highways, increased utilization of low-noise pavement surfaces may reduce overall traffic noise or reduce the need for expensive traditional noise mitigation measures. Developing low-noise pavement surfaces that are both durable and safe is of high interest to both state highway agencies and FHWA. Utilization of low-noise surfaces may also provide a noise reduction alternative where traditional noise mitigation measures such as walls and berms are not a viable solution.

STUDY OBJECTIVES:
The objectives of the Tire/Pavement Noise Research Consortium pooled fund study are as follows:
1. Provide a forum for states to discuss noise issues and develop a proposed research plan.
2. Pool resources and efforts of multiple state agencies and industry to perform tire/pavement noise research in a similar manner (avoiding duplication) and sharing of data.

RESEARCH TASKS:
The anticipated scope of the study would consist of the following tasks:
1. Provide a forum for states to discuss noise issues, utilize the same techniques to build a larger database, and share data; the ultimate goal is to incorporate pavement type into the FHWA Traffic Noise Model.
2. Perform a synthesis of global practice in regards to utilizing pavement technology for decreasing tire/pavement noise;
3. Perform a synthesis on the cost/benefits of using low-noise pavements;
4. Produce a document for general public information regarding noise reduction;
5. Provide a baseline for quieter pavement discussion (e.g. definitions, list of acronyms, etc.);
6. Provide a guideline for best practices in measuring and evaluating noise benefits and decreases over the wearing life of the roadway surface.

A technical advisory group consisting of a pavement expert and a noise expert from each contributing agency and invited participants will refine/expand this scope of work and provide technical input/guidance throughout the duration of the research.

PROJECT DELIVERABLES:
Reports as required.
STATEMENT OF NEED:
In many cases, slope instability can be attributed to the effects of groundwater and associated pore-water pressures. Typically, drainage considerations for embankments can be readily incorporated during the design and construction process. However, subsurface drainage design and installation for marginally stable existing or new cut slopes can be challenging and typically involves the installation of horizontal drains and interceptor trenches. Horizontal drains can function unpredictably if not designed or installed adequately, or sited in inappropriate materials. Subsurface drainage is generally understood to be an important concept; nevertheless, the underlying principles, design, construction and maintenance considerations are not fully realized nor is the star-of-the-practice adequately documented. As a result, subsurface drains are often installed in a makeshift manner with varying degrees of success. Research is needed to identify, collect and develop best practices and guidelines to raise the standards for subsurface drainage design, installation and maintenance.

STUDY OBJECTIVES:
The objectives of this research are as follows: to provide best practices and guidance for subsurface drainage applications for slope stabilization, including subsurface investigation and testing, groundwater-flow characterization, analysis, drain configurations and design, installation methods, monitoring, and maintenance; and to evaluate new applications of existing materials and technologies, such as trenchless technologies and other innovative technologies and materials, for stabilizing slopes and subsurface drainage.

RESEARCH TASKS:
The anticipated scope of the study will consist of the following tasks: 1) perform a literature review of applications, design methodology, construction, and maintenance of subsurface drainage systems used for slope stabilization; 2) survey an appropriate range of designers/owners regarding applications, types of systems, design methodologies, and function/performance; 3) evaluate short- and long-term performance of a limited number of existing installations utilizing available or new instrumentation; 4) with currently available groundwater characterization and modeling techniques, develop methodology for determining appropriate applications and design of subsurface drainage for slope stabilization; and 5) produce a summary report that includes detailed recommendations/guidelines on site suitability; groundwater characterization; design methodology; detailing and generalized specifications; construction; and maintenance of subsurface drainage systems.

PROJECT DELIVERABLES:
Reports as required.
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in HMA Pavements

TPF Number: TPF-5(153)  Lead Agency: Minnesota Department of Roads
Project Type: Pavement  Funding Type: 100% Federal

Technical Liasons: Roger Green
Aric Morse

Total Project Cost: $375,000.00
Total ODOT Cost: $75,000.00
Contract Start Date: 5/1/2009
End Date: 5/1/2014

STATEMENT OF NEED:
Few if any studies have examined the pavement performance after placing a preventive maintenance treatment immediately after construction, but this can be accomplished in this study. Many of the existing studies monitor pavements under live traffic loadings. This study hopes to examine strictly environmental aging by either leaving pavement sections without traffic or by studying shoulders for their performance under various preventive maintenance treatments. MnROAD has the potential to be only the second site in the country that would apply surface treatments to a pavement with known properties at various times to study the effects of the surface treatments on aging. Finally, MnROAD provides a unique opportunity to study pavements with detailed weather information and known traffic applications in a safe and controlled work environment. The ability to divert traffic allows researchers to monitor and sample test sections in a safe manner, and it encourages researchers to push the envelope and try something new without causing a major disruption to the traveling public if it fails prematurely.

STUDY OBJECTIVES:
The goal of the Optimal Timing of Preventive Maintenance for Addressing Environmental Aging in HMA Pavements pooled fund study is to determine the proper timing of preventive maintenance treatments in order to optimize life cycle costs and pavement performance. Environmental aging of the asphalt binder in the underlying pavement is not well understood, and this project will seek to better understand the aging mechanism and how it can be reduced through pavement preservation.

RESEARCH TASKS:
This project is expected to consist of the following activities:

1. Work Plan: The work plan for this pooled fund study will be developed by the participating organizations.

2. Instrumentation Design: Thermocouples, strain gages, etc.

3. Surface Treatment Application: Determine the parameters to include in designing and applying surface treatments to HMA pavements and/or shoulders at MnROAD. Preventive maintenance treatments (i.e., chip seal, fog seal, rejuvenator, flexible slurry, etc.) will be applied to successive sub-sections at various times throughout the pavement life (from immediately behind the paver to successive years). Consideration will be given to the type of binder in the surface treatment (modified vs. neat).

4. General Testing & Monitoring: Monitor the pavement performance over this time on each of the sub-sections. Monitoring activities will include distress surveys, ride measurements, friction, and analysis of pavement sensor data.

5. Special Testing & Monitoring: Obtain field cores from each sub-section every year to determine material properties, especially related to aging. The pooled fund panel will recommend the proper laboratory tests to evaluate the pavement (especially binder) performance under certain surface treatments at certain times during the pavement life, from the refinery through various stages of pavement construction and service life. The testing and monitoring activities will compare untreated vs. treated pavements.

PROJECT DELIVERABLES:
Work done under a research contract will develop interim and final reports that document the findings of this study.
STATEMENT OF NEED:
The industries and farms of the Mississippi Valley region can compete in the marketplace only if their products can move reliably, safely and at reasonable cost to market. Growing congestion threatens the sustainability of this freight movement. The people of the region are dependent upon farms and industries for their livelihoods and their economic quality of life depends on the flow of goods to our markets. The Mississippi Valley Freight Coalition was created to protect and support the economic wellbeing of the industries, farms and people of the region by keeping the products of those industries, farms and people flowing to markets reliably, safely, and efficiently.

STUDY OBJECTIVES:
The objectives of the Mississippi Valley Freight Coalition pooled fund study are to:

1. Share information between agencies that will improve the understanding of freight issues and the management of freight services and facilities.
2. Reach out to and share ideas with private sector shippers and carriers on approaches to making freight flow more smoothly through the region.
3. Gather, analyze and share information on the movement of freight throughout the region with sister agencies and with private sector interests.
4. Define a system of regionally significant freight highway, rail and water corridors and facilities and establish performance expectations for those facilities that will guide their management and operations.
5. Evaluate, implement and enforce traffic and vehicle regulations that promote the reliable, efficient and safe movement of freight.
6. Evaluate, implement and enforce traffic and vehicle regulations that promote the reliable, efficient and safe movement of freight.
7. Identify corridors or bottlenecks that frustrate the movement of freight and then take actions, individually or as a group, to improve those corridors or bottlenecks.
8. Define and support national transportation policies that will support and improve the movement of freight in the region.

RESEARCH TASKS:
The Coalition seeks to work closely with the ten states of the Mississippi Valley region to maximize the operational efficiency of the freight transportation system within our region. This can be achieved through the accomplishment of the objectives above. The objectives can be accomplished through a close working relationship between an executive committee made up of CEOs of each of the ten state DOTs, a technical committee made up of freight policy and traffic operations advisors, and a customer committee made up of shippers and carriers in the region, providing the perspective of the private sector.

PROJECT DELIVERABLES:
Through effective communication between all committees, coordinated by staff of the Wisconsin Transportation Center, a Coalition Action Plan will be generated that identifies research projects, workshops and planning and outreach activities to guide the Coalition's efforts.
STATE FISCAL YEAR 2012


TPF Number: TPF-5(158)
Project Type: Environmental

Lead Agency: FHWA

Funding Type: 100% Federal
Total Project Cost: $166,500.00
Total ODOT Cost: $30,000.00
Contract Start Date: 1/1/2008
End Date: 1/1/2012

Technical Liaisons: Noel Alcala

STATEMENT OF NEED:
The FHWA Traffic Noise Model (FHWA TNM) was originally released in 1998 and has undergone several upgrades. On May 2, 2005 the FHWA TNM Version 2.5 became the required traffic noise prediction model to be used on Federal-aid highway projects.

STUDY OBJECTIVES:
The objectives of the FHWA Traffic Noise Model: Version 3.0 Software and Training pooled fund study are to:

FHWA TNM Version 3.0 Software Development:
1. Enhance the graphical user interface (GUI).
2. Correct known software bugs.
3. Enhance functionality.

FHWA TNM Web-based Training:
Develop a National Highway Institute (NHI), instructor-led, web-based training course for the FHWA TNM. The development of the course will coincide with development of Version 3.0. Since Version 3.0 will take longer to develop, the training course will be updated once Version 3.0 is completed.

RESEARCH TASKS:
Through this pooled-fund study, a Design Review Group (DRG) made up of representatives from the participating State DOTs will work with the FHWA to identify and help prioritize additional software enhancements. Since it is essential to include input from the TNM user community, the Highway Noise Subcommittee of the TRB ADC40 committee, Transportation Related Noise and Vibration, will also be solicited for input on model enhancements. Some enhancements may be contingent upon additional work outside the scope of this pooled-fund study. For example, implementing pavement noise effects into the FHWA TNM is dependent on related investigations currently being funded by FHWA. Pavement noise effects may be added at a future date, possibly as part of a pooled fund project, depending on the outcome of ongoing research.

The DRG will be solicited to determine the basic structure, duration and key points to be included in an NHI instructor-led, web-based training course on the FHWA TNM. The DRG will be provided updates on the development of the course and be asked to submit comments on its content.

PROJECT DELIVERABLES:
Software and reports as required.
STATEMENT OF NEED:
Increasingly, state departments of transportation (DOTs) are challenged to design and build longer life concrete pavements that result in a higher level of user satisfaction for the public. One of the strategies for achieving longer life pavements is to use innovative materials and construction optimization technologies and practices. In order to foster new technologies and practices, experts from state DOTs, Federal Highway Administration (FHWA), academia and industry must collaborate to identify and examine new concrete pavement research initiatives. The purpose of this pooled fund project is to identify, support, facilitate and fund concrete research and technology transfer initiatives.

The Iowa DOT will serve as the lead state for the execution of the pooled fund project described in this proposal. The Iowa DOT, through the National Concrete Pavement Technology Center (CP Tech Center) at Iowa State University, will handle all administrative duties associated with the project. The CP Tech Center will also serve as the lead research institution for the project.

STUDY OBJECTIVES:
It is anticipated that this consortium would become the national forum for state involvement in the technical exchange needed for collaboration and new initiatives, and be part of the CP Road Map Mix Design and Analysis Track team.

RESEARCH TASKS:
- Identify needed research projects
- Develop pooled fund initiatives
- Provide a forum for technology exchange between participants
- Develop and fund technology transfer materials
- Provide on-going communication of research needs faced by state agencies to the FHWA, industry, and CP Tech Center
- Provide guidance as part of the Track Team for the CP Road Map Mix Design and Analysis Track
- Provide assistance as requested by the CP Road Map Executive Committee on other select tracks as needed

PROJECT DELIVERABLES:
All efforts by the TTCC will be focused towards these project activities and deliverables:
- Identify and guide the development and funding of technology transfer materials such as tech brief summaries and training materials from research results
- Review the CP Road Map initiatives and provide feedback to the FHWA, industry, and the CP Tech Center on those initiatives
- Be part of the Track Team for the CP Road Map Mix Design and Analysis Track providing guidance to coordinating activities with the track.
- Provide research ideas to funding agencies Identify and instigate needed research projects Include current activities and deliverables of the pooled fund on the CP Road Map project website
- Maintain pooled fund project website with current activities and deliverables
- Develop pooled fund research projects for solutions to concrete and concrete pavement issues
- Act as a technology exchange forum for the participating entities
- Contribute to a technology transfer newsletter on concrete pavement research activities every six months in cooperation with the CP Road Map activities
- Publish electronic quarterly reports following lead state guidelines Post quarterly reports to the website
- Submit a final report to participants that documents the results of the entire project
The long-term objective of this effort is to establish guidelines for the use of integral abutments with curved girder bridges. The project scope will focus on the monitoring and evaluation of constructed bridges that will be documented by reports outlining the findings and recommendations for design policies.

RESEARCH TASKS:
Phase IA includes placing instrumentation on six curved girder bridges in Iowa with integral and semi-integral abutments that will be constructed in 2008. These instrumented bridges will give us a better understanding of the behavior of curved girder integral abutment bridges.

In addition to the Iowa bridges identified above, other participating states may also propose additional curved girder integral abutment bridges (outside of Iowa) to be instrumented and monitored in Phase IB. Phase IB will be an extension/expansion of Phase IA where additional bridges (if desired) can be selected by the TAC.

PROJECT DELIVERABLES:
Project Reports
STATE OF NEED:
“Non-intrusive” sensors are defined as those sensors that can be installed, calibrated and used without disruption to traffic. The most common non-intrusive technologies (NIT) used for traffic detections include: passive or active infrared, magnetic, microwave or radar, ultrasonic, passive acoustic, and video. Other, more recent applications use infrared technology to classify vehicles by counting each vehicle’s axles from the side of the road. Since 1994, the Minnesota Department of Transportation, the Federal Highway Administration, and pooled fund study members have implemented a series of NIT sensor evaluations. The most recent project, completed in 2005, designed, fabricated and field tested a portable non-intrusive traffic detection system. These studies have provided valuable information, benefiting both public and private agencies in selecting appropriate technologies for their own data collection purposes.

STUDY OBJECTIVES:
The objective of the proposed project is to conduct field tests of the latest generation of non-intrusive traffic sensors. The field tests will assess the capabilities and limitations in detecting traffic under a variety of conditions. Specific test conditions will be driven by the needs of participating state agencies.

RESEARCH TASKS:
The project is broken into the following six tasks.
1) Identify test scope, goal, and objectives
Outline project goals and objectives, and scope of tests.
2) Develop Test Plan
Develop a detailed test plan that will guide the test activities; ensuring they meet the identified project goals and objectives. The test plan will provide test procedures that detail how to assess the sensors under various test conditions. The test plan will also present the selected test methodologies and testing scenarios that facilitate the evaluation of sensors’ performance and capabilities.
3) Sensor Procurement
A literature search will be conducted to identify the potential participating vendors based on existing and newly developed NIT technologies.
4) Site Preparation
The Mn/DOT NIT test site facilitates both baseline and sensor data collection. These facilities include in-place inductive loops, an automatic data recorder, and communication hardware and software. The existing facilities will be reviewed and upgraded as needed to ensure accurate data collection.
5) Field Testing and Data Acquisition
Installation and Field Test Activities

PROJECT DELIVERABLES:
Appropriate statistical measures will be identified and used to quantify the performance of sensors in an assortment conditions. Analyzed data will be summarized into various formats to present in the final report.
STATEMENT OF NEED:
Cracks in concrete bridge decks provide easy access for water and deicing chemicals that shorten the life of the deck. Both materials increase the effects of freeze-thaw damage, while the deicing chemicals lead to higher concentrations of chlorides, and subsequently, corrosion of reinforcing steel. Measurements taken on bridges in Kansas show that dense, high quality concrete can significantly slow the penetration of chlorides to the level of the reinforcing steel. However, measurements taken at cracks show that the chloride content of the concrete can exceed the corrosion threshold at the level of the reinforcing steel by the end of the first winter. The formation of cracks, thus, significantly lowers the effectiveness of other techniques that are used to increase the life of a deck.

STUDY OBJECTIVES:
The purpose of this study is to implement the most cost-effective techniques for improving bridge deck life through the reduction of cracking. The work involves cooperation between state departments of transportation, cement companies, contractors, and designers.

RESEARCH TASKS:
1. Develop a detailed plan to construct bridge decks with minimum cracking by incorporating "best practices" dealing with materials, construction procedures, and structural design.
2. Work with state DOT's, designers, contractors, inspectors, and material suppliers to modify designs, specifications, contracting procedures, construction techniques, and materials to obtain decks exhibiting minimal cracking.
3. Select and schedule bridges to be constructed using "best practices" and pre-qualify designers and contractors in application of the techniques.
4. Perform detailed crack surveys on the bridge decks six months, one year, two years, and three years after construction.
5. Correlate the cracking measured in task 4 with environmental and site conditions, construction techniques, design specifications, and material properties and compare with earlier date.
6. Document the results of the study.
7. Update the training program developed (and currently being presented) in Phase I to assist the participating states in implementing the findings of the study.

PROJECT DELIVERABLES:
State departments of transportation expend significant effort and resources on the construction of durable reinforced concrete bridges and bridge decks. Existing data indicates that specific modifications to construction procedures, materials, and design details will significantly reduce the degree of cracking in bridge decks and, thus, reduce exposure of reinforcing steel to the corrosive effects of deicing chemicals and decrease freeze-thaw damage. Of the two, corrosion is by far the greater problem. The project provides a mechanism for combining ideas from research and practice to develop a comprehensive strategy for the construction of bridge decks. If successful, as demonstrated to date, the result will be a major reduction in bridge deck cracking, an improvement in durability, and an increase in the useful life of bridges. A great deal is known about the factors that affect cracking in bridge decks - the goal of the proposed effort is to implement that knowledge.
Project Title: Traffic Analysis and Simulation

TPF Number: TPF-5(176)

Project Type: Roadway

Lead Agency: FHWA

Funding Type: 100% Federal

Total Project Cost: $435,000.00

Total ODOT Cost: $200,000.00

Contract Start Date: 7/15/2008

End Date: 7/15/2012

Technical Liasons: James Young

STATEMENT OF NEED:
As congestion grows on our nation's roadways, increasing pressure is put on transportation professionals to find more innovative and efficient transportation solutions. Transportation professionals use traffic analysis tools to find the best transportation solutions for their region. However, as our transportation solutions become more sophisticated and complex, so do our traffic analysis tools. As a result, many public agencies are facing new and difficult issues regarding the usage of traffic analysis and simulation tools for transportation decision-making. Rather than have each public agency address these challenges and issues separately, agencies could tackle these issues in a collective and comprehensive manner through the Pooled Fund Study (PFS) process.

STUDY OBJECTIVES:
The goal of this study is to improve the state-of-the-practice in traffic analysis and simulation so public agencies can make the best possible transportation investment decisions based upon high-quality traffic analyses. The objectives of this study are to assemble regional, State, and local agencies, and FHWA to: 1) identify challenges and issues common among those responsible for conducting, managing, and/or approving traffic analysis and simulation studies; 2) suggest approaches to addressing identified issues; 3) initiate and monitor projects intended to address identified challenges and issues; 4) provide guidance and recommendations and disseminate results; 5) provide leadership and coordinate with other agencies, groups, or forums interested in traffic analysis and simulation; and 6) promote and facilitate technology transfer related to traffic analysis and simulation issues nationally.

RESEARCH TASKS:
The Traffic Analysis and Simulation (TAS) PFS is intended to serve as a forum and provide an opportunity for the participants to identify, address, and collectively take on the key issues and challenges that are common among public agencies in conducting, managing, and/or approving traffic analysis and simulation studies. The TAS PFS will address key technical and programmatic traffic analysis issues through the investigation and development of best practices, lessons learned, and recommended guidelines or methodologies. The TAS PFS will also provide an opportunity to facilitate the interaction, sharing of information, and exchange of knowledge with a broader audience to advance and improve upon the current state-of-the-practice related to the usage, management, and/or approval of traffic analysis and simulation tools. The exact nature and scope of the studies will be determined through consensus of the participating agencies.

PROJECT DELIVERABLES:
Project reports

Monday, May 16, 2011
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: SafetyAnalyst Support [Formerly SPR-2(210)]

TPF Number: TPF-5(182)

Project Type: Safety

Lead Agency: FHWA

Funding Type: 100% Federal

Total Project Cost: $1,053,828.00

Total ODOT Cost: $50,000.00

Contract Start Date: 10/1/2008

End Date: 6/30/2009

Technical Liaisons: Jennifer Townley
Jonathan Hughes

PROBLEM STATEMENT:
SafetyAnalyst is a software product that provides state-of-the-art analytical tools for use in the decision-making process to help highway agencies identify and manage a systemwide program of site-specific improvements to cost effectively enhance highway safety. The analytical tools support the steps of the traditional highway safety improvement process: network screening to identify potential sites for safety improvements, diagnosis of the safety issues at sites, selection of potential countermeasure, economic appraisal of proposed countermeasures, priority ranking of proposed countermeasures, and evaluation of implemented countermeasures. The tools will also support States in their implementation of strategic highway safety plans through capabilities to screen the highway network for promising sites at which to proactively install selected countermeasures. The capabilities are described in more detail at www.safetyanalyst.org. SafetyAnalyst development has been managed by FHWA and jointly funded by FHWA and 24 States through transportation pooled-fund studies SPR-2(210) and TPF-5(60). Primary development of SafetyAnalyst will be completed by September 30, 2008.

The consensus of participating State representatives during the December 2007 meeting of the SafetyAnalyst Technical Working Group was that the preferred mechanism for long-term distribution, maintenance, technical support, and enhancement of SafetyAnalyst is AASHTOWare, AASHTO's Cooperative Software Development Program. While a majority of participating States reported progress on or plans for preparing their data for SafetyAnalyst, they also reported the need for additional time for data preparations, testing, and evaluation, before SafetyAnalyst development could be considered complete. Therefore, the technical working group recommended that a short-term project be undertaken to provide continuity of SafetyAnalyst support services from October 1, 2008, when the current study ends, through June 30, 2009, after which licensing as an AASHTOWare product would begin. It was further decided that the project should be managed by FHWA as a transportation pooled-fund study.

STUDY OBJECTIVES:
The objectives of "SafetyAnalyst Support" are as follows: 1) support participating States' efforts to prepare their data and conduct hands-on testing and evaluation of SafetyAnalyst; and 2) complete development of SafetyAnalyst in preparation for its long-term distribution, maintenance, technical support, and enhancement as an AASHTOWare product.

RESEARCH TASKS:
This study has eight tasks:
1. Distribute SafetyAnalyst
2. Maintain the SafetyAnalyst software package
3. Provide technical support
4. Enhance SafetyAnalyst
5. Market SafetyAnalyst
6. Deliver SafetyAnalyst training
7. Develop documentation for licensing of SafetyAnalyst as an AASHTOWare product
8. Perform project management to support the above objectives

PROJECT DELIVERABLES:
Continuity of SafetyAnalyst support services from October 1, 2008 through June 30, 2009.
PROBLEM STATEMENT:
Vehicle classification data are important for transportation agencies in a wide range of applications, from freight, to pavement engineering, to safety, to cost allocation. Axle-based vehicle classification has been used for two decades but length-based vehicle classification is newer. The capabilities, limitations, and issues involved with collecting length-based vehicle classification (LBVC) data need to be researched. Agencies need to know how to properly install and calibrate the LBVC installations. LBVC uses traditional loops and other technologies. Agencies need to know the pros and cons of different technologies to best utilize their resources. The proper length bins to aggregate LBVC data need to be established.

STUDY OBJECTIVES:
The objectives of "Loop and Length Based Classification Pooled Fund" including the following: Field test installation methods and procedures for LBVC devices to compare the efforts required for proper installation and calibration. Field test various length bins to bind the best known distance to use for length based classification by region. Determine the number of bins that LBVC data can support. Determine the variances involved with collecting LBVC data in recreation areas. Find and document the seasonal variations of LBVC data. Determine the best way to relate LBVC data to axle-based vehicle classification data, in particular to the 13 vehicle types in the Traffic Monitoring Guide.

RESEARCH TASKS:
Task 1 - Literature Review
Task 2 - Determine the errors associated with collecting LBVC data and how those errors can be reduced or eliminated
Task 3 - Establish LBVC calibration standards
Task 4 - Determine the feasibility of having common bins for LBVC
Task 5 - Provide real multi-state results of the use of the proposed length bins to demonstrate how it will work and the errors that may occur using these parameters
Task 6 - Determine if quality LBVC data can be obtained from single loop arrays or single non-intrusive length based devices
Task 7 - Final Report

PROJECT DELIVERABLES:
Final report in hard-copy and electronic format.
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Midwest States Crash Testing Program [Formerly SPR-3(017)]

TPF Number: TPF-5(193)  Lead Agency: Nebraska Department of Roads
Project Type: Roadway

Funding Type: 100% Federal
Total Project Cost: $327,150.00
Total ODOT Cost: $116,000.00
Contract Start Date: 7/1/2008
End Date: 6/30/2010

Technical Liasons: Michael Bline

STATEMENT OF NEED:
The need for continuous research to improve roadside safety and to reduce injuries and fatalities associated with ran-off-road crashes was recognized in the early 1990s by various states. In an effort to address this concern, the concept of a State Department of Transportation, annually-funded, research program was conceived. In 1991, the Mid-West States Crash Testing Program was established to coordinate and conduct crash testing of appurtenances that are of mutual interest among the participating states. The Midwest Roadside Safety Facility (MwRSF) of the University of Nebraska-Lincoln was chosen to administer the work of the program.

STUDY OBJECTIVES:
MwRSF is a research organization with a main focus of researching all aspects of highway design and safety. MwRSF conducts safety performance evaluations of various roadside appurtenances, developing new and innovative design concepts and technologies in the area of highway safety to assure that nationally established criteria is met.

RESEARCH TASKS:
To share information concerning the crash testing of bridge rail, guardrail, sign supports, traffic control devices, and other highway appurtenances. Specific goals of MwRSF include the following:

1. Improve highway safety by making the roadside less hazardous for motorists;
2. Design, develop, and crash test roadside hardware;
3. Conduct safety performance evaluations of existing roadside features; and
4. Perform computer simulation modeling of vehicle impacts with roadside hardware.

PROJECT DELIVERABLES:
Reports as required

For more information visit: http://www.mwrsf.unl.edu/
STATEMENT OF NEED:
Building on the information and guidance developed in the Urban Mobility Study since 1986, and adding components from research and planning studies by the U.S. Census and national, state and local transportation agencies and trade groups, the Urban Transportation Performance measure project will refine estimation methods and create ways to link information from several sources.

STUDY OBJECTIVES:
The objective of the Urban Mobility Study pooled fund project is to develop a set of performance measures, the tools to use them in a broad set of applications, and guidance on how to utilize several sources of data to create a complete picture of urban transportation conditions.

RESEARCH TASKS:
1. Form Steering Committee, which will decide on the congestion reduction methods to include in the new methodology and which cities will be included in study.
2. Continuously Refine the Congestion Index to include multimodal operations or regional operational improvement programs (i.e., ITS service, incident detection and response, travel demand management, transportation systems management, and computerized signal control coordination.
4. Add Additional Urban Areas.
5. Respond to Requests for Mobility Data.

PROJECT DELIVERABLES:
Project reports.
Project Title: HY-8 Culvert Analysis Program - Phase Three of Development Efforts

TPF Number: TPF-5(202)  Lead Agency: Federal Highway Administration, HRTM-2

Project Type: Structures  Funding Type: 100% Federal

Total Project Cost: $110,000.00  Total ODOT Cost: $15,000.00

Technical Liasons: John Stains

STATEMENT OF NEED:
The HY-8 is a computerized implementation of FHWA culvert hydraulic approaches and protocols. The FHWA publication "Hydraulic Design Series 5: Hydraulic Design of Highway Culverts" (HDS-5) [publication FHWA-NHI-01-020, May 2005 revision] documents the technical methods applied in the HY-8 program and should be considered the primary technical reference for the software.

In 2005, the FHWA contracted with the Brigham Young University to develop a 32-bit (and 64-bit) Windows compatible version of HY-8. This version provided graphical user interface (GUI) for the same hydraulic calculations performed in DOS versions of HY-8. FHWA intended to plan and fund this development effort using a series of planned phases. The first phase resulted in an initial release (version 7.0) that performed basic culvert hydraulics. The second phase (version 7.1) incorporated energy dissipater module; performed hydraulic analyses of embedded culverts; allowed use of modified outlet loss coefficients; incorporates dynamic culvert shape database with new materials; and implemented various improvements, technical updates, and bug corrections.

STUDY OBJECTIVES:
The objective of "HY-8 Culvert Analysis Program – Phase Three of Development Efforts" is to continue the phased development of HY-8. The effort would be funded by FHWA and other State DOT contributors (PFP members).

RESEARCH TASKS:
Task 1 - Project Meetings
Task 2 - Enhance Source Code Efficiencies
Task 3 - Hydrograph Routing
Task 4 - Hydraulic Jump Code Implementation
Task 5 - Broken Back Culvert Code Implementation
Task 6 - Allow Modification of the Individual Analysis Discharge Values
Task 7 - Horizontal Culvert Barrels
Task 8 - Adversely Sloped Barrels
Task 9 - Flared End Sections
Task 10 - Concrete Open-bottom Arches
Task 11 - South Dakota's Prefabricated Reinforced Concrete Box Culverts

PROJECT DELIVERABLES:
Project reports
STATEMENT OF NEED:
State departments of transportation are aggressively pursuing new technologies and practices to improve winter highway maintenance. Current research efforts address one or more aspects of the complex task of anticipating and responding to snow and ice events on highways and bridges across local and state jurisdictions. Considerable effort is directed at developing, deploying and evaluating sensing and communication technologies collected under the umbrella of anti-icing and road weather information systems (AI/RWIS). Some evaluation of anti-icing and de-icing materials and snow and ice removal equipment is also being carried out—a much needed effort. For the most part, however, these testing activities are related to the properties and characteristics of the materials and equipment in and of themselves, how they meet specifications or perform on standard lab tests. What is needed, in addition, is related field-testing/follow-up.

STUDY OBJECTIVES:
The objective of the Clear Roads - Test and Evaluation of Materials, Equipment and Methods for Winter Highway Maintenance pooled fund study is to conduct structured field testing and evaluation across a range of winter conditions and different highway maintenance organizational structures to assess the practical effectiveness, ease of use, optimum application rates, barriers to use, durability, and so on, of innovative materials, equipment and methods for improved winter highway maintenance.

RESEARCH TASKS:
Investigate the applicability of various winter maintenance materials, equipment and methods for use by state and local highway maintenance crews. Working with the nation's premier researchers, this pooled fund project will be ongoing, with new projects undertaken as previous work is completed to:

1. Evaluate winter maintenance materials, equipment and methods under real-world conditions.
2. Develop specifications and recommendations.
3. Study and promote innovative techniques and technologies that will save agencies money, improve safety and increase efficiency.
4. Make results quickly available to interested agencies.

For more project information, visit the following internet link: http://www.clearroads.org/projects.htm

PROJECT DELIVERABLES:
The deliverables include a final report of each study to document research findings, conclusions, and recommendations.
STATEMENT OF NEED:
The safety and traffic operational benefits of roundabouts for the typical vehicle fleet have been well documented. Although roundabouts have been in widespread use in other countries for many years, their general use in the United States began only in the recent past, but their use is growing. Roundabouts can offer several advantages over signalized and stop controlled alternatives, including better overall safety performance, lower delays, shorter quests, better management of speed and opportunities for community enhancement features. In some cases roundabouts can avoid or delay the need for expensive widening of an intersection approach that would be necessary for signalization. However, the potential use of roundabouts with all their benefits is greatly diminished because they may not accommodate oversize/overweight vehicles (superloads). This is the central issue and the need for this research.

STUDY OBJECTIVES:
The objectives of “Accommodating Oversize/Overweight Vehicles at Roundabouts” are to (1) compile current practice and research by various states and countries related to the effects that oversize/overweight vehicles (superloads) have on roundabout location, design and accommodation and (2) to fill in information gaps with respect to roundabout design and operations for these classes of vehicles.

RESEARCH TASKS:
Task 1 - Initial meeting with partner state representatives.
Task 2 - Document states’ historical state-of-the-practice regarding policy on permitting oversized vehicles on their state highways.
Task 3 - Obtain data on and document roundabout constraints to superloads.
Task 4 - Collect data on and categorize the characteristics of superloads allowed on state’s highways. Determine effect on current, common roundabout geometrics.
Task 5 - Provide an interim report for review.
Task 6 - Obtain relevant data and/or information on a preliminary list of possible changes and/or innovations to mitigate constraints by roundabouts on routes necessary for free flow of superloads.
Task 7 - Determine and conduct an in-depth study of the most promising solution(s) or improvements.
Task 8 - Provide a draft final report for review.
Task 9 - Revise draft and finalize final report

PROJECT DELIVERABLES:
Project report
STATEMENT OF NEED:
In 2008 and 2009 the Iowa Department of Transportation and the EERC hosted an annual workshop on Intelligent Compaction for Soils and HMA. As part of the workshop a roadmap for addressing the research and educational needs for integrating intelligent compaction technologies into practice was developed. An ongoing forum is needed to provide broad national leadership that can rapidly address the needs and challenges facing STAs with the adoption of intelligent compaction technologies. The vision for the road map was to identify and prioritize action items that accelerate and effectively implement IC technologies into earthwork and HMA construction practices. Coupled with the IC technologies are advancements with in situ testing technologies, data analysis and analytical models to better understand performance of geotechnical systems supported by compacted fill, software and wireless data transfer, GPS and 3D digital plan integration, new specification development, and risk assessment.

STUDY OBJECTIVES:
The objective of the pooled fund study “Technology Transfer Intelligent Compaction Consortium (TTICC)” is to research new developments in intelligent compaction that lead to the implementation of new technologies which will lead to longer life pavements through the use of an integrated system of emerging innovative technologies.

RESEARCH TASKS:
Task 1 - Identify and instigate needed research projects
Task 2 - Develop pooled fund research projects for solutions to intelligent compaction issues
Task 3 - Act as a technology exchange forum for the participating entities
Task 4 - Be a forum for states and researchers to share their experience with IC technologies
Task 5 - Identify and guide the development and funding of technology transfer materials such as tech brief summaries and training materials from research results
Task 6 - Review the IC Road Map as updated annually and provide feedback to the FHWA, industry, states, and the Earthworks Engineering Research Center (EERC) on those initiatives
Task 7 - Provide research ideas to funding agencies
Task 8 - Include current activities and deliverables of the pooled fund on the TTICC website
Task 9 - Maintain pooled fund project website with current activities and deliverables
Task 10 - Contribute to a technology transfer newsletter on intelligent compaction research activities every six months in cooperation with the EERC
Task 11 - Post minutes to the website following web meetings
Task 12 - Post a report following each in-person workshop to the website

PROJECT DELIVERABLES:
Two workshop meetings will be conducted each year. One of the meetings will be in person and is anticipated to occur during fall. The location of the in-person workshop meetings will be determined by the Executive Committee and moved regionally each year to participating states. The second meeting will be a webinar and occur in early spring hosted by the EERC.
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Transportation Library Connectivity
continuation of TPF-5(105)

TPF Number: TPF-5(237)  Lead Agency: Missouri Department of Transportation

Project Type:  

Funding Type: 100% Federal

Total Project Cost: $0.00

Total ODOT Cost: $20,000.00

Contract Start Date:  

Technical Liaisons:  

End Date:  

STATEMENT OF NEED:
Accessible, reliable, and timely information is central to quality performance for all transportation agencies and stakeholders. Yet, a vast amount of transportation-related information is neither collected nor made available for use by others. Technology transfer activities—converting information into knowledge—are crucial for getting information in the hands of decision-makers. This pooled fund is a continuation of TPF-5(105).

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

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

Monday, May 16, 2011
POOLED FUND PROJECT - OHIO IS PARTICIPATING
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Transportation Library Connectivity
continuation of TPF-5(105)

TPF Number: TPF-5(237)  
Lead Agency: Missouri Department of Transportation

Project Type: 

Funding Type: 100% Federal
Total Project Cost: $0.00
Total ODOT Cost: $20,000.00
Contract Start Date: 
End Date: 

Technical Liasons:

TO MEMBER LIBRARIES.

E) Digitization support for institutions wishing to convert printed copies of older materials to digital formats.

Project Deliverables:
Pooled fund activities will include the tasks listed above. All seven of these can be classified into one of three areas: promote library and information services, support the development of a national transportation information infrastructure by connecting libraries, or providing resources for members to ensure that these networks can serve practitioner and decision-maker needs.

STATEMENT OF NEED:
Through this pooled fund project, the Missouri Department of Transportation plans to work with other State Departments of Transportation (DOTs) to establish a program in order to facilitate the implementation of promising innovations and technologies.

STUDY OBJECTIVES:
This project will provide a forum for State DOTs to share their maintenance innovations with each other, support technology transfer activities and develop marketing and deployment plans for the implementation of selected innovations. Resources will be provided for implementing the innovations that includes travel, training and other technology transfer activities.
It is anticipated that this consortium would become the national forum for state involvement in the technical exchange needed for collaboration and new initiatives, and be a forum for advancing the application and benefit of research technologies. State participation in this process will be through the pooled fund. FHWA, industry and others will be invited to participate in the project discussions and activities.
Workshops could be provided for the states participating in the pooled fund project. This project will help DOTs to save time and money by not investing in the same research that has already been performed by other State DOTs. Hence rather than having each DOT identify and implement research separately, DOTs can work collectively through this pooled fund project. The Missouri DOT will serve as the lead state for the execution of the pooled fund project described in this proposal. The Missouri DOT will handle all administrative duties associated with the project.

RESEARCH TASKS:
Study tasks include the following:

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

PROJECT DELIVERABLES:
Meeting participation twice a year, in person and via a webinar
Active collaboration with each other and others to identify, support, facilitate and fund research and technology transfer initiatives Championing within their state the deliverables from the pooled fund, such as technical material to key staff, and facilitate implementation of new technologies and practices.
Project Title: 2012 National Asset Management Conference and Multi-State Implementation Workshop

TPF Number: tpf-5(245)  Lead Agency: California Department of Transportation
Project Type: 

Funding Type: 100% Federal
Total Project Cost: $10,000.00
Total ODOT Cost: $10,000.00
Contract Start Date: 
End Date: 

Technical Liasons: Andrew Williams

STATEMENT OF NEED:
There is a need for State transportation departments to come together to learn how to better enhance their implementation of asset management.

STUDY OBJECTIVES:
1. To provide a conduit for enhancing the practical knowledge of member states concerning asset management implementation.
2. To enhance the working knowledge of the asset management community.
3. To provide for continued information sharing among member states beyond the 2012 Workshop.

RESEARCH TASKS:
1. Learning Session - Provide a workshop type forum for member states to learn and review issues associated with implementation of asset management. Since member states may be at different stages of implementation, this is an opportunity to share best practices and strategies for overcoming certain challenges.
2. Asset Management Conference Participation - Provide a venue for the member states to exchange information on the challenges to asset management implementation. Members will work together to organize the TRB sponsored 2012 Asset Management conference and help identify presentations they would like to see to address issues they are dealing with. Active conference participation will enable member states to evaluate their agency=s current capacity in all areas of asset management and help determine priorities.
3. Outreach - Provide a series of webinars to allow member states to continue dialogue and information sharing on implementation of asset management. Member states will identify the scope of the webinars and if additional communication forums are necessary to assist the agency journey toward improved asset management.

PROJECT DELIVERABLES:
Reports as required. Facilitate communication between the state DOT=s concerning diverse ways assets are handled and to look for more efficient and effective ways to track information.
APPENDIX B

SP&R PART 2

STATE FISCAL YEAR 2012

PROPOSED PROJECTS

DESCRIPTIONS

Includes 100% federally funded and 80% federally funded active research projects
STATEMENT OF NEED:
In April 2009, two consultants began the development of a database to assist in the efficient and accurate management of ODOT's Research, Development and Technology Transfer Program. The Automated Research Management System (ARMS) is a .NET application that is web-enabled, browser rich, and JavaScript library oriented. ARMS was intended to have four major areas of functionality: (1) the tracking and reporting of projects and contacts, which includes the development and publishing of the annual State Planning and Research Part 2 (SP&R2) program book; (2) submission, review, and prioritization of research needs; (3) submission and review of proposals for the awarding of projects; and (4) a streamlined electronic review of and commenting on research reports. Function area #1 of ARMS was deployed to production in May 2010. While initial testing of the application is promising, further analysis is needed to determine if ARMS is appropriately addressing the needs of ODOT's Innovation Research and Implementation Section (IRIS) and then implement appropriate enhancements.

STUDY OBJECTIVES:
The objective of "Analysis and Enhancement of the Automated Research Management System (ARMS)" is to expand the functionality of ARMS and provide continuity in the maintenance of the application.

RESEARCH TASKS:
Task 1 - Provide troubleshooting and corrections to problems with the existing ARMS application.
Task 2 - Thoroughly review and evaluate the performance of ARMS. Provide a SWOT and GAP analysis.
Task 3 - Prepare a requirements brief with recommendations and strategy for further development of ARMS.
Task 4 - Perform system enhancements, prepare use case summaries, and participate in iteration meetings as instructed.
Task 5 - Conduct multiple tests of ARMS and make adjustments as necessary.
Task 6 - Assist in data migration and population activities as needed. Perform data integrity tests as appropriate.
Task 7 - Provide training to ODOT staff on the use and maintenance of the database.
Task 8 - Prepare a user's manual with complete instructions on all aspects of ARMS.
Task 9 - Prepare a programmer’s guide to include troubleshooting recommendations.
Task 10 - Propose an annual maintenance agreement for continued troubleshooting and minor program enhancements covering a three-to-five year period.

PROJECT DELIVERABLES:
1. Adjustments and enhancements to the ARMS database
2. Quarterly progress reports
3. Requirements Brief
4. Use cases as identified
5. An easy to follow user’s manual
6. A detailed programmer’s guide including troubleshooting recommendations
7. Provide training to ODOT staff on the use and maintenance of ARMS.
8. Participation in the following meetings: project start-up, strategy, iterations (as planned), and project wrap-up.
Project Title: Probabilistic Use of LiDAR Data to Detect and Characterize Landslides

Problem Statement No: 2011-09

Project Type: Geotechnical

Funding Type: 80/20 Federal/State

Total Project Cost (est): $369,592.00

Research Agency: The Ohio State University

Researchers: Dorota Brzezinska

Technical Liaisons: Kirk Beach

Gene Geiger

STATEMENT OF NEED:
Landslide hazard and its consequences in the transportation network are well-understood; however, current methods to identify and assess landslide conditions are inefficient. These methods are mostly based on labor-intensive field surveys and many sites are not easily accessible. Light Detection And Ranging (LiDAR) technology has seen phenomenal developments in the past ten years. Both airborne and terrestrial LiDAR have been shown to directly provide accurate surface models. This technology is a prime consideration for landslide detection and monitoring. It is relatively easily available, efficient and can achieve the accuracy needed for detecting surface changes in the cm-level range. Given Ohio's extensive road infrastructure and its fast rate of deterioration, an assessment into the feasibility of using LiDAR for landslide identification and subsequent development of a methodology for its use is needed.

STUDY OBJECTIVES:
The objective of "Probabilistic Use of LiDAR Data to Detect and Characterize Landslides" is to develop and validate computer models for automatic detection and assessment of landslides using time-series airborne LiDAR data.

RESEARCH TASKS:
Task 1 - Gather data from ODOT on selected test location (State Route 666).
Task 2 - Analyze LiDAR and field data to determine landslide signatures.
Task 3 - Back-test and calibrate computer models using SR 666 data.
Task 4 - Provide summary findings and recommendations for further testing and calibration (if appropriate).

Based on the results of this study, ODOT may opt to initiate a second phase, which would include full production level testing of the probabilistic approach in other geographic and geologic settings in the state.

PROJECT DELIVERABLES:
1) Quarterly reports
2) Summary of findings and recommendations from Task 4. If ODOT opts to initiate a second phase, this summary will serve as an interim report and a proposal for Phase 2 will be requested. If ODOT opts not to initiate a second phase, this summary will be expanded into a final report and executive summary for publication.
3) Two computer models, one for landslide location and one for landslide volume, in both raw code (Matlab) and executable versions suitable for stand-alone use on a PC.
4) Hardware requirements to run the computer models.
5) Training session for ODOT personnel on use of the computer models (if needed).
6) Participation in required meetings (i.e. start-up, review sessions, results presentation).
7) Article for R&D newsletter (upon request).
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Alternative Backfilling Solutions for Underground Mines

<table>
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<th>Problem Statement No:</th>
<th>2012-03</th>
<th>Research Agency: To Be Determined</th>
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<tr>
<td>Project Type:</td>
<td>Geotechnical</td>
<td>FundingType: 80/20 Federal/State</td>
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<td>Researchers:</td>
<td>To Be Determined</td>
<td>Total Project Cost (est): $750,000.00</td>
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<tr>
<td>Technical Liasons:</td>
<td>Dave Nicklaus, Michael Baur</td>
<td>Estimated Duration: 24 months</td>
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STATEMENT OF NEED:
Mining operations utilize two common methods to remove coal reserves from the ground: surface or strip mining and underground mining. Surface or strip mining involves removing large amounts of overburden consisting of soil and rock that overlies the mineable coal reserves. Underground mining involves accessing the coal formation through shafts or horizontal/sloping entries and removing the coal by rail. Most underground mines use what is referred to as the room-and-pillar method. This method has produced most of the abandoned underground voids that are present in Ohio because of improperly backfilled shafts and entries as well as room voids remaining when 50 to 70 percent of the coal seam is removed. Over 1776 abandoned underground mines underlie nearly 555 lane miles of highways in Ohio. These mines pose a risk to the traveling public due to the potential subsidence of the overburden. The cost to remediate these sites is estimated at $4.2M per lane mile. A typical remediation technique involves the drilling and backfilling of the mine voids with a cementitious grout mix. The drilling and grouting effort is very time consuming and costly. For the Nelsonville Bypass project, alternative grouting materials were considered to reduce the cost of the project by an estimated $4M. However, due to the limited amount of research information, the use of alternative materials was determined to be a high risk.

STUDY OBJECTIVES:
The objective of "Alternative Backfilling Solutions for Underground Mines" is to assess the use of alternative materials and/or grout additives that could be used to backfill mine voids. This work must address the implications of partial or flooded mine voids, acid mine waters, impacts of roof fall or undulating roof surface, confinement pressures, changes in grout characteristic associated with grouting paths and grout pumping and flow distances.

RESEARCH TASKS:
Task 1 - Literature search
Task 2 - Preliminary design of field application
Task 3 - Test site selection
Task 4 - Field design of research facility and test program
Task 5 - Development of research implementation plan
Task 6 - Construction
Task 7 - Research testing
Task 8 - Site restoration

PROJECT DELIVERABLES:
1) Interim reports (Tasks 1, 2, 3, & 4)
2) Site selection
3) Design plans and specifications
4) Materials to be included in OGE Geotechnical Bulletin
5) Construction and restoration of testing site
6) Laboratory testing equipment
7) Quarterly progress reports
8) Draft and approved versions of a final report and executive summary
9) Article for Research newsletter (upon request)
10) Participation in required meeting

Tuesday, May 17, 2011
Project Title: Uncontrolled Concrete Bridge Parapet Cracking

Problem Statement No: 2012-04
Project Type: Structures

Researchers: Norbert Delatte
Technical Liaisons: Randall Over
Dale Crowl

Research Agency: Cleveland State University
Funding Type: 80/20 Federal/State
Total Project Cost (est): $40,000.00
Estimated Duration: 16 months

STATEMENT OF NEED:
There appears to be wide-spread premature cracking of bridge concrete parapets on relatively recently constructed bridge decks. The District has identified 27 bridges exhibiting premature cracking of bridge concrete parapets to varying degrees. Bridge concrete parapets can be replaced without bridge deck replacement, and the decks on which these problem parapets were poured appear to be performing as anticipated. A cursory review of District 12 parapets shows little correlation between deck characteristics; some are on short spans, while other longer spans on skews. Also, multiple contractors and concrete suppliers are involved. The District continues to design and construct these bridge concrete parapets similarly every year. The District did replace one cracked parapet (without replacing the deck) and the cost was about $140,000. Cracked parapets are a safety concern and the potential cost to the Department to remove and replace parapets could be significant.

STUDY OBJECTIVES:
The objective of "Uncontrolled Concrete Bridge Parapet Cracking" is to provide a list of supported hypotheses for premature cracking on bridge concrete parapets.

RESEARCH TASKS:
Task 1 - Develop a list of hypotheses for premature cracking considering design, materials and construction aspects. This task will be performed in close collaboration with District personnel.
Task 2 - Attempt to identify a bridge without a cracking parapet from within the same time frame, in order to compare with four bridges with cracking parapets that the District has identified: Sheldon Road over I-71, Spring Road over Jennings Freeway/SF176, Canterbury Road over I90 and Wagar Road over I90.
Task 3 - Perform a desk study of available records (e.g., plans, construction documents, test results) for each of the four bridges, as well as the comparison bridge (if one has been identified).
Task 4 - Carry out site visits to compare as-built to planned condition, measure and map cracks, test with nondestructive evaluation equipment (e.g., impact-echo, ultrasonic pulse velocity)
Task 5 - Analyze results to determine what hypotheses are supported and which are refuted by the available data

PROJECT DELIVERABLES:
1) Initial draft of hypotheses prior to investigations or analysis
2) Quarterly progress reports
3) Draft and approved versions of a final report and executive summary
4) Article for Research newsletter (upon request)
5) Participation in required meeting

Tuesday, May 17, 2011
STATEMENT OF NEED:
As Ohio’s roadways age, the stability of the rock cut slopes are becoming less viable resulting in a higher frequency of rockfalls and debris impacting the roadway; thus, creating a hazard to the traveling public. On very active rock slopes, the problem can be continuous. Most active slopes have rockfall occurring predominately in the winter and spring of the year during fluctuation between freeze-thaw cycles and following snow melt and heavy rainfall. A common solution to address these rockfalls is the placement of portable concrete barriers or construction of cast-in-place concrete barriers. The challenge with this solution is that these barriers can be inadequate when larger rockfall blocks occur. These larger rockfall blocks typically occur at least twice a year. Cost to construct 50-inch portable concrete barrier and cast-in-place (CIP) costs range from $62.00 to $144 per lineal foot. It is difficult to determine an average maintenance cost for the current process; however, most ODOT districts handle these costs as a work orders for ditch clean out. As a result, it is impossible to differentiate between routine maintenance and rockfall cleanup in the ODOT management system. To determine the applicability of concrete barrier for rockfall containment typically computer simulation is used to determine the impact loads and bounce heights of the blocks. Typically these results are overly conservative resulting in oversizing catchment areas and the subsequent heights of the barriers. As a result, the following costs are incurred by ODOT: (1) oversized catchment area will add additional ROW costs and construction costs; (2) oversized barrier wall will add additional material and construction costs; and (3) undersized barrier could result in an accident and replacement/repair costs. Other state DOTs are designing their systems in a similar manner as ODOT to a point when the slope height or size of rockfall becomes too large. At that point, most DOTs use alternative methods (e.g. slope drapes or slope attenuators) which ODOT has not yet accepted on a larger scale.

STUDY OBJECTIVES:
The objective of "Rockfall Concrete Barrier Evaluation and Design Criteria" is to develop a technical guidance document to direct ODOT’s engineers and its consultants on the proper sizing and type of barrier required to minimize and control the amount of rockfall debris reaching the pavement.

RESEARCH TASKS:
Task 1 - Literature search.
Task 2 - Develop a research plan to address input variables for rockfall models
Task 3 - Determine a testing location for field tests.
Task 4 - Conduct laboratory testing of instrumented portable concrete barrier.
Task 5 - Design field testing program and sequencing of slope/bench configurations.
Task 6 - Perform computer modeling of the testing location.
Task 7 - Conduct roll-out tests to determine the distances of the unrestrained catchment areas.
Task 8 - Erect instrumented test sections of portable and in place barrier and roll boulders into the barriers for comparison with laboratory test data.
Task 9 - Monitor the boulders and the barrier sections to collect impact and bounce data for analysis.
Task 10 - Return the test location to an acceptable condition.
Task 11 - Analyze the field data to develop modified input parameters for the computer simulation.
Task 12 - Develop design charts based on slope characteristics and anticipated block sizes for appropriately sized barrier types and sizes.
13. Define design modifications to current designs criteria to address large block sizes.

PROJECT DELIVERABLES:
1) Interim reports for Tasks 2, 3, 4, 5, 10 and 12.
2) Draft and approved versions of a final report and executive summary. Report must detail the research, data collection, data reduction, and conclusions.
3) Modifications to existing GB-3 and reference documents including: (a) revised Colorado Rockfall Simulation Program (CRSP) input parameters; (b) design charts based on slope characteristics and anticipated block sizes for appropriately sized barrier types and sizes; and © typical details of barrier designs including standard drawings.
4) Test site must be restored to acceptable working condition per ODOT and ODNR personnel and the property owner.
5) Quarterly progress reports
6) Article for Research newsletter (upon request)
7) Participation in required meeting

Tuesday, May 17, 2011
STATEMENT OF NEED:

ODOT currently owns and operates 88 county garages, 127 outposts, and 12 district garage and central office facilities. Additionally, ODOT owns and operates a fleet of 1674 dump trucks utilized, primarily, to combat snow and ice on 49,000 lane miles of interstate and state highways. When cleaning the fleet vehicles after the snow and ice removal process, industrial wastewater is created and must be disposed of in an eco-friendly manner. Currently, wastewater generated from washing the equipment is disposed of in one of two methods:

1. If the garage or facility is in an area that sanitary sewer is available, the wastewater is drained into the existing sewer system. Based on the data from the District 10 county garage, the cost is approximately $3500/year.

2. If sewer is not available, the wastewater is filtered to remove oil then stored in tanks to be re-used to make salt brine. Based on the data from District 10 county garage, the cost is approximately $28,690/year.

Storing wastewater to re-use in making salt brine is preferred as it is cost effective and environmentally friendly; however, the quantity of wastewater generated currently exceeds the amount of salt brine needed. As a result, the excess wastewater must be transported to a sanitary treatment facility in those regions of the state where sanitary sewer is not available.

STUDY OBJECTIVES:

The objective of “Snow Removal Wastewater Disposal Alternatives” is to provide an evaluation of the existing process that is utilized when sanitary sewer is not available and recommend a solution that will (a) alleviate the creation of industrial wastewater in the equipment cleaning process entirely or (b) provide a more cost effective solution to safely, efficiently, and environmentally dispose of wastewater generated from the process.

RESEARCH TASKS:

Task 1: Evaluate the snow and salt removal wastewater disposal procedures for at least one county garage in each of the 12 ODOT districts.

Task 2: Evaluate if any commercially viable solutions are available today that could be used to prevent the creation of industrial wastewater. If it is determined that no suitable solutions are commercially available, then an analysis should be done to evaluate the solutions that are being utilized today by the 12 ODOT districts, and the industry in general, and a best-practices recommendation should be provided by the researcher.

Task 3: Develop a matrix of alternatives that will compare and contrast solutions that are available today and provide a recommendation on the most viable solution(s).

Task 4: Provide a summary of the findings from steps 1 & 2; and a detailed description and benefit/cost analysis for the recommendations provided in step 3 (inclusive of an estimate of the budget and time needed to complete each method included in the matrix).

PROJECT DELIVERABLES:

1) District process comparison matrix
2) Matrix of proposed alternatives/solutions
3) Quarterly progress reports
4) Article for Research newsletter (upon request)
5) Participation in required meeting
STATEMENT OF NEED:
ODOT’s infrastructure is comprised of thousands of roadway miles and hundreds of buildings across the state to support the needs of the traveling public. ODOT spends approximately $12 million annually to power the transportation system. The deployment of alternative energy generating assets, such as a wind turbine, within the highway right-of-way provides an opportunity to reduce operating expenses and generate revenue for the Department.

The economic viability of commercial and utility scale wind turbine deployment is largely dependent on three main variables: (1) wind resource availability above ground level; (2) site conditions such as topography; and (3) individual wind turbine power curve ratings. The northern half of Ohio has documented wind resources capable of creating and sustaining economically viable turbine installation while wind resources in the southern half of Ohio are considered marginal. Ultimately wind resources and weather are variables effecting turbine efficiency, economic viability, and the Department’s return on investment.

As a vehicle moves along the highway it acts as a piston, creating a wake of moving air at or near ground level. Strength of this artificial wind resource can be amplified by the presence of structures such as bridges and jersey barriers. Vehicle generated wind resources have the potential to create a scenario that makes the deployment of micro and small scale wind turbine economically viable, reduce operating costs, and accelerating the Department’s return on investment. Evaluation of vehicle induced wind resources and availability will enable ODOT to consider alternative methods of electrifying the highway infrastructure.

STUDY OBJECTIVES:
The objective of "Evaluation of Wind Resources Generated from Vehicle Wake" is to: (1) evaluate and characterize wind resources generated by highway traffic, and (2) evaluate the feasibility deployment within the highway system.

RESEARCH TASKS:
Task 1 - Expanded Literature Review
Task 2 - Wind Resource Data
Task 3 - Wind Location Profile
Task 4 - Energy Production Analysis
Task 5 - Highway Siting Considerations
Task 6 - Economic Analysis
Task 7 - Final Report

PROJECT DELIVERABLES:
1) Monthly Progress Meetings
2) Literature Review
3) Quarterly progress reports
4) Draft and approved versions of a final report and executive summary.
5) Article for Research newsletter (upon request)
6) Participation in required meeting

Tuesday, May 17, 2011
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Bio-Engineering Techniques for Landslide Stabilization - Supplement

Problem Statement No: 2012-09
Project Type: Geotechnical

Researchers: To Be Determined
Technical Liaisons: Steve Taliaferro
Kirk Beach

Research Agency: To Be Determined
FundingType: 80/20 Federal/State
Total Project Cost (est): $80,000.00
Estimated Duration: 24 months

STATEMENT OF NEED:
Many land instability problems persist along earthen embankments, stream banks, and cut slopes throughout Ohio's highway system. Significant funds are expended each year in the remediation of these problems. Bio-engineering methods have been widely used in Europe and Asia for erosion control. If these methods can be used for stabilizing landslides, they can provide substantial savings over conventional repair methods. Application to stabilization of shallow slope failures with depths of 2-3 ft was first studied in the UK around 2002. In 2005, the ODOT Office of Geotechnical Engineering initiated a research project to study the use of bio-engineering to stabilize shallow slope failures. As part of this study, bioengineering (willow poles) were utilized on the 3 research sites. Based on the findings of the study, it was determined that bio-engineering techniques can be used for shallow landslide stabilization, provided that issues involving vegetation survivability could be addressed. It is estimated that that 10 percent of the landslides inventoried in the state could be candidates for a bio-engineering solution. ODOT currently spends between $40M to $60M per year on the remediation of landslide problems. With regards to potential savings, the researchers on the Phase 1 project (SJN: 134169) stated in their Executive Summary that the cost of bioengineering stabilization is expected to be approximately 25% less than for conventional construction methods for similar scale projects. If performed proactively, it is estimated that the cost reduction could be as much as 80%.

STUDY OBJECTIVES:
The objective of "Bio-Engineering Techniques for Landslide Stabilization Supplement" is to supplement the previous study by exploring the issues that impact vegetation survivability including plant species, installation procedures, soil moisture conditions, and necessary maintenance techniques. The previous study showed that bioengineering techniques could be successful provided that the survivability issues could be addressed. At the completion of this project, ODOT should be provided with the following: (1) clarification of which species is most effective including under various scenarios (e.g., slopes that are wet consistently or just seasonally, etc.); (2) installation techniques that are easily repeatable with minimal initial training; and (3) list of the necessary maintenance techniques for evaluated species.

RESEARCH TASKS:
Task 1 - Site Selection
Task 2 - Remediation Design
Task 3 - Construction and Construction Monitoring
Task 4 - Post Construction Monitoring
Task 5 - Final Report

PROJECT DELIVERABLES:
1) Training for ODOT staff.
2) Quarterly progress reports
3) Draft and approved versions of a final report and executive summary.
4) Article for Research newsletter (upon request)
5) Participation in required meeting

Tuesday, May 17, 2011
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Bicycle Trip Forecasting Model: Cincinnati Metropolitan Case Study

Problem Statement No: 2012-10  
Project Type: Planning  

Research Agency: University of Cincinnati  
FundingType: 80/20 Federal/State  
Total Project Cost (est): $40,000.00  
Estimated Duration: 16 months

Researchers: Heng Wei  
Technical Liaisons: Heather Bowden

STATEMENT OF NEED:
The potential of bicycle and pedestrian travel to provide convenient mobility, reduce congestion, improve environmental quality, and promote public health has received increasing attention since the last decade. For concerns with the emerging issues related to transportation greenhouse gases and energy saving in the recent years, non-motorized transport means has been highly desired to promote alternatives to automobile travel. The need for improving conditions for bicyclists and pedestrians has then become critically important to the relevant planning and policymaking efforts. As a vital analysis tool, bicycle and pedestrian travel forecasting models are anticipated to greatly benefit a variety of uses -- for instance, estimating the benefits of a proposed project, prioritizing projects based on the greatest benefit to existing users or on the greatest payoff in attracting new bicyclists or walkers; planning bicycle or pedestrian paths and networks, identifying and correcting deficiencies in existing networks based on desired travel patterns and facility characteristics; and planning for bicycle and pedestrian safety by developing exposure information for crash/safety models. The modeling effort requires much data, such as travel and facility characteristics as well as user preferences, to advance the state-of-the-practice in this area. However, deficiencies and limitations in existing sources for these data often hamper these efforts.

STUDY OBJECTIVES:
The objective of "Bicycle Trip Forecasting Model" is to explore the methodology of developing a bicycle trip forecasting model based on household travel survey data.

RESEARCH TASKS:
Task 1 - Acquiring necessary data and other supplemental data  
Task 2 - Extracting bicycle trip and pedestrian data from the GPS-based HTS data  
Task 3 - Determining variables influencing bicycling and walking trips and trip forecasting models  
Task 4 - Model validation  
Task 5 - Summarizing the results and new findings

PROJECT DELIVERABLES:
1) Bicycling and walking trip data extracted from the Greater Cincinnati GPS-based HTS data.  
2) Results of analysis of contributing factors to bicycling and walking travel attitudes (decision making) and purposes.  
3) Bicycling and walking trip forecasting models, including model validation results.  
4) Recommendations for model applications, as well as enforcement, education and encouragement.  
5) Quarterly progress reports  
6) Draft and approved versions of a final report and executive summary.  
7) Article for Research newsletter (upon request)  
8) Participation in required meeting
STATEMENT OF NEED:
Travel Demand Forecasting Models (TDFM) employ many statistical models to generate estimates of trip generation, distribution and modal split in most urban areas. These models are then used in a variety of purposes, including transit alternatives analyses, roadway design and air quality conformity analyses. The Department maintains fifteen urban models in addition to the statewide TDFM. Modal Choice models in TDFMs are estimated from Transit On-Board Surveys. New On-Board Surveys are required by the FTA for certain projects such as New Starts, including new or extended fixed-guideway service.

On-Board Surveys have traditionally been conducted by handing a paper survey to a boarding transit passenger and requesting the passenger to fill out the survey while on board the bus or train and returning it upon exiting. While there is always a mail-back option, few surveys are returned once the passenger alights from the vehicle. Therefore, the likelihood of receiving surveys from passengers who are only riding a few blocks is poor. To date, there have been efforts to factor surveys by distance, however, this has only been easily accommodated by service where tickets are read when entering and exiting stations, such as the DC Metro.

As On-Board Surveys are being or have recently been conducted in Cleveland, Columbus, and Cincinnati, it is appealing to quantify the bias found in reported distance so that these surveys could be re-weighted to accurately reflect transit usage. A more accurate representation in the TDFMs of current conditions will then allow for more representative transit patronage forecasts. This is important for the Department as it will affect District 8’s Cincinnati Eastern Corridor. Other affected projects include GCRTA’s Blue Line Extension, and possibly Bus Rapid Transit Service for COTA or Metro. Additionally, On-Board Surveys are expensive to collect. While new methods of collecting unbiased survey data are being tested in Atlanta and Los Angeles, these new methods have additional costs above that of a standard survey. Typically, the cost of an On-Board Survey is prohibitive for small and medium-sized urban areas. As Automatic Passenger Counters (APC) are being installed on newer buses, there may be an opportunity to use the APC data to estimate origin-destination flows without the cost of an On-Board Survey.

STUDY OBJECTIVES:
The objective of "Evaluation of Biases in Transit On-Board Surveys" is to quantify the amount of bias in the 2008 COTA On-Board Survey (and other similar On-Board Surveys), specifically in regards to distance traveled and inclusive of any others that the researcher discovers, and to determine appropriate methods to ameliorate those biases in the data. A secondary focus is to ascertain whether APC data can be used to approximate origin-destination flows that are collected as a part of an On-Board Survey.

RESEARCH TASKS:
Task 1 - Survey Instrument, Materials and Schedule
Task 2 - Boarding/Alighting Survey and Other Possible Surveys
Task 3 - Survey Data Weighting
Task 4 - Evaluation of the Use of Counts to Determine Passenger Origin-Destination Flows
Task 5 - Final Report

PROJECT DELIVERABLES:
1) Recommendations on how RTAs can use APC data alone or in conjunction with their On-Board Surveys to inform their planning efforts to provide options for their clients, specifically those who are transit dependent.
2) Re-weighted survey data (by all the methods) in dbf format.
3) Survey instruments
4) Technical memoranda from Tasks
5) Quarterly progress reports
6) Draft and approved versions of a final report and executive summary.
7) Article for Research newsletter (upon request)
8) Participation in required meeting

Tuesday, May 17, 2011
STATE FISCAL YEAR 2012

Project Title: Development of a Standard Specification for Horizontal Direction Drilling

Problem Statement No: 2012-13  
Project Type: Construction  
Funding Type: 80/20 Federal/State  
Total Project Cost (est): $35,900.00  
Estimated Duration: 16 months

Research Agency: Bowling Green State University  
Researchers: Alan Atalah  
Technical Liaisons: Peter Narsavage

STATEMENT OF NEED:  
Ohio is grappling with an aging infrastructure and a state budget crisis. In order for Ohio to modernize its underground infrastructure, innovative technologies need to be utilized by the ODOT and utility owners. Horizontal Directional Drilling (HDD) has become one of the fastest-growing alternative construction methods in comparison to the open trench construction method for the installation of underground pipelines and conduits (Najafi 2010). The majority of the rapid growth in the application of HDD occurred during the last 15 years after the Telecommunications Act of 1996. The board of directors of the Ohio Horizontal Directional Drilling Association informed us that there are many HDD specifications employed in Ohio that vary significantly in their content and requirements. Consequently, inferior products have been installed and unnecessary risks have been taken on. Also, level competition plain field among contractors, subcontractors, and suppliers have been compromised. It is necessary to create a fair specification for HDD that ensure that HDD pipes are designed and installed correctly without damaging the Ohio roadways. It is also critical to provide ODOT with a guideline that ensures high quality product installation that mitigate and manages risks associated with HDD.

STUDY OBJECTIVES:  
The objective of "Development of a Standard Specification for Horizontal Direction Drilling" is to investigate the use of HDD in Ohio and develop draft specifications for its use.

RESEARCH TASKS:  
Task 1 - Collection of HDD specifications and expanded literature review  
Task 2 - Development of the Ohio HDD specification committee and stakeholder survey  
Task 3 - Development of the first draft of HDD standard specifications  
Task 4 - Final report

PROJECT DELIVERABLES:  
1) A standard specification for horizontal directional drilling  
2) Quarterly progress reports  
3) Draft and approved versions of a final report and executive summary.  
4) Article for Research newsletter (upon request)  
5) Participation in required meetings

Tuesday, May 17, 2011
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER

STATE FISCAL YEAR 2012

Project Title: Assessing the Performance of the SpeedInfo Sensor

Problem Statement No: 2012-14
Project Type: Traffic

Research Agency: Ohio State University

Funding Type: 80/20 Federal/State
Total Project Cost (est): $40,000.00
Estimated Duration: 16 months

Researchers: Benjamin A. Coifman
Technical Liaisons: George Saylor
Dave Gardner

STATEMENT OF NEED:
Traditionally freeway traffic operations data were collected in-house by ODOT using loop detectors that provide speed, flow, and occupancy by lane. Ultimately, most real time management applications only use the speed (e.g., traveler information and congestion monitoring). In recent years a new company, SpeedInfo, emerged with a different paradigm for traffic operations data collection which promises a cost-effective means for traffic data collection. SpeedInfo is slated to become ODOT’s dominant traffic detection technology for real time operations and management. During the transition, approximately 65 loop detector stations of the Columbus Metropolitan Freeway Management System (CMFMS) will be operational simultaneously with SpeedInfo. This overlap of coverage provides an opportunity to validate the performance of the SpeedInfo sensors to the soon to be decommissioned CMFMS.

STUDY OBJECTIVES:
The objective of "Assessing the Performance of the SpeedInfo Sensor" is to validate the performance of the system over an extended period, examining potentially challenging conditions, diagnose any biases, and provide guidance in working with the new data source.

RESEARCH TASKS:
Task 1 - Collect archived SpeedInfo data and loop detector data.
Task 2 - Correlate the location of SpeedInfo sensors and detection zones with existing loop detector stations.
Task 3 - Develop a method to easily time synchronize the two data sets.
Task 4 - Aggregate the loop detector data at the same rate as the SpeedInfo data.
Task 5 - Compare overlapping data from two sensor systems.
Task 6 - Diagnose problems and discrepancies discovered between data sets.
Task 7 - Investigate and document potential biases inherent in the radar system utilized by SpeedInfo.
Task 8 - Investigate relationships in the context of SpeedInfo data and traditionally utilized metrics not available in SpeedInfo for ramp meeting (if time permits).
Task 9 - Investigate potential issues concerning performance degradation during precipitation (if data is available).

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Draft and approved versions of a final report and executive summary.
3) Article for Research newsletter (upon request)
4) Participation in required meetings
Improving Work Zone Safety Through Speed Management

Problem Statement No: 2012-15

Project Type: Safety

Researchers: Deborah McAvoy

Technical Liaisons: Reynaldo Stargall

Research Agency: Ohio University

Funding Type: 80/20 Federal/State

Total Project Cost (est): $37,077.00

Estimated Duration: 16 months

STATEMENT OF NEED:
Work zones are necessary for road improvement projects and cause changing traffic patterns, reduced speed limits, congestion and an influx of construction and maintenance workers as well as equipment on the road. The proper use of traffic control devices is an important part of every work zone where their primary function is to provide for a reasonably safe and efficient movement of traffic while protecting workers. In order to determine what impact alternative traffic control devices or modifications to work zone temporary traffic control design have on speed reduction, various devices and methods will be evaluated for their effectiveness in terms of worker risk and motorists safety is warranted.

STUDY OBJECTIVES:
The objective of "Improving Work Zone Safety through Speed Management" is to determine the safest and most efficient method for the reduction of vehicular speeds through construction and maintenance work zones.

RESEARCH TASKS:
Task 1 - Conduct a literature review to identify traffic control devices or countermeasures which have the potential to reduce vehicular speeds through work zones as well as non-work zones.
Task 2 - Select up to twenty speed countermeasures for simulator testing based upon discussions with and recommendations from ODOT’s Division of Highway Operations Office of Traffic Engineering.
Task 3 - Design schematic traffic control plans for the selected countermeasures and upon approval from ODOT, develop the virtual worlds in the simulator.
Task 4 - Conduct controlled laboratory experiments to quantify driver behavior and performance of a representative focus group using ORITE’s driving simulator.
Task 5 - Statistically analyze the effect of the countermeasures tested in the simulator.
Task 6 - Develop recommendations for field implementation.
Task 7 - Prepare final report

PROJECT DELIVERABLES:
1) Synthesis of the State-of-the-Art Review
2) Summary of driving behavior and performance of the focus group from the controlled laboratory experiments using the driving simulator through work zones
3) Preliminary Data Summaries and Findings
4) Quarterly progress reports
5) Draft and approved versions of a final report and executive summary.
6) Article for Research newsletter (upon request)
7) Participation in required meetings
Project Title: The Use of Atomic Force Microscopy to Evaluate Warm Mix Asphalt

Problem Statement No: 2012-16

Project Type: Materials

Research Agency: Ohio University

Funding Type: 80/20 Federal/State

Total Project Cost (est): $39,998.00

Estimated Duration: 16 months

STATEMENT OF NEED:
Warm Mix Asphalt (WMA) has received considerable attention in past few years due to its benefits in reducing energy consumption and pollutant emissions during production and placement of asphalt mixtures, widening the paving season, and increasing the pace of the construction process. However, many concerns and questions are still unanswered regarding the performance and durability of WMA. One key issue is the moisture susceptibility of WMA. Although the results of standard laboratory tests indicated that WMA may be more susceptible to moisture damage than Hot Mix Asphalt (HMA), data obtained from the field does not support those results. Some data also suggests that the resistance of WMA to moisture damage improves with time and may ultimately be equivalent to that of HMA. In addition, the healing characteristics of WMA have not yet been studied or evaluated in a methodical, scientific manner. Research is needed to determine if the degree of healing in WMA is sufficient to increase their resistance to damage, and hence enhance their long term durability.

STUDY OBJECTIVES:
The objective of "The Use of Atomic Force Microscopy (AFM) to Evaluate Warm Mix Asphalt" is to study the micro-scale behavior of WMA using the AFM and identify the testing parameters that can be utilized in the evaluation of its moisture susceptibility and healing characteristics.

RESEARCH TASKS:
Task 1 - Conduct literature search
Task 2 - Securing materials and sample preparation
Task 3 - Conduct AFM experiments to study micro-scale structure of WMA
Task 4 - Conduct AFM experiments to examine moisture damage mechanisms in WMA
Task 5 - Conduct AFM experiments to examine healing characteristics of asphalt binder
Task 6 - Conduct tests to examine the macro-scale properties of considered WMA materials
Task 7 - Conduct data analysis
Task 8 - Prepare final report

PROJECT DELIVERABLES:
1) Sample preparation and testing protocols for using AFM to examine moisture susceptibility and healing characteristics of asphalt materials.
2) Recommendations on the moisture susceptibility of different types of WMA based on AFM experiments.
3) Recommendations on the effect of different types of WMA on the healing characteristics of asphalt materials.
4) Quarterly progress reports
5) Draft and approved versions of a final report and executive summary.
6) Article for Research newsletter (upon request)
7) Participation in required meeting

Tuesday, May 17, 2011
Project Title: Examination of Factors Associated in Motorcycle Crashes in Work Zones

Problem Statement No: 2012-17
Project Type: Safety

FundingType: 80/20 Federal/State
Total Project Cost (est): $35,900.00
Estimated Duration: 16 months

Researchers: Bill Schneider
Technical Liasons: Reynaldo Stargall
Michelle May

STATEMENT OF NEED:
The number of fatal injuries involving motorcyclists has increased from 3,365 in 2002 nationally to 5,409 in 2008 (NHTSA). Fortunately in 2009 the total number of fatal injuries decreased to 4,595 (NHTSA). Over this time period the State of Ohio had a similar trend with 144 fatal injuries in 2002 increasing to 212 in 2008 and then decreasing to 163 in 2009 (Ohio Crash Facts). Additionally from 2006 to the end 2010 there were 336 work zone related crashes resulting in 70 property damage only, 38 possible injuries, 141 non-incapacitating, 82 incapacitating and 10 fatalities.

There is a two-fold reason why work zones are especially dangerous for motorcyclists. In the first case, many of the work zones correspond to the summer riding season when there is a higher number of motorcyclists on the road increasing the likelihood of interaction between the two. In the second case, the roadway surface is altered in the work zone resulting in a reduction of traction between the wheel and the road. In comparison to cars and trucks, motorcycles have a limited surface area between the tire and the road and, in turn, the lower surface area magnifies the importance of maintaining traction of the motorcycle. Some of the common examples faced during construction include uneven or grooved lanes, ruble strips, steel places, and asphalt patches. In each of these cases, the traction between the pavement and the motorcycle wheel is decreased and, in turn, increases the potential likelihood for motorcycle related crashes. While most of these cases are necessary for road maintenance, some of these applications may be more severe for the motorcyclist. In these cases it is especially important to make the motorcyclist aware of the condition and allow the motorcyclist to seek a different route around the hazard. One potential solution may be posting signage with enough time allowing the motorcyclist to exit the highway prior to the upcoming work zone.

STUDY OBJECTIVES:
The objective of "Examination of Factors Associated in Motorcycle Crashes in Work Zones" is to evaluate motorcycle work zone related crashes and provide ODOT and the riding community with the most current knowledge on the contributing factors associated with motorcycle related work zone crashes.

RESEARCH TASKS:
Task 1 - National survey on the state of practice on special treatments used with motorcyclists and work zones.
Task 2 - Collect all motorcycle work zone crash data for Ohio.
Task 3 - In addition to the OH-1 crash report, this study will also collect all the corresponding crash narratives.
Task 4 - Collect the work zone plans associated with the individual crashes.
Task 5 - Provide the statistical analysis of the contributing factors that were associated with each of the crashes.
Task 6 - Conduct personal interviews with riders and trainers.
Task 7 - Synthesize the findings from this study.

PROJECT DELIVERABLES:
1) A motorcycle work zone related clearinghouse that will be housed on the Center for Transportation Safety and Innovation website
2) Quarterly progress reports
3) Draft and approved versions of a final report and executive summary.
4) Article for Research newsletter (upon request)
5) Participation in required meeting

Tuesday, May 17, 2011
Incorporating Chemical Stabilization of the Subgrade in Pavement Design and Construction Practices

Problem Statement No: 2012-18
Project Type: Pavement

Researchers: Shad Sargand
Technical Liasons: Roger Green
Chris Merklin

Research Agency: Ohio University
Funding Type: 80/20 Federal/State
Total Project Cost (est): $70,000.00
Estimated Duration: 16 months

STATEMENT OF NEED:
Chemical stabilization is a well-established practice that has been used to improve the engineering properties of subgrade soils by reducing their moisture holding capacity, plasticity, and swell potential; by improving their workability; increasing their strength and stiffness; and by enhancing their long-term durability even under severe environmental conditions. Therefore, the use of chemical admixtures such as lime and cement to stabilize subgrade soil has several benefits that include improving the long-term performance of pavements as well as reducing their required thickness.

ODOT’s Office of Geotechnical Engineering (OGE) has evaluated the use of global chemical stabilization of subgrade soils based on data obtained from reconstruction and widening of project on IR-71 corridor. The results of this evaluation showed that stabilizing the subgrade results in significant cost savings, enhancement to productivity by providing a stable work platform for compaction equipment, and reduction of construction arguments, issues, and claims related to subgrade. Based on the results of this evaluation, OGE recommended the use of global chemical stabilization on major projects regardless of the soil conditions.

Global chemical stabilization is currently not implemented in ODOT pavement design and construction practices, since there still concerns and issues that have not been addressed. These include: in-situ durability of stabilized subgrade soils, variability in their in-situ properties, quality control procedures used during their construction, and differences between their field and laboratory properties. This study aims at addressing those concerns and developing a framework for incorporating the strength/stiffness benefits of subgrade chemical stabilization in ODOT pavement design and construction practices.

STUDY OBJECTIVES:
The objective of "Incorporating Chemical Stabilization of the Subgrade in Pavement Design and Construction Practices" is to develop a framework for incorporating of subgrade chemical stabilization in ODOT pavement design and construction practice.

RESEARCH TASKS:
Task 1 - Conduct literature review
Task 2 - Conduct field and laboratory testing programs
Task 3 - Conduct pavement analysis to evaluate the benefits of the subgrade chemical stabilization
Task 4 - Evaluate the mix design procedures of chemically stabilized subgrade soils
Task 5 - Develop a method to determine depth of stabilization
Task 6 - Prepare final reports

PROJECT DELIVERABLES:
1) Framework for incorporating the strength benefits of stabilized subgrade soil in pavement design and construction practices
2) Recommendation for changes, if any, in quality control specifications of chemically stabilized subgrade soils.
3) Recommendation for modifications, if any, in mix design procedures for lime and cement stabilized subgrade soils.
4) Assessment of the uniformity and durability chemically stabilized subgrade in existing pavements in Ohio.
5) MEPDG material inputs database for chemically stabilized layers
6) Quarterly progress reports
7) Draft and approved versions of a final report and executive summary.
8) Article for Research newsletter (upon request)
9) Participation in required meeting
STATEMENT OF NEED:
The U.S. transportation conformity program requires transportation plans, programs, and projects to "confirm to" the goals established in statewide transportation improvement programs and ensure that transportation activities will not cause new air quality violations, worsen existing violations, or delay timely attainment of the National Ambient Air Quality Standards for traffic-generated air pollutants. According to FHWA and ODOT’s guidance on project-level conformity and hot-spot analysis, a PM hotspot analysis is required if a project is located in a PM2.5 nonattainment or maintenance area and the project’s design year average annual daily traffic is greater than 125,000 and comprised of more than 8% diesels. FHWA is requiring all state DOTS to utilize the Motor Vehicle Emissions Simulator (MOVES) to conduct PM2.5 analysis by the end of calendar year 2012.

STUDY OBJECTIVES:
The objective of "On-Road Traffic Operation Data and Criteria for Project-Level PM2.5 Conformity Analysis" is to compare and contrast MOVES with CUBE/VISUM, while leveraging the Traffic Air Environmental Health Impact analysis (TEAHIA - a system developed by the University of Cincinnati), to provide ODOT with recommendations on how to perform regional and project level PM2.5 conformity analysis.

RESEARCH TASKS:
Task 1 - Investigate nonattainment/maintenance areas for selection of case study sites
Task 2 - Investigate ODOT traffic data sources and collection techniques
Task 3 - Collect data at case study corridor sites
Task 4 - Evaluate regional level data with MOVES and travel demand analysis models
Task 5 - Conduct project level PM2.5 conformity analysis with MOVES/VISSIM
Task 6 - Evaluate regional and project level input variables and relationship
Task 7 - Compare dispersion models with TAEHIA

PROJECT DELIVERABLES:
1) Demonstrations of TAEHIA model
2) Methodology, evaluation results and relevant recommendations
3) Quarterly progress reports
4) Draft and approved versions of a final report and executive summary.
5) Article for Research newsletter (upon request)
6) Participation in required meeting
Project Title: Managing Transportation Assets: Developing of Enabling Decision Support Tools

Problem Statement No: 2012-20
Project Type: Planning

Research Agency: University of Toledo

Funding Type: 80/20 Federal/State
Total Project Cost (est): $150,000.00

Researchers: Eddie Y. Chou
Technical Liaisons: Andrew Williams

Estimated Duration: 24 months

STATEMENT OF NEED:
Implementing transportation asset management is a process of continuous improvement. The importance of senior management support cannot be overstated. The benefits of asset management as a decision support tool in making crucial funding decisions, planning budget trade-offs, monitoring asset performance, reducing asset life-cycle costs, and optimizing resource allocations may not be as apparent as the required investments in data collection and integration, process and definition standardization, and management information system acquisition and implementation, etc. A prototype platform that can readily demonstrate the benefits and capabilities of asset management as a decision support tool to the senior management will be highly valuable in building consensus and support for implementing asset management throughout the Department.

Currently, various data reside in multiple databases, while senior management often needs reports or presentations based on a summary of the data (i.e., metadata) to make decisions. Since data are frequently updated to reflect current condition and cost estimates, new report/presentation needs to be generated each time and it can become tedious or inconsistent, if not automated. A web-based platform that contains automatically generated up-to-date reports/presentations based on a set of standard templates and is capable of interactive what-if analysis to support executive level asset management decision-making is warranted.

STUDY OBJECTIVES:
The objective of "Managing Transportation Assets: Developing of Enabling Decision Support Tools" is to develop a web-based platform for asset management.

RESEARCH TASKS:
Task 1 - Conduct a best practices assessment of existing asset management practices.
Task 2 - Develop a prototype platform that contains enabling decision support tools and processes.
Task 3 - Perform a gap analysis to identify areas of critical needs for successful implementation.
Task 4 - Provide training to ODOT on prototype platform.

PROJECT DELIVERABLES:
1) Web-based platform that contains a set of decision support tools that demonstrate the benefits and capabilities of transportation asset management as a decision tool
2) Gap analysis results
3) Quarterly progress reports
4) Draft and approved versions of a final report and executive summary.
5) Article for Research newsletter (upon request)
6) Participation in required meeting

Tuesday, May 17, 2011
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Changing Economy, Demographics, Land Use, Transportation Policies and their Impacts on Travel Behavior

Problem Statement No: 2012-21
Project Type: Planning

Research Agency: Ohio State University
Funding Type: 80/20 Federal/State
Total Project Cost (est): $135,815.00
Estimated Duration: 16 months

Researchers: Gulsah Akar
Technical Liasons: Rebekah Anderson, Joanna Pinkerton

STATEMENT OF NEED:
Facing major challenges relating to energy consumption, global warming, environmental quality, and economic viability, metropolitan regions around the world are examining the consequences of alternative growth patterns on resource consumption. As we plan for new land use policies and investments in the transportation system over the next decade, we will face a new set of challenges tied to the changing demographic and economic conditions in Ohio, in addition to the rising costs of energy and related policies aimed at reducing the carbon footprint of our economy. The first step in understanding the possible implications of these changes is a deeper understanding of the current relationships between land use and travel behavior, and how these might be impacted by future land use, transportation and energy policies.

STUDY OBJECTIVES:
The objective of "Changing Economy, Demographics, Land Use, Transportation Policies and their Impacts on Travel Behavior" is to develop a user-friendly regional land use allocation decision analysis model that will enable the analysts and decision-makers develop scenarios and understand the impacts of the changing economy, demographics, and land use policies on the resulting travel behavior of Ohioans.

RESEARCH TASKS:
Task 1 - Analyzing demographics, land use and travel behavior in Ohio
Task 2 - Determining trip generation rates for various urban typologies
Task 3 - Development of the Land Use Allocation Division Model and scenario Analysis

PROJECT DELIVERABLES:
1) Regional Land Use Allocation Decision Analysis Tool
2) Quarterly progress reports
3) Draft and approved versions of a final report and executive summary.
4) Article for Research newsletter (upon request)
5) Participation in required meeting

Tuesday, May 17, 2011
PROPOSED RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Implementation and Thickness Optimization of Perpetual Pavements in Ohio

Problem Statement No: 2012-22
Research Agency: Ohio University

Project Type: Pavement
FundingType: 80/20 Federal/State

Total Project Cost (est): $189,200.00
Estimated Duration: 24 months

Researchers: Shad Sargand
Technical Liaisons: Roger Green
Joshua Booher

STATEMENT OF NEED:
Increases in traffic volume and loads, demands for longer-lasting pavements that reduce user delays due to reconstruction, and rising costs of energy and asphalt materials are some of the major challenges facing the paving industry and State DOTs in the United States. The concept of perpetual pavements has been identified as an emerging design technique to solve these challenges. Perpetual asphalt pavements are designed and built to last 50 years or more without requiring major structural rehabilitation or reconstruction. In perpetual pavements distresses are confined to the upper layer of the structure, by eliminating or reducing the potential for fatigue cracking through maintaining the strains in the pavement below a critical fatigue endurance limit (FEL).

While there have been a number of successful installations of perpetual pavements, there are still questions to be answered in order to achieve a comprehensive understanding of the design of such pavements. For example, although various endurance limits have been proposed, none have been determined and validated for efficient design. The National Center for Asphalt Technology (NCAT) suggested that the FEL value for most perpetual pavement designs is in the range of 70 to 100 με. However, based on the results of different in-service pavement sections, some researchers suggested that the FEL can withstand up to 150 με depending on the type of mixture used.

STUDY OBJECTIVES:
The objective of "Implementation and Thickness Optimization of Perpetual Pavements in Ohio" is to develop a framework for the selection of the optimal design for perpetual pavements in Ohio.

RESEARCH TASKS:
Task 1 - Literature review
Task 2 - Instrumentation of perpetual pavement sections
Task 3 - Characterization of mechanical properties of the materials in pavement test sections.
Task 4 - Controlled load tests
Task 5 - Development of design alternatives for perpetual pavements in Ohio

PROJECT DELIVERABLES:
1) Literature review or annotated bibliography on perpetual pavements
2) A framework for the selection of the optimal designs for perpetual pavements in Ohio
3) Recommendations on how to retrofit existing conventional asphalt pavements in good condition to meet the perpetual pavement requirements.
4) Catalogue for MEPDG Level 1 and Level 2 material inputs for pavement layers and subgrade soil
5) Quarterly progress reports
6) Draft and approved versions of a final report and executive summary.
7) Article for Research newsletter (upon request)
8) Participation in required meeting

Tuesday, May 17, 2011
Project Title: Evaluate the Performance of Multifunctional Polymeric Thermochromic Dye to Increase Durability of Asphalt Pavement

Problem Statement No: 2012-23

Project Type: Materials

Research Agency: Case Western Reserve University

Researchers: Bill Yu

Technical Liasons: David Powers

Roger Green

Funding Type: 80/20 Federal/State

Total Project Cost (est): $110,000.00

Estimated Duration: 24 months

STATEMENT OF NEED:
The majority of highways in Ohio are surfaced with asphalt. The conventional asphalt has high solar absorbance due to its dark color. Consequently, the surface temperature of asphalt pavement can be considerably higher during summer than pavement with a lighter surface, i.e., concrete pavement. The dark color also means asphalt road radiate thermal energy faster during winter and therefore cools at a fast rate. The influence of thermal loads can be translated into reduced structural strength, increased rutting, accelerated aging of binders and thermal cracks; all compromise pavement performance. Pigments and seals have become available to change the color of an asphalt surface to make it lighter. However, common types of pigments are based on metallic powder or crystal salt, which does not have good compatibility with polymeric binders. ODOT experience indicated that the use of Verglimit, a crystalline phase change materials for thermal energy storage, resulted in failure of pavement. Polymeric dye, which feature excellent compatibility with asphalt binder, has promise to overcome the limitations and significantly increase the durability via its multifunctional roles.

STUDY OBJECTIVES:
The objective of "Evaluate the Performance of Multifunctional Polymeric Thermochromic Dye to Increase Durability of Asphalt Pavement" is to evaluate the effectiveness of multifunctional polymeric thermochromic dye to increase the longevity of asphalt pavement via multifunctional roles of both improving its optical properties and microstructure.

RESEARCH TASKS:
Task 1 - Screen and select thermochromic dyes
Task 2 - Measure the optical and mechanical properties of thermochromic dye modified asphalt binder
Task 3 - Evaluate the durability in model scale or field scale testing
Task 4 - Develop a life cycle cost model
Task 5 - Develop guidelines for construction procedures
Task 6 - Generate quarterly and final reports

PROJECT DELIVERABLES:
1) Matrix for thermochromic paint selection
2) Recommendation of optimal dye content
3) Testing protocol for evaluating the effectiveness of polymeric thermochromic dyes
4) Procedures to introduce polymeric thermochromic dyes into asphalt mixture
5) Quarterly progress reports
6) Draft and approved versions of a final report and executive summary.
7) Article for Research newsletter (upon request)
8) Participation in required meeting
STATE FISCAL YEAR 2012

Project Title: Relative Operational Performance of Geosynthetics Used as Subgrade Stabilization

Problem Statement No: Sol 1266

Project Type: Research Agency: Montana Department of Transportation

Researchers: Jeff Jackson
Technical Liaisons: Gene Geiger

Funding Type: 100% Federal
Total Project Cost (est): $50,000.00
Estimated Duration: 24 months

STATEMENT OF NEED:
The main objective of this project is to determine material properties of geosynthetics that affect in-field performance of geosynthetics used for subgrade stabilization, so that DOT personnel can objectively and confidently select appropriate geosynthetics based on material properties and cost for a specific situation, while also allowing competition from different manufacturers.

STUDY OBJECTIVES:
To accomplish the stated objective, test sections will be constructed at a controlled test site to investigate the relative benefit to an unpaved road of various geosynthetics available on the market. An artificial subgrade will be constructed to provide equivalent conditions for each test section; likewise the gravel surfacing along the entire test bed will be uniform to be able to make direct comparisons between geosynthetic products. Laboratory tests on the subgrade, base course and geosynthetics, as well as large-scale box tests conducted by a commercial testing laboratory, will be used to determine key material properties. Laboratory tests that will be used to characterize the materials used during this research project.

Additionally, post-traffic examination will provide invaluable information regarding the performance and installation survivability of the geosynthetics. Post-trafficking, forensic investigations will be conducted to evaluate damage to the geosynthetic from trafficking, as well as to re-evaluate pertinent soil strength characteristics. Intensive evaluations will take place in areas within each test section that have similar rutting. The base course will be removed from a sample area to carefully expose the geosynthetic. The geosynthetic will then be carefully removed from the area to analyze damage to junctions, rib integrity and material continuity. Samples of the extracted material will be removed to conduct monotonic tensile tests to evaluate changes in tensile strength during construction and trafficking, as well as to determine how much permanent strain was imparted in the material from construction and trafficking. Several DCP, LWD and in-field CBR measurements will be taken on the exposed subgrade surface within each test section. Additionally, the depth of the base course aggregate layer will be measured during these evaluations. The transverse rut profile of the base and subgrade will be measured on each side of the excavated area during these investigations to determine strain in the base course aggregate and characterize movement of the subgrade due to trafficking. Finally, the subgrade will be excavated from this area to comprehensively evaluate soil mixing between the subgrade and base course in the rutted areas, soil shear strength at various depths using the hand-held vane shear, and to facilitate a visual evaluation of the rutted area.

Further analysis will be conducted to illustrate cost savings by optimizing material properties that most influence the design and performance of these materials, thereby increasing the knowledge base, confidence and efficiency for state DOTs to update their specifications.

RESEARCH TASKS:
Controlled traffic loading with frequent rut measurements will indicate performance benefits of each geosynthetic. Five basic measurements are necessary in this research project to quantify and understand the behaviors of the geosynthetic in the field test sections during trafficking:
1) longitudinal rut depth of the gravel surface,
2) transverse rut profile of the gravel surface,
3) displacement of the geosynthetic in the transverse direction,
4) strain in the geosynthetic in the transverse direction, and
5) pore water pressure in the upper layer of the subgrade.

Deliverables:
Reports as required.
STATE FISCAL YEAR 2012

Project Title: Motorcycle Crash Causation Study

Problem Statement No: SOL 1300

Research Agency: FHWA

Project Type: Problem Statement No: SOL 1300

Funding Type: 100% Federal

Total Project Cost (est): $150,000.00

Estimated Duration: 48 months

Researchers: Craig Thor

Technical Liasons: Michelle May

STATEMENT OF NEED:
The existing federally supported crash databases provide only limited information on motorcycle crashes and are not tuned to the unique causative factors that affect motorcycle crashes. As a result, acquiring information that focuses on the motorcycle-specific causative factors in crashes has been made a priority by State and Federal Governments alike. The data resulting from this motorcycle crash causation study that will be developed through this pooled-fund project will serve as the foundation for answering the important questions about why motorcycle crashes occur and what data-supported countermeasures can be introduced to address these issues.

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

RESEARCH TASKS:
Not identified

PROJECT DELIVERABLES:
The disparity in safety improvements for passenger vehicles compared to motorcycles with regard to crash and fatality rates is increasingly becoming a significant public health issue in the United States. The findings of this study will help identify the motorcycle-specific crash causation factors and assist the states in producing effective measures to address these issues.

Tuesday, May 17, 2011
STATE FISCAL YEAR 2012

Project Title: Highway Safety Manual Implementation

Problem Statement No: Sol 1301

Total Project Cost (est): $80,000.00

Researchers: Esther Strawder

Technical Liaisons: Jonathan Hughes

Funding Type: 100% Federal

Research Agency: FHWA

Estimated Duration: 48 Months

STATEMENT OF NEED:
The AASHTO Standing Committee on Highway Traffic Safety has established a goal to institutionalize the AASHTO Highway Safety Manual (HSM) and its associated analytical tools to make data-driven decisions, advance the science of safety, and to ultimately reduce fatalities and serious injuries. One proposed action in support of that goal is to establish and maintain an HSM Implementation Transportation Pooled-Fund Study.

STUDY OBJECTIVES:
The objectives of the study are (1) to advance ongoing efforts by lead states to implement the HSM, and (2) to expand implementation to all states. This study would be coordinated with other ongoing and planned implementation activities sponsored by AASHTO, FHWA, and TRB, including NCHRP Project 17-50 "Lead States Initiative for Implementing the Highway Safety Manual." It will also be coordinated with projects that develop content for future editions of the HSM including NCHRP Project 17-45 "Enhanced Safety Prediction Methodology and Analysis Tool for Freeways and Interchanges," NCHRP Project 17-54 "Consideration of Roadside Features in the Highway Safety Manual," and Transportation Pooled-Fund Study TPF-5(099) "Evaluation of Low Cost Safety Improvements."

RESEARCH TASKS:
This study would conduct research tasks and develop products that would enable States to accelerate their implementation of the HSM. The specific tasks and products would be identified and prioritized by a Technical Working Group consisting of one representative each from participating agencies. Specific tasks may include:
(1) developing a calibration manual to accompany the HSM that provides practical advice and examples on how best to adapt HSM calibration procedures to meet the needs of a particular agency,
(2) developing technical guidance for agencies on developing safety performance functions, and
(3) developing guidance for agencies on assembling and managing the data needed for safety analyses.

PROJECT DELIVERABLES:
The study would also facilitate Technical Working Group representatives participation in peer exchanges and other forums through which agencies can exchange information, best practices, lessons learned, and remaining challenges in implementing the HSM appropriately into agencies’ system planning, project planning and preliminary engineering, design and construction, and operations and maintenance procedures and processes. These exchanges would feed an annual process through which the Technical Working Group identifies and prioritizes future tasks to be conducted under the study.

Tuesday, May 17, 2011
APPENDIX C

SP&R PART 2

STATE FISCAL YEAR 2012

ACTIVE PROJECTS
Awaiting Reports

DESCRIPTIONS

Includes 100% federally funded and 80% federally funded active research projects
STATEMENT OF NEED:
A number of state and federal agencies are developing geotechnical databases which may be queried for information used for maintenance of existing projects as well as design, construction, etc. of nearby projects. Unfortunately, through the lack of a standard data definition for geotechnical data, there exists significant difficulty in archiving, reusing and sharing data. This problem has been exacerbated by the dependence on computer software as the standard for design, construction, and maintenance of new and existing infrastructure projects.

STUDY OBJECTIVES:
The objective of "Development of Geotechnical Data Schema in Transportation" is to develop an international standard interchange format for geotechnical data. This standard will include a data dictionary and XML schema which are GML compliant. The dictionary and schema will include a structure for geotechnical data, foundation data, and geophysical data as well as a method for adding new features and guidelines for adding to the schema. This standard will be submitted to international bodies for acceptance.

RESEARCH TASKS:
1. Develop the strawman schema;
2. Develop straw survey;
3. Send to GMS team;
4. Finalize survey questions;
5. Response comments from GMS;
6. Distribute survey;
7. Reduce survey data;
8. Daft out for comments;
9. Final schema/dictionary delivered;
10. Develop additional straw dictionaries, hierarchy and schema; and
11. Finalize new elements for draft schema.

PROJECT DELIVERABLES:
● Final hierarchy and schema of new elements, and reports as required.

http://www.diggsml.org/

As per FMIS, participating states include: CA($225,000), CONN($25,000), GA($25,000), IND($25,000), KY($70,000), MINN($25,000), MO($20,000), N CAR($15,000), OHIO($40,000), TENN($75,000)
STATE FISCAL YEAR 2012

Project Title: Phase 2 - A Comparison of Optical Gradation Devices to Current Test Methods

State Job Number: 134330
Project Type: Materials
Research Agency: Infrastructure Management and Engineering, Inc.
Funding Type: 80/20 Federal/State
Total Project Cost: $114,120.74
Start Date: 1/17/2007
End Date: 12/31/2010

Researchers: Arudi Rajagopal
Technical Liaisons: Jeff Wigdahl

STATEMENT OF NEED:
In Phase I of this study, the performance of the selected optical devices was compared with the conventional AASHTO procedures. At the conclusion of Phase I, the researchers recommended that a comprehensive evaluation of the selected device be undertaken in order to validate the initial findings. In Phase II of this study, the researchers will evaluate reliability, repeatability, precision, and durability of this device.

STUDY OBJECTIVES:
The primary objective of the Phase 2 - A Comparison of Optical Gradation Devices to Current Test Methods study is to conduct tests on additional aggregate sources. After completing the laboratory tests, the researchers will analyze the data and prepare recommendations for ODOT to revise specifications and to purchase equipment based on the capability, precision, durability, and cost of the evaluated equipment.

RESEARCH TASKS:
1. Collect aggregate samples.
2. Conduct standard laboratory tests.
3. Develop a database and analyze data.
4. Prepare recommendations.

PROJECT DELIVERABLES:
Final reports as required.
STATEMENT OF NEED:
Performance curves generated from ODOT’s pavement condition rating database have shown the rubblize and roll rehabilitation technique for reinforced concrete pavement will result in performance approximately the same as a flexible pavement. This data is primarily based on data collected from pavements rubblized with a sonic beam breaker. Recently, two types of multi head breakers (MHB), one manufactured by Antigo Construction and one manufactured by Specialties, Inc., have been contracted to rubblize concrete pavement in Ohio. Evaluation of the break patterns produced by these MHB under a current ODOT research project, entitled Investigation of Pavement Cracking on SR-4 and Demonstration of Multi-head Breaker in Fracturing Reinforced PCC Pavement before Overlay, focuses on break and seat and has shown these breakers may or may not produce the specified break pattern. Further research focusing on rubblization is needed to determine: 1) If either MHB can produce a specified break pattern on a consistent basis and 2) The amount of breakage needed to achieve performance equal to a flexble pavement.

STUDY OBJECTIVES:
The objective of the Evaluation of Rubblization Projects in Ohio study is to develop appropriate guidelines for reinforced concrete pavement rubblization in Ohio.

RESEARCH TASKS:
Specific tasks included the following:
Task 1: Evaluate the use of rubblization in other states.
Task 2: Evaluate the performance of rubblization projects in Ohio.
Task 3: Dig a test pit to evaluate the break pattern produced by the MHB. Compare the results with the evaluation of test pits on SR 4 in Montgomery County, I-71 in Fayette County, and US-36 in Coshocton County performed under the research project entitled Investigation of Pavement Cracking on SR-4 and Demonstration of the Multi-Head Breaker in Fracturing Reinforced Concrete Pavements before Asphalt Overlay.

PROJECT DELIVERABLES:
1. A final report documenting all of the work performed for this project.
2. Construction guidelines for fracturing reinforced concrete pavement prior to overlay.
PROBLEM STATEMENT:
In March 2000, the Ohio DOT initiated a study to design a project to statistically verify the effectiveness of ODOT’s current crack sealing program on pavement condition and life. The primary objective of that study was to determine if crack sealing was cost effective and, if so, to determine the optimal time, in terms of pavement condition rating or distress, to perform the sealing operation. From 2000 through 2002, the researchers worked with the Office of Pavement Engineering (OPE), the Districts, and Counties to initiate the field experiment, set up over 700 test sections (including control sections), conduct preliminary pavement condition evaluations, develop an interactive database, and establish guidelines for long term monitoring. ODOT has continued to collect data according to procedures recommended by the researchers after 2002. In early 2005, OPE asked the original PI to conduct a preliminary review of the data. The researcher critically reviewed the database and reported two important findings: 1) The database is incomplete with respect to certain fields, i.e., the crack seal date is missing; and 2) The pavement performance on certain test sections does not follow a logical trend, i.e. spikes in the pavement performance time plot.

STUDY OBJECTIVES:
The objective of this project is to critically review, verify data integrity and completeness, and validate the crack seal database. Phase 1 is for verification of data integrity, completeness and validation of crack seal database. Phase 2 is for analysis of effectiveness of crack sealing on pavement serviceability and life.

RESEARCH TASKS:
1. Review the contents of the database for its completeness.
2. Prepare a list of sections where the data is missing; identify sources for locating sources of missing data; collect the missing data from these sources; and update the database.
3. Perform data screening, verification and validation checks by performing a range of tests, or by manually reconciling suspect values.
4. Visit randomly at least 20% of the sites to verify the PCR data.
5. Submit an updated and validated version of ODOT-ECS.
6. Submit an interim report detailing the work performed.
7. Perform a comprehensive analysis of the performance data available in the database for the test sections and control sections to determine the cost effectiveness of sealing cracks in asphalt surfaced pavements.
8. Submit a final report detailing the work performed for this project.

PROJECT DELIVERABLES:
1. An updated and validated database.
2. Standard reports as required by the RD&T2 Manual of Procedures.
STATEMENT OF NEED:
The Indiana bat is a federally endangered species that is present, or potentially present, within all 88 Ohio Counties. ODOT's roadway program is associated with several activities that result in impacts to the bat. In accordance with the Endangered Species Act of 1973, federal agencies are required "to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of any habitat of such species determined to be critical unless an exemption has been granted." As a result, ODOT (often acting on FHWA's behalf and using federal funds) must plan and implement its program in a manner that avoids or minimizes impacts to the Indiana bat. The more information that is learned about the Indiana bat and its behavior, the more successful, cost effective, and efficient ODOT will be in planning projects and avoiding impacts to the bat on a project specific and statewide level.

STUDY OBJECTIVES:
The objectives of this study are to: 1) determine characteristics of trees used by Indiana bats for roosting and rearing of offspring; 2) determine characteristics of patches of habitat surrounding roost trees to identify habitats that are ecologically important for conservation of Indiana bats; 3) determine characteristics of foraging habitats used by Indiana bats during the summer; 4) determine the proportion of females that return to the same maternity colony area among successive years; 5) determine the summer and annual survival rates of adult and juvenile bats; 6) determine the proportion of adult females that give birth each year; and 7) determine the return rates of juvenile bats to the maternity roosting area from one year to the next.

RESEARCH TASKS:
The tasks of this study are: 1) capture Indiana bats during May-August 2007-2009 using mist nets set adjacent to roost trees, across flight corridors, and beneath forest canopies throughout the study area; 2) assess sex, reproductive condition, and age (adult or juvenile); 3) band captured bats with lipped bands (Model 1BR3521, Lambournes, Leominster, England) stamped with a unique 4-digit number and the letters "OHIO DNR"; 4) attach transmitters (Holohil Systems, Carp, Ontario, Canada) to the mid-sagittal dorsal portion of 30 female Indiana bats by using surgical adhesive (Skin-Bond Cement, Smith & Nephew, Largo, Florida); 5) radio-tagged bats will be monitored using hand-held telemetry equipment and aircraft to determine their location and monitor survival; 6) create a GIS habitat map of the study area by using existing vegetation type data; 7) determine what habitats are preferred by Indiana bats during the summer for foraging and roosting; 8) estimate summer and annual survival for radio-tagged bats in each sex class; 9) Estimate return rate of adult and juvenile bats to the study area in subsequent years; and 10) estimate the proportion of female bats that produce offspring each year.

DELIVERABLES:
Reports as required.
Project Title: Evaluation of Geotextile Fabric in Undercut on MSE Wall Stability

State Job Number: 134396
Project Type: Structures
Research Agency: Cleveland State University
Funding Type: 80/20 Federal/State
Total Project Cost: $19,849.25
Start Date: 3/1/2009
End Date: 12/31/2010

Researchers: Lutful Khan
Technical Liaisons: Peter Narsavage
                      Jawdat Siddiqi

PROBLEM STATEMENT:
Compaction of granular base materials at sites with fine grained native soils often causes unwanted material loss due to penetration. In 2007, ODOT began placing geotextile fabrics in the undercut of MSE walls to facilitate construction. It is probable that the sliding resistances of the retaining walls are affected by this practice. At this time, it is unknown how the frictional resistances at the base of the MSE walls changes by the addition of geotextiles and, if the factor of safety against sliding failure is compromised to an unacceptable level. It is essential to verify the reliability of this practice because serious financial and safety consequences could results if these walls should fail.

STUDY OBJECTIVES:
The central objective of "Evaluation of Geotextile Fabric in Undercut on MSE Wall Stability" is to evaluate the sliding resistance of the MSE walls built with geotextile at the interface of granulate backfill and native soil, by means of a series of direct shear tests performed in the laboratory. The frictional resistance at the backfill/geotextile interface will be determined and compared to that of backfill/soil interface. In case of a deviation, specific recommendations will be made to modify the current design specifications. Alternatively, it if is determined that no significant change occurs in the frictional resistance, the objective will be to provide all documentation supporting the current design practice. If time permits, small-scale replicas will be built in the lab to validate these shear tests.

RESEARCH TASKS:
The work plan consists of conducting a series of direct shear tests to determine the various friction angles that exist between the different soil interfaces and fabric/soil interfaces. IF time permits, small-scale replicas will be built in the lab to validate the results from the direct shear test. Prior to performing these tests, a large-scale shear device will be designed and fabricated at the CSU machine shop. The standard AASHTO designation T 236-72 testing procedure is inadequate to handle the large nature of these specimens. Another obstacle that must be overcome is the geotextile rolling up during the shear testing. The shear device must be modified to compensate for this.

PROJECT DELIVERABLES:
Quarterly progress reports, draft final report and executive summary, approved final report and executive summaries, article for newsletter, and participation in project start-up meeting, review session, and project wrap-up meeting
**AWAITING REPORT RESEARCH PROJECT**

**SPR - PART 2 WORK PROGRAM**

**RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER**

**STATE FISCAL YEAR 2012**

**Project Title:** GPS-Based Household Interview Survey for the Cincinnati Ohio Region

**State Job Number:** 134421

**Project Type:** Planning

**Research Agency:** Abt SRBI

**Funding Type:** 80/20 Federal/State

**Total Project Cost:** $1,299,918.62

**Start Date:** 10/17/2008

**End Date:** 6/30/2011

**Researchers:** Laurie Wargelin

**Technical Liasons:** Greg Giaimo

Ansen Wu

Rebekah Anderson

STATEMENT OF NEED:
Travel Demand Forecasting Models (TDFM) employ many statistical models to generate estimates of trip generation, distribution and modal split in most urban areas. These models are then used in a variety of purposes, including roadway design and air quality conformity analyses. TDFMs are estimated from information collected from Household Interview Surveys (HIS). Traditionally, HISs have been conducted by recruiting households to complete a paper travel diary on their one or two travel days, and to report that information back over the phone. This requires a substantial burden on the part of the interviewee and has led to poor response rates and missing data. Global Position System (GPS) devices have been used in recent years in conjunction with HIS to help determine the level of underreporting inherent in the traditional diary-based surveys. In recent years, technology has advanced so that GPS devices are now of a size that can be carried around by a person without hardship; hence, it is now possible to capture all trips by an individual person via GPS, instead of only vehicle trips. It is appealing to conduct an entire HIS utilizing GPS tracking, as it reduces respondent burden and underreporting and potentially reduces the cost of the survey. It also provides detailed geographic information about trips not captured by traditional survey methods that could potentially influence the way trips are modeled. However, a large scale GPS-based survey has not been conducted in the United States, and it is uncertain whether a GPS-based survey is able to capture all information that has historically been available in a diary-based survey, such as trip purpose, mode, travel cost (e.g. transit fare, driving cost and parking cost) and vehicle occupancy.

STUDY OBJECTIVES:
The objectives of “GPS-Based Household Interview Survey for the Cincinnati, Ohio Region” are to collect multiple-day data from a sample of households, using portable GPS devices, and then to improve existing processing software, so as to provide output data that are comparable in content to the data achieved from conventional diary surveys and that can support current modeling approaches in the state of Ohio.

RESEARCH TASKS:
Task 1 - Oversight Committee
Task 2 - Work Plan
Task 3 - Survey Instruments and Materials
Task 4 - Sample Design and Response Rate
Task 5 - Interviewer Training and Survey Processing
Task 6 - Survey
Task 7 - GPS Data Processing
Task 8 - Geocoding, Data Quality Control and Data Implementation
Task 9 - Survey Data Weighting and Expansion
Task 10 - Final Report

PROJECT DELIVERABLES:
A final report detailing the survey methods, results of the GPS-based survey and the diary-based control group, weighting methodology, trip defining algorithms, imputing methods, limitations of both types of surveys, and recommendations on what type of survey is appropriate in what situations. Geocoded, weighted survey data in dbf format. Files with GPS coordinates and acceleration rates and speeds for each trip recorded from the GPS units. Survey instruments. Technical memoranda from tasks and other required reports.

Tuesday, May 17, 2011
AWAITING REPORT RESEARCH PROJECT
SPR - PART 2 WORK PROGRAM
RESEARCH, DEVELOPMENT AND TECHNOLOGY TRANSFER
STATE FISCAL YEAR 2012

Project Title: Investigate Feasibility of Using Ground Penetrating Radar in QC-QA of Rubblization Projects

State Job Number: 134431
Project Type: Pavement

Research Agency: Infrastructure Management and Engineering
Funding Type: 80/20 Federal/State
Total Project Cost: $87,102.53
Start Date: 2/23/2009
End Date: 6/23/2010

State Fiscal Year 2012

PROJECT TITLE: Investigate Feasibility of Using Ground Penetrating Radar in QC-QA of Rubblization Projects

STATEMENT OF NEED:
ODOT constructed its first rubblization project in 1988. Since then, the department has consistently used this treatment on many of its rehabilitation projects. A thorough QC/QA process is critical to the successful completion of a rehabilitation program. To ensure the extent of breaking meets the desired size specifications, a test pit is made at the beginning of a project to check for proper particle size throughout the thickness of the concrete. Once the engineer has verified the specification requirements are being met, field personnel rely on visual observation of fracturing pattern obtained on the top surface and assume there is a fairly similar pattern through the depth of concrete. Preliminary testing conducted by the researcher has indicated that surface appearance may not be indicative of actual condition. There is a need for continued monitoring of the fracturing process; however, test pits are destructive tests, time consuming, and costly. An alternative procedure that can monitor fracturing results with reduced effort, perhaps in real-time, is needed.

STUDY OBJECTIVES:
The objective of "Investigate Feasibility of Using Ground Penetrating Radar in QC/QA of Rubblization Projects" is to determine whether GPR is a suitable technology for mapping the physical condition of fractured slab rapidly, without disturbing the fractured layer.

RESEARCH TASKS:
Task 1 - Review current QC/QA procedure.
Task 2 - Review GPR technology
Task 3 - Identify rubblization projects and setup test section
Task 4 - Conduct field studies
Task 5 - Construct physical models in a lab
Task 6 - Analysis and reporting

PROJECT DELIVERABLES:
Reports as required.
PROBLEM STATEMENT:
Urban yard waste poses solid waste management difficulties for many communities. In many areas, municipal solid waste is disposed of in sanitary landfills. However, yard waste may not be landfilled. Communities must collect and dispose of this separately. With the increasing cost of fuel, separate yard waste collection is an increasing financial burden on these communities. Furthermore, there are few waste management alternatives for yard waste. Most communities compost yard waste but this is not an ideal solution: (1) composting takes time, energy, and a large amount of space; (2) yard waste compost is not in high demand as a consumer product; (3) yard waste composting can lead to aesthetic problems such as concern about odor; (4) yard waste composting can lead to concerns about plant and animal pathogens that are not deactivated in compost piles; and (5) composting yard waste releases all of the CO2 potential of this organic waste.

CWRU has been evaluating an alternative method of managing yard waste. Research is evaluating the potential of managing yard waste by carbonization. This offers the possibility of allowing for co-collection of yard waste with conventional solid waste (i.e. in one truck instead of two), yard waste management at landfill sites rather than at separate composting facilities, production of soil amendment products that permanently sequester CO2 (carbon added to soil has been shown to increase crop productivity), and the production of valuable byproducts during the carbonization process. This proposed research will explore the possibility of recovering bioasphalt bitumen from yard waste carbonization processes. This will produce a non-petroleum based product of value to the transportation industry that results from a “carbon negative” process that sequesters more CO2 than it releases. The amount of bitumen that can be produced from yard waste, the physical and chemical properties of this bitumen, and the carbonization operating conditions under which the production of this material is optimized are all unknown, but the potential advantages of this yard waste management strategy are compelling.

STUDY OBJECTIVES:
The objective of “Bioasphalt from Urban Yard Waste Carbonization” is to conduct groundbreaking research to answer fundamental questions about the potential of yard waste carbonization (YWC) to produce a practical bitumen product that could be used to produce bioasphalt.

RESEARCH TASKS:
Task 1 - Design and fabrication of reactors to optimized production of YWC bitumen
Task 2 - Determine what tests should be used to characterize YWC bitumen
Task 3 - Communicate with professional and manufacturer organizations
Task 4 - Identify and communicate with Ohio universities interested in asphalt research
Task 5 - Evaluate conditions under which YWC bitumen production is optimized
Task 6 - Evaluate the bitumen mass yield fractions of yard waste components
Task 7 - Evaluate the volume and composition of YWC non-bituminous products
Task 8 - Carbonize sufficient waste to produce enough bitumen for bioasphalt property testing
Task 9 - Plan for expanding this research to a pilot-scale project
Task 10 - Publicize Research Results

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Draft and approved versions of a final report and executive summary (including electronic versions)
3) Participation in required meetings (i.e. start-up, review, results presentation
4) Article for R&D newsletter
PROBLEM STATEMENT:
As part of the certification under the Clean Water Act 404 Nationwide Permit (NWP) in 2002, the Ohio Environmental Protection Agency (OEPA) mandated that the Ohio Department of Transportation (ODOT) install bankfull culverts in all new culvert installations subject to the permit. Bankfull culverts are designed to approximate the waterway’s width/depth ratio at bankfull discharge and they are required to be buried or depressed approximately 10% below the grade of the waterway. The bankfull discharge is the point where the stream bank starts to overflow its banks onto the adjacent floodplain. By embedding the culvert, the bottom of the culvert is to take on the characteristics of the natural streambed and promote the passage of fish and other aquatic organisms. The OEPA’s requirement to install bankfull culverts has resulted in increased design and construction costs. Preliminary investigations conducted at Cleveland State University indicate that the increased cost may be $1 million or more for a standard culvert design. Despite this increased cost, a search of the literature reveals that there has been no published research conducted to determine under what physical conditions bankfull culverts are effective in establishing a natural channel bottom or in allowing for the passage of migratory aquatic species present in Ohio waterways. In fact, preliminary investigations conducted at Cleveland State University indicate limited, if any, environmental benefits in several installations, especially when installed at greater than approximately 1.5 % slope or in smaller streams subject to significant spates (large variations in flow).

Currently, the OEPA’s general conditions for the new NWP program would require that bankfull culverts with depressed inverts on all new culverts installed at a slope of less than 3% despite the lack of scientific evidence indicating when these culvert design techniques are appropriate and effective. More research must be done to determine the effectiveness of these culvert design techniques to justify the expenditure of funds and to assure that future regulations are developed based on sound science.

STUDY OBJECTIVES:
The objectives of "Study of Bankfull Culvert Design Effectiveness" are to examine the parameters which control the benefits (both hydrologic and environmental) of bankfull culverts when installed.

RESEARCH TASKS:
Task 1 - Literature review
Task 2 - Survey of Existing Culverts
Task 3 - Analysis of Data
Task 4 - Hydrologic Modeling

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Draft and approved versions of a final report and executive summary (including electronic versions)
3) Participation in required meetings (i.e. start-up, review, results presentation)
4) Article for R&D newsletter
PROBLEM STATEMENT:
The Veterans' Glass City Skyway (VGCS), formerly known as the Maumee River Crossing, is one of only two installations in the United States that uses a new cable-stayed cradle system that eliminates anchorages in the pylon by carrying the stays from anchorages in the bridge deck, through the pylon and back to anchorages in the deck. The stay cables consist of a series of parallel stainless steel tubes inside a larger stainless steel outer sheathing. The stainless steel sheathing offers aesthetic and life cycle cost advantages over other materials; however, there have also been other unexpected results. Specifically, ice accumulates on the stays, which presents safety issues for the motorists traveling below. When this occurs, the department must close lanes in each direction until the ice is gone. This landmark structure, which is an important connector for multimodal transportation and economic development, has thousands of vehicles crossing daily. Extended lane closures impede economic activity and are a tremendous inconvenience to the traveling public and the surrounding community. A cost effective method to safely and efficiently remove ice from the stays without damaging the structure or causing additional safety concerns and delays to the public is desirable. A cost effective method to prevent the formation of ice on the stays is preferable.

STUDY OBJECTIVES:
The objective of "Ice Prevention or Removal on the Veteran's Glass City Skyway Cables" is to identify of the most effective and reliable solution to this problem. It is intended to implement a cost effective solution prior to next winter season. This is necessary for the safety of the traveling public along with minimizing the inconvenience due to traffic delays caused by closing two of the available three lanes of traffic. It is anticipated that the research performed will determine if a cost effective solution is available that will not impact the aesthetics of the stainless steel cables. This research may not only benefit the Veterans’ Glass City Skyway but cable stay bridges across the world that encounter icing conditions.

RESEARCH TASKS:
Task 1 - Identify all available technologies and procedures that could be used to solve this problem.
Task 2 - Examine the advantages, disadvantages and potential applicability of each on the VGCS.
Task 3 - Recommend at least three viable solutions.
Task 4 - Provide an interim report that includes a summary of the findings from steps 1 & 2; and a detailed description and benefit/cost analysis for each recommended solution in step 3 (along with an estimate of the budget and time needed to complete step 5 for each recommendation).
Task 5 - Based on review and approval by the department, fully develop the selected recommendation for implementation.

PROJECT DELIVERABLES:
1) Quarterly progress reports
2) Interim Report
3) Draft and approved versions of a final report and executive summary (including electronic versions)
4) Participation in required meetings (i.e. start-up, review, results presentation
5) Article for R&D newsletter

Tuesday, May 17, 2011
Project Title: Instrumentation of the Maumee River Crossing  
State Job Number: 426354  
Project Type: Structures  
Research Agency: University of Cincinnati  
Funding Type: 80/20 Federal/State  
Total Project Cost: $459,766.00  
Start Date: 12/15/2003  
End Date: 6/15/2011  
Researchers: Arthur Helmicki  
Douglas K. Nims  
Victor Hunt  
Technical Liasons: Tim Keller  
Mike Loeffler  

STATEMENT OF NEED:  
The Ohio Department of Transportation is currently undertaking the construction of the Maumee River Crossing (MRC) in Toledo, Ohio. This structure will consist of 56 approach spans (totaling 7,273') and a main span unit of 1,525' from expansion joint to expansion joint, crossing the Maumee River for an overall bridge length of 8,798'. The structure is of pre-cast segmental concrete design with a deck system nearly 120' wide carrying three lanes of traffic in each direction. The main support tower will be 379'-3" above the waterline and the main span unit will sit more than 120' above the Maumee River.  

The design specifications require the structure to be able to carry Michigan Grain Train Truck loading in addition to the standard AASHTO HS25-44 and alternate military live loadings. The construction plans call for a portion of the erection to occur directly over the existing I-280 interstate in a staged fashion making use of temporary pier columns so as to allow continued use of the interstate during erection. The main span unit of the MRC will be one of Ohio’s first long-span, cable-stayed bridges and one of only a few dozen such bridges in service in the nation at this writing. As such, this structure will be vastly different from the types of structures that are currently in the Ohio bridge inventory. In fact, bridges of this design type, together with the set of associated construction technologies necessary to build them, have been used extensively around the world for only the past two decades.  

Because of the relative novelty of a cable stayed bridge’s design, it is important to address the issues related to maintenance and bridge management early on with an effective bridge monitoring system so that long-term bridge behavior, as well as any changes in bridge condition can be determined.  

STUDY OBJECTIVES:  
The objectives of the Instrumentation of the Maumee River Crossing study are to: 1) develop a detailed instrumentation and testing plan; 2) collect data during construction and in-service periods that will be used to field calibrate and verify a main span finite element model; 3) verify design assumptions and erection load conditions; and 4) assemble a database of measurements for use as a supplement to the designer’s maintenance manual.  

RESEARCH TASKS:  
1. Develop and calibrate a 3-D analytical model of the main span of the bridge.  
2. Establish test schedule.  
3. Establish final sensor and cable layouts.  
4. Install sensor suite.  
5. Conduct construction event and ambient monitoring.  
6. Perform field tests for baseline and service condition assessment.  

PROJECT DELIVERABLES:  
Project deliverables will include: a final report of research findings; calibrated analytical finite element models of the main span; detailed instrumentation of the bridge’s critical locations; a database of all field tests including various construction events; a detailed analysis of all data obtained from field tests; the development and presentation of a training event to ODOT personnel; and recommendations of a health monitoring program.