1) Strategic Research Focus Areas

2) FHWA Program Approval

3) SPR2 Financial Summary

4) Active Project List

5) Active Project Abstracts

6) Proposed Project List

7) Proposed Project Abstracts

8) Pooled Fund Commitments

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

Goals
The primary goal of the RD&T2 program is to provide decision makers with the information and tools they need to meet the evolving transportation needs of Ohioans and the traveling public. The secondary goals of the program include: maximizing research investments; taking advantage of new technologies; and producing practical research results with strong implementation potential.

Jennifer Townley, Deputy Director
Division of Planning

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

Cynthia Jones, Section Head
Research Section

In cooperation with the U.S.
Department of Transportation, Ohio
Division of the Federal Highway Administration
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. Below are the RD&T² program’s three focus areas. The focus areas guide how the majority of program funds are expended. However, in acknowledgment of specialized or urgent needs program funding will not be limited to these broad based areas.

Transportation Infrastructure Preservation and Enhancement
ODOT’s largest asset is its transportation infrastructure, such as roads, bridges, intermodal facilities, railways and ports. Through usage and the passage of time, the system degrades and can become inadequate for both current and projected travel demands. Maintenance of the infrastructure presents many challenges as well as opportunities for improvements. Developing methods to better utilize resources and integrate advances in science, technology, and construction techniques will assist ODOT in efforts to both modernize and support our system.

Organizational Transformation
ODOT is faced with challenging situations brought about by economics, demographics, management trends, downsizing, shifts in federal funding, and increased maintenance needs. Research can guide ODOT in creating opportunities to foster innovation, leverage resources, and streamline and enhance both decision making and project delivery.

Transportation Safety
Ensuring the safety of those utilizing and maintaining our transportation system is a priority for ODOT. The traveling public expects the system to meet their individual needs in a manner that is safe, convenient, economic, and efficient with minimal disruption to their daily routines. In addition, protection for highway crews working on-location is a prominent concern. Identifying, developing and implementing corrective strategies before hazardous events occur is key to advancing a safe and reliable transportation system.
## ODOT Research Financial Forecast

As of May 31, 2016

<table>
<thead>
<tr>
<th>Estimated Allocation</th>
<th>Current Year Budget (SFY 17)</th>
<th>Future Year Budgets</th>
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<th>Estimated Ending Balance</th>
<th>Current Year Budget (SFY 17)</th>
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<td>Development of Transportation Asset Management Decision Support Tools</td>
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<td>2 134661</td>
<td>Polymeric Thermochromic Dye for Improvement of Asphalt Pavement Durability</td>
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<td>3 134690</td>
<td>Structures Research Services</td>
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<td>4 134702</td>
<td>Effectiveness of Asphalt Penetrating Sealers in Extending New Asphalt Pavement Life</td>
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<td>Development of an Automated System for QC/QA of Asphalt and Aggregate Materials - Phase 2</td>
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<td>Assessment of ODOT's Conduit Service Life Prediction Methodology</td>
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<td>7 134731</td>
<td>Procedures for Waste Management from Street Sweeping and Storm Water Systems</td>
<td>43</td>
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<td>8 134740</td>
<td>Evaluation of GPS/AVL Systems for Snow &amp; Ice Operations Resource Management</td>
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<td>Passenger Flow Estimation and Characteristics Expansion</td>
<td>36</td>
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<td>Evaluation of High Performance Pavement and Bridge Deck Wearing Surface Repair Materials</td>
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<td>11 134820</td>
<td>Development of a Pavement Marking Materials Matrix for ODOT District 11</td>
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<td>12 134821/135013</td>
<td>Alternative Stream Channel Maintenance at Bridge Crossings</td>
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<td>13 134831</td>
<td>Development of an Overlay Design Procedure for Composite Pavements</td>
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<td>Evaluating Vegetation Management Practices for Woody and Herbaceous Vegetation</td>
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<td>15 134835</td>
<td>AASHTO Transportation System Preservation (TSP2)</td>
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<td>Implementation and Transition of Data Interchange for Geotechnical and Geoenvironmental Specialists (DIGGS)</td>
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<td>Waterproofing Details of Connections for Adjacent Precast Concrete Box-Beam Bridges</td>
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<td>Transportation Curriculum Coordination Council (TC3)</td>
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<td>19 134877</td>
<td>Estimating External Travel Using Purchased Third-Party Data</td>
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<td>20 134881</td>
<td>Bubble Plate Implementation</td>
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<td>Evaluation and Analysis of Liquid Deicers for Winter Maintenance</td>
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<td>Extended Life Concrete Bridge Decks Utilizing Improved Internal Curing to Reduce Cracking</td>
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<td>23 134989</td>
<td>Analysis of Ground Tire Rubber (GTR) in Mix Design on Local Roadways in Ohio</td>
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<td>24 134993</td>
<td>Hydraulic Engineering Research On-Call Services (ROC)</td>
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<td>25 134994</td>
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<td>26 134996</td>
<td>Forensic Study of Early Failures with Unbonded Concrete Overlays</td>
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<td>Evaluation and Design of a TL-3 Bridge Guardrail System Mounted to Steel Fascia Beams</td>
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<td>28 135024</td>
<td>Effectiveness of Wildlife Mitigation Treatments on the Nelsonville Bypass</td>
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<td>Performance Comparison of Abutment and Retaining Wall Drainage Systems</td>
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<td>30 135031</td>
<td>Inspection, Repair, Retrofit Procedures, and Design Recommendations for Non-Redundant Steel Structures</td>
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<td>Veteran's Glass City Skyway Ice Dashboard Implementation</td>
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<td>Graphical Design Task Order</td>
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<td>Validation and Calibration of Finite Element of Forces in Wingwalls</td>
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<td>34 135103</td>
<td>Understanding the Soil Plugging Mechanism in Large Open Ended Pipe</td>
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<td>LUC-2-1682 Long Term Maintenance of the Anthony Wayne Suspension Bridge Main Cables</td>
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<td>Development and Field Testing of an Automatic Turning Movements Identification System</td>
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<td>37</td>
<td>Fundamental Evaluation of the Interaction between RAS/RAP and Virgin Asphalt Binders</td>
<td>24</td>
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<td>38</td>
<td>Technical Editing for Ohio DOT Research Reports</td>
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<td>39</td>
<td>Route Optimization for ODOT Snow Plow Trucks, Phase 1</td>
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<td>Investigate Feasibility of GPR to Measure In-Place Density of New Asphalt Pavement</td>
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<td>41</td>
<td>Evaluation of Safety Practices for Short Duration Work Zones</td>
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<td>Effective and Efficient Roadside Ditch Cleaning Using BMPs for Erosion and Sediment Control</td>
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<td>AASHTOWare Project 3.01 Software</td>
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<td>Bridge Condition Index for Transportation Asset Management in Ohio</td>
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<td>Determining Optimum Thickness for Long-Life Concrete Pavement in Ohio</td>
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<td>Synthesis of Research on Load Capacity of Concrete Slabs Without Plans</td>
<td>17</td>
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<td>48</td>
<td>Assessment of Salt Procurement and Distribution Processes</td>
<td>24</td>
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<td>No Boundaries Roadway Maintenance Practices</td>
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<td>Structural Benefits of Concrete Paving of Steel Culvert Inverts</td>
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<td>Structures Research On-Call Services</td>
<td>24</td>
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<tr>
<td>52</td>
<td>Best Practices of Road User Maintenance Agreements Amongst Local Government Agencies in Ohio</td>
<td>16</td>
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<td>53</td>
<td>Evaluation of Roadway Subsurface Drainage on Rural Routes</td>
<td>24</td>
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<td>54</td>
<td>Update Regional Skew Characteristics of Annual Peak Flows Through StreamStats</td>
<td>28</td>
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<td>55</td>
<td>Evaluating the Particle Size Distribution of Ohio's Stormwater Runoff</td>
<td>32</td>
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<td>56</td>
<td>Reduction of Bridge Deck Cracking through Alternative Material Usage</td>
<td>28</td>
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<td>57</td>
<td>Recommendations and Strategies for IRP Truck Licensing Impacts for Ohio Counties</td>
<td>12</td>
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<td>58</td>
<td>Dedolomitization and Alkali Reactions in Ohio-Sourced Dolostone Aggregates</td>
<td>16</td>
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<td>59</td>
<td>Operation &amp; Maintenance of a Statewide Crest-Stage Stream Gauging Network in Ohio July 2015 - June 2019</td>
<td>216</td>
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<td>60</td>
<td>Earthen Berm Noise Reduction Analysis</td>
<td>12</td>
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<td>61</td>
<td>Crack Resistance and Durability of RAS Asphalt Mixtures</td>
<td>10</td>
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<td>62</td>
<td>Timber Rattlesnakes' (Crotalus horridus) Use of Man-made Rocky Features Constructed in Roadway Right-of-Ways</td>
<td>15</td>
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<td>63</td>
<td>Streamlining Implementation of Sustainable Channel Maintenance Practices</td>
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<td>Bonded Concrete Overlay (BCO) Cost Effectiveness Evaluation</td>
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<td>Evaluation of Optional and/or Replacement Concrete Sealers</td>
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$20,599,238.88
Project Title: Development of Transportation Asset Management Decision Support Tools

Research Agency: University of Toledo

Researcher: Eddie Y. Chou

Status: Active

State Job #: 134639

RFP #: 2012-20

Start Date: January 15, 2012

End Date: August 30, 2017

Classification: OPREP

Project Type: Planning

Technical Lead: Andrew Williams

Abstract:

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
Project Title: Polymeric Thermochromic Dye for Improvement of Asphalt Pavement Durability

Research Agency: Case Western Reserve University

Status: Active

State Job #: 134661

RFP #: 2012-23

Start Date: July 10, 2012

End Date: January 10, 2016

Researcher: Bill Yu

Technical Lead: David Powers

Classification: OPREP

Project Type: Pavements

Abstract:

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.
Project Title: Structures Research Services

Research Agency: Ohio University

Researcher: Eric Steinberg

Status: Active

State Job #: 134690

RFP #: 2013-05

State Fiscal Year: 2017

Start Date: July 13, 2012

End Date: October 26, 2016

Classification: Standard

Technical Lead: Tim Keller

Project Type: Structures

Abstract:

STATEMENT OF NEED:
The Ohio Department of Transportation (ODOT) is a large state agency charged with management and maintenance a vast transportation system in Ohio. ODOT strives to execute its charge in the most effective and efficient manner possible. Frequently, ODOT encounters situations where low cost, short term research services are needed to meet immediate needs for system management and maintenance improvements. Some of the short term research needs may go unmet due to the immediacy of the need and the perceived long delay in navigating ODOT’s research process.

STUDY OBJECTIVES:
The objective of "Structures Research Services" is to establish an on-call contract with a research team possessing strong expertise in the field of structural engineering to conduct low cost, short term research in advance of identifying specific research needs.

RESEARCH TASKS:
Specific research tasks will be determined as needs arise. Potential research topics may include, but are not limited, to the following:
1) Assist with forensic investigations when concerns are raised about a bridge
2) Investigate physical properties and structural behavior on unique and special bridges to model and determine forces, capacities, failure, modes, etc.
3) Investigate the loadings within critical gusset plates using a photo-elastic material to better understand how the loads transfer through the gusset plate
4) Determine MSE wall long term stability and maintenance recommendations
5) Investigate concrete slab full depth cracking in continuous structures - causes and recommendations to alleviate cracking
6) Conducting a forensic investigation of a collapsed culvert in Licking County to determine the cause(s) of failure and how to avoid similar failures in this kind of installation.
7) Develop an experimental procedure for ascertaining the load carrying and stiffness contributions of the Carbon Fiber reinforced polymers.
8) Research for the development of standardized horizontal loading and safety requirements for bridge inspection access systems.
Abstract:

STATEMENT OF NEED:
Over the last 30 years, the Ohio Department of Transportation (ODOT) has investigated the benefits of using various asphalt rejuvenators. To date, results have been mixed. ODOT would like to test several of these products in a controlled research study to measure their effectiveness in extending the life of new asphalt pavement.

STUDY OBJECTIVES:
The objective of this research is to evaluate three products currently used by ODOT, Replay, supplied by Ohio Pavement Systems Inc., Reclamite, supplied by Pavement Technology Inc., and Bio-Re-Stor, supplied by Asphalt Systems Inc.

RESEARCH TASKS:
1. Measure in place asphalt permeability both before and after treatment and after 4 years in service for all treated and control sections. Use the air-induced field permeameter, developed by the Kentucky Transportation Cabinet, for this testing. For additional information on this research visit: http://www.ktc.uky.edu/Reports/KTC_01_19_SPR216_00_1F.pdf. The number of tests and test location for this testing will be determined by the researcher.
2. Perform detailed pavement condition surveys for all treated and control sections initially and annually for 4 years. Use the methods defined by the Long Term Pavement Performance Distress Manual (FHWA-RD-03-031, June 2003). The 500 foot sections used as a part of this distress survey will remain constant throughout the evaluation period.
3. Perform sand patch testing according to ASTM E 965-96 (Reapproved 2006) for all treated and control sections. Complete the testing initially and annually for 4 years. The number of tests and locations for this testing will be determined by the researcher. The location of the testing will remain constant thought out the evaluation period.
4. The Department also wishes to collect skid testing data on the treated and untreated sections. It is known that asphalt rejuvenating products such as these will reduce the initial skid resistance of the pavement. The Department will collect both smooth tire and ribbed tire skid data on all the treated and untreated sections. The timing of this testing will occur before treatment, after treatment, at 7 days, and finally after 30 days. It will be the researcher's responsibility to coordinate with our skid testers to schedule this testing and to summarize the results.
5. The researcher should plan on pulling and testing at least three, 4 inch or larger cores from each test section to show that the pavement was relatively uniform in density between test sections. Maximum Specific Gravity values for this purpose can be taken from each days TE-199 quality control report available through the construction project. Testing must be performed by an approved and experienced technician.
**Project Title:** Development of an Automated System for QC/QA of Asphalt and Aggregate Materials - Phase 2  
**Research Agency:** University of Akron  
**Researcher:** Ala R. Abbas  
**State Job #:** 134705 B  
**RFP #:** 2013-13 B  
**Status:** Active  
**Start Date:** June 23, 2014  
**End Date:** September 15, 2016  
**Classification:** Standard  
**Technical Lead:** David Powers  
**Project Type:** Materials  

**Abstract:**

The objective of this research is to design automated process improvements for ensuring QC/QA of asphalt and aggregate materials utilized by ODOT Contractors on highway projects. As ODOT moves towards becoming a leaner more efficient agency, research into the development of an automated process that enables Asphalt and Aggregate Contractors to directly input information into a system that conducts preliminary analysis for established quality controls measures is needed in order to fully streamline ODOT’s management of highway materials.

Phase I of this project is complete and focused on researching the development of an automated process that enables Asphalt and Aggregate Contractors to directly input information into a system that conducts preliminary analysis for established quality control measures, which is needed in order to fully streamline ODOT’s management of highway materials.

Phase 2 will develop the system in accordance with the approved interim report that was provided at the end of Phase I. Multiple user testing will be conducted throughout the development process, and adjustments to the system will be made based on testing as necessary to ensure proper functionality. Documentation will be developed and maintained on the system development in accordance with ODOT’s IT requirements. The system will be developed with oversight from ODOT’s IT division in collaboration with Outerbox (a subcontractor).

Phase 2 activities will include a pilot build and evaluation of the automated process, which would involve developing, adjusting, and testing the system to ensure that it functions properly; developing an online, interactive training module or user manual as part of the system; and developing a programmer guide to be used by ODOT information technology (IT) staff.

Phase 2 is pending ODOT IT Governance approval in July 2014.
Abstract:

STATEMENT OF NEED:
Currently, ODOT manages and maintains approximately 100,000 culverts statewide. The design, evaluation, and service life predictions of these assets are done in accordance with the Location and Design (L&D) Manual, Volume 2 (available online at: http://www.dot.state.oh.us/Divisions/Engineering/Hydraulic/LandD/Pages/LDManual,Volume2.aspx). The existing design service life predictions are limited to culverts and do not include other conduits such as storm sewer. The data utilized to develop ODOT’s methodology for predicting service life is from the 1970’s. Since then, additional conduit types, material types, and protective coatings have been introduced. As a result, the manner in which ODOT currently predicts service life for conduits may no longer be appropriate. ODOT’s current approach to conduit maintenance is reactionary. Deficiencies that are discovered by inspection or observations (i.e.: sinkholes) are addressed as they are identified. As a result, methods of conduit rehabilitation may be limited to more costly alternatives than would be available if a more proactive approach was available. An accurate service life estimate for conduit materials and protective coatings will allow ODOT to develop a proactive approach for conduit maintenance.

STUDY OBJECTIVES:
The research will evaluate the effectiveness of ODOT’s current methodology for estimating service life of culverts and it will evaluate metrics to be used for storm sewer conduits. The research will evaluate and propose alternative metrics, as necessary, to ensure accurate and reliable service life predictions. It is expected that a service life estimate would be made using degradation models developed through the research for various materials and protective coatings currently used by ODOT.
Abstract:

STATEMENT OF NEED:
Knowledge of handling waste materials from maintenance activities is currently limited. Temporary storage of collected material at ODOT facilities is currently allowed, but involves thorough understanding and better education of the regulations associated with the waste material. Once collected, the material is required to be properly separated into liquid and solid forms (decanting) prior to disposal at a waste facility. Currently, ODOT maintenance crews need economically feasible options for decanting this material once collected.

STUDY OBJECTIVES:
The research covered by this project may be utilized by multiple offices within ODOT. ODOT will use the research data and recommendations to update maintenance procedures and policies improving efficiency while decreasing regulatory risks. The material testing and literature research will be used to help inform regulatory entities for creating beneficial reuse strategies and ensuring ODOT’s interest are included. The research will help facility planning for use in optimizing equipment purchases and develop design criteria for ensuring purchased equipment is located and sized appropriate for demand requirements.
Project Title: Evaluation of GPS/AVL Systems for Snow & Ice Operations Resource Management

Research Agency: University of Akron

Researcher: Bill Schneider

Status: Active

State Job #: 134740

RFP #: 2013-01

Start Date: December 23, 2012

End Date: September 1, 2016

Classification: Standard

Technical Lead: Brian Olson

Project Type: Maintenance

Abstract:

STATEMENT OF NEED:
Beginning with the 2009-2010 winter season, ODOT implemented a ten truck GPS/AVL resource management system pilot at Cuyahoga County’s Independence Garage. For the past two winter seasons, ODOT has utilized the system and gathered information for the purposes of determining the advantages, disadvantages, and feasibility of using GPS/AVL as an enhanced method for the tracking and management of ODOT’s snow and ice resources. Based on the experiences from the pilot, the following three implementation levels have been established for the potential incorporation of GPS/AVL into ODOT’s snow and ice control program.

Level 1: Tracking of plow trucks
Level 2: Tracking of plow trucks with real-time snow & ice related telemetry
Level 3: Tracking of plow trucks with real-time snow & ice related telemetry and automated resource usage reporting

Thus far, ODOT has determined that GPS/AVL systems can be utilized to successfully track the real-time and historical locations of ODOT’s plow trucks. However, the system’s ability to be a true resource management system by providing consistent snow and ice removal related telemetry and producing accurate resource usage reports from the acquired data remains undetermined. Therefore, further evaluation and analysis of snow and ice based GPS/AVL systems is needed to assess the data accuracy required for automated resource usage reporting and the potential implementation of GPS/AVL as a resource management tool for ODOT’s snow and ice control operations.

STUDY OBJECTIVES:
The objective of this research is to identify, select, and implement GPS/AVL resource management systems in District 3 Medina County and District 4 Stark County and evaluate the technology’s potential to provide consistent and accurate data for the purposes of real-time snow and ice operations management, automated resource usage reporting, and implementation into ODOT’s winter maintenance program. The installations of GPS/AVL systems will include approximately 25 units at two garages in Medina County and 23 units at one garage in Stark County. The exact number of units will be determined prior to system implementation. In addition to the data provided from the Medina and Stark systems, data will be made available for evaluation from the existing GPS/AVL systems located in Cuyahoga, Delaware, and Madison counties.
Project Title: Passenger Flow Estimation and Characteristics Expansion

Research Agency: The Ohio State University

Researcher: Rabi Mishalani

Status: Active

State Job #: 134752

RFP #: 2012-12

Start Date: March 4, 2013

End Date: March 4, 2016

Classification: Standard

Project Type: Planning

Technical Lead: Rebekah Anderson

Abstract:

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.
Project Title: Evaluation of High Performance Pavement and Bridge Deck Wearing Surface Repair Materials

Research Agency: Cleveland State University

Researcher: Norbert Delatte

Status: Active

State Job #: 134816

RFP #: 2014-01

Classification: Standard

Project Type: Pavements

Start Date: August 13, 2013

End Date: August 13, 2016

Technical Lead: Gary Middleton

Abstract:

STATEMENT OF NEED:
The Ohio Department of Transportation has identified the need to specify durable, more permanent high performing pavement and bridge deck patching materials that allow for expediting pavement and bridge deck wearing surface repair for worker and user safety. Currently, either temporary or generally specified in-kind or like materials are being used to perform pavement patching. Usually, the Department provides generally specified cementitious or cold asphalt materials for patching wearing surfaces with varied performance characteristics. Current products used for this purpose are generally those that have been used for many decades for which competition exists. However, new or proprietary products are difficult to specify unless incorporated into a construction project for research purposes, an approved equal is permitted, or procurement of the product complies with the Department's direct purchasing requirements. Consequently, this creates a situation in which the desired product is precluded from use.

GOALS AND OBJECTIVES:
- Identify/determine acceptable field performance criteria for comparative analysis of selected products.
- Install the products at mutually agreed locations as described herein.
- Evaluate the products based on field performance criteria.
- Provide updated field performance evaluation criteria based on the field performance analysis.
- Provide a comprehensive standard material and performance based generic specifications in the Standard ODOT Construction and Material Specifications or Supplemental Specifications format based on desired ASTM or equivalent material properties and field performance analysis.
- Provide a decision matrix for use of the recommended products.
Project Title: Development of a Pavement Marking Materials Matrix for ODOT District 11

Research Agency: University of Akron

Researcher: Ala R. Abbas

State Job #: 134820

RFP #: 2014-09

Status: Active

Classification: Standard

Start Date: November 15, 2013

End Date: November 15, 2016

Technical Lead: Bobby Taylor

Project Type: Maintenance

Abstract:

STATEMENT OF NEED:
Pavement markings play a vital role in providing guidance to motorists during the day and at night under both normal and adverse weather conditions. A wide range of pavement marking materials are available, including alkyd (or solvent-based) and waterborne (or water-based) traffic paints, polyester, thermoplastic, epoxy, preformed tape, polyurea, methacrylate, and modified urethane. These materials vary in cost, effectiveness in providing a contrast in color from that of the underlying surface, visibility under adverse weather conditions such as rain and fog, adherence to different pavement surfaces, and durability under different traffic and environmental conditions. As a result, each of the previous factors must be considered in determining the optimum marking material.

The proposed study will evaluate the performance of three pavement marking materials (fast-dry traffic paint, polyester, and epoxy) in order to determine which materials are most suitable for the environmental and traffic conditions in ODOT District 11. The evaluation will include laboratory test procedures to examine the quality of the pavement markings and glass beads used in this study, and estimate the initial retroreflectivity of these materials. Results from the laboratory tests will be utilized to select a number of products to be evaluated in the field. The field evaluation will include two-lane and four-lane highways having a variety of pavement types, pavement condition, geometries, and traffic volumes. The field performance results will be analyzed to determine the service life of the various marking materials. In addition, these results will be used to estimate the life cycle cost of these materials and develop a material selection matrix for District 11. This new matrix will provide a repeatable methodology to assist the district’s decision makers in selecting the most cost-effective pavement marking materials conforming to ODOT specifications that will meet budgetary limitations in District 11 from year to year.

GOALS AND OBJECTIVES:
The proposed research aims at evaluating the performance of selected pavement marking materials and developing a material selection matrix for utilization by District 11. The findings of the proposed study are expected to:
- Advance the state of the technology by identifying long lasting pavement markings that are visible during the day and at night under normal and adverse weather conditions.
- Improve safety for the traveling public on the roads in District 11 by using markings with increased visibility to maintain roadway delineation.
- Identify and include durable materials to use under various conditions (highway classification, pavement surface, pavement condition, traffic level, etc.). The recommended materials are expected to last longer than those currently used in District 11, which will reduce both the amount of marking materials used and the frequency of restriping long lines in the district.
**Project Title:** Alternative Stream Channel Maintenance at Bridge Crossings  

**Research Agency:** The Ohio State University  

**Researcher:** Jon Witter  

**Status:** Active  

**State Job #:** 134821/135013  

**RFP #:** 2014-05  

**Start Date:** September 3, 2013  

**End Date:** February 3, 2017  

**Classification:** Standard  

**Project Type:** Maintenance  

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### Abstract:

**STATEMENT OF NEED:**

Historically, bridge design practices have excluded the impact place on stream channel morphology. Bridge structures can have significant impacts on stream channel morphology within their immediate vicinities. Human activity, including the construction of bridges, causes channel instability. Stream channel instability is a major concern because it can compromise the safety of bridge foundations. The magnitude of instability that a channel experiences is a function of a variety of factors that include watershed characteristics, stream type, bank vegetation, bed and bank materials, and flow habit.

Typical hardened countermeasures can create a permanent solution, but this practice often leads to over-application of rock material or concrete leading to unnecessary costs. Permitting is also a costly endeavor when using rock material and concrete. Applying a Natural Channel Design (NCD) approach will introduce practices that consider bank stability while also limiting the degree of aggradation and degradation impacting the bridge opening. These practices are intuitively designed to consider both the form and the function of channel and the adjacent floodplain. The challenge associated with applying a NCD approach is that it typically requires more data collection and analysis to ensure the design is optimized for the specific application. This project will be initiated with a thorough site assessment and data collection process accompanied by research of available resources pertaining to NCD and the application to channel/bridge stability. The knowledge gained from this effort will translate to hands-on design and construction oversight of pilot projects to acclimate the state and local staff to these practices, with the project culminating in documentation and training on NCD methods.

**GOALS AND OBJECTIVES:**

- Create a baseline understanding of current practices and capabilities
- Identify appropriate pilot project locations for assessment and implementation of NCD methods.
- Demonstrate techniques and assess project success/failure through post construction monitoring and disseminate knowledge through outreach education.
**Project Title:** Development of an Overlay Design Procedure for Composite Pavements  

**Research Agency:** University of Toledo  

**Status:** Active  

**State Job #:** 134831  

**End Date:** September 5, 2016  

**Technical Lead:** Adam Au  

**Researcher:** Liangbo Hu  

**RFP #:** 2014-03  

**Classification:** Standard  

**Project Type:** Pavements

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**Abstract:**

**STATEMENT OF NEED:**

A majority of ODOT's 4-lane and interstate highways are composite pavement; with the vast majority being Portland cement concrete (PCC) pavement overlaid with asphalt concrete (AC). Each year, ODOT rehabilitates several hundred miles of existing AC/PCC pavements by additional overlay. It is important to have an effective means to evaluate the existing AC/PCC pavements and to design the overlay thickness required to carry anticipated future traffic loading. The pavement overlay thickness design procedure currently exercised by ODOT works well for both flexible and rigid pavements, but it tends to produce overly conservative designs for composite pavements. For composite pavements with relatively thick asphalt overlays, the current design procedure consistently recommends very high overlay thickness that is deemed structurally unnecessary. Research is needed to evaluate and verify the assumptions used for composite pavements in the current overlay design procedure and provide modifications as needed or to develop a new deflection based overlay design procedure for composite pavements.

The proposed study investigates the possible cause(s) and finds solution(s) to address the problem within the composite overlay design procedure and to verify and validate the revised procedure through actual pavements.

**GOALS AND OBJECTIVES:**

- The primary goal is to develop and validate a Falling Weight Deflectometer (FWD) deflection-based overlay design procedure for composite pavements and incorporate it into the most current version of ODOT's overall design software.
- Provide ODOT with the ability to mechanistically determine the effective thickness of the PCC slab portion of a composite pavement for use in the U.S. Army Corps of Engineers' equation for the design of unbonded concrete overlays.
**Project Title:** Evaluating Vegetation Management Practices for Woody and Herbaceous Vegetation  

**Research Agency:** Davey Resource Group  

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<th><strong>Researcher:</strong></th>
<th>Jenny Gulick</th>
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<th><strong>Technical Lead:</strong></th>
<th>Tom Corey</th>
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**Abstract:**

Phase I (6 months):
The objective of Phase I of this research was to conduct a four month in-depth analysis of ODOT’s current Integrated Vegetation Management (IVM) process and provide recommendations on how to improve safety, cost effectiveness, environmental compliance and reduce labor hours. Phase I is now complete and has revealed that ODOT lacks tools and techniques commonly used in cutting-edge rights-of-way (ROW) vegetation management programs, resulting in inefficiencies and increased program costs. Recommendations on process changes with potential cost savings for each were identified.

Phase II (30 months):
Phase II will validate the projected cost savings of selected recommendations by comparing the performance of new and alternative mechanical and chemical methods against ODOT’s standard vegetation management operating procedures. The attached Phase I interim report and decision matrix prepared for ODOT outlines the equipment and chemical testing that will be evaluated.

Benefits of this project include: 1) improved sight distances (safety) of the traveling public; 2) increased time between needed maintenance cycles on the rights-of-way; 3) reduced annual right-of-way vegetation management costs; 4) updated tools and techniques available for right-of-way maintenance; and 5) increased ODOT staff efficiency, knowledge and worker safety.

This project will require a great amount of project management and time that ODOT does not have the staff or availability to perform. Davey will be working with the Districts to monitor the vegetation management, document the progress of each method, and perform a cost benefit analysis that will assist ODOT in determining future changes to the vegetation management program. Objectives of Phase II include: 1) Utilize new mechanical methods for vegetation management; 2) Make use of new chemical methods for vegetation management; 3) Extend maintenance cycles for herbaceous and woody vegetation; 4) Better safety for workers and users; 5) Decrease the amount of noxious weeds on the rights-of-way; and 6) Improve the abilities of workers to utilize equipment and herbicides properly.
| Project Title: | AASHTO Transportation System Preservation (TSP2) |
| Research Agency: | AASHTO |
| Status: | Active |
| State Job #: | 134835 |
| Start Date: | July 1, 2013 |
| End Date: | June 30, 2018 |
| Technical Lead: | Aric Morse |
| Researcher: | AASHTO |
| RFP #: | TSP-001 |
| Classification: | Program |
| Project Type: | Pavements |

Abstract:

This is a program that will be run from AASHTO Technical Services Program. ODOT's Office of Pavement Engineering has an interest in contributing money to this project. It is not a pooled fund, but a project being done by AASHTO.
Abstract:

A number of state and federal agencies are developing geotechnical databases which may be queried for information used for planning, design, and construction of new projects or the maintenance of existing projects. Unfortunately through the lack of standard data definition for geotechnical data, there exists significant difficulty in archiving, reusing, and sharing data. In 2005, a pooled fund study [TPF-5(111)] was initiated to establish a geotechnical data dictionary from which a national standard XML data interchange format schema could be established. This pooled fund resulted in a data interchange for geotechnical and geo-environmental transportation related data (DIGGS). DIGGS is positioned to be an international data transfer standard.

The objective of this project is to conduct additional testing, provide tool completion, and refinement. In order to ensure ongoing stability of DIGGS, transition of this tool to an institution capable of long-term hosting and management is needed. The significance of this new work is to reach the public delivery level for the DIGGS system and establish a permanent home for the system. The successful deployment of DIGGS 2.0 will produce tangible benefits for the state. It will enable efficient, compatible, and understandable information sharing among state and federal agencies. The centralized system will allow for quick retrieval of historical data, improved storage of new data, increased data sharing, and reductions in error due to the direct transfer of data. This will result in significant cost savings to the department as data searches for archived information will not be time consuming and the need for field technicians to duplicate past data collection is eliminated. It will capitalize on the benefits of collaborative development as compared to individual development of multiple independent systems. Software developers will be able to develop programs that fit within the framework and are compatible nationwide and internationally thereby reducing costs to users and increasing interchangeability among programs. Finally, in addition to transportation agencies, other potential users that can benefit from this system include natural resource and environmental agencies, consultants, and academics.
Project Title: Waterproofing Details of Connections for Adjacent Precast Concrete Box-Beam Bridges

Research Agency: University of Akron

Researcher: Anil Patnaik

Status: Active

State Job #: 134847

End Date: March 31, 2017

Classification: OPREP

Project Type: Structures

Technical Lead: Waseem Khalifa

Abstract:

Adjacent box-beams need to work together for a bridge to function effectively as a single unit. Structural performance of non-composite box-beam bridges is greatly dependent on the shear key, the connection details including the grout, waterproofing, and the tie rods. Severe leakage is commonly documented. Water leakage leads to premature aging and is the primary cause for corrosion of the prestressing strands and non-prestressed steel, which causes spalling and snapping of strands.

Prevention of water leakage is critical to minimize corrosion related deterioration at the longitudinal joints of adjacent box-beams. Any cracking along the joints and differential deflection of adjacent beams causes water proofing membrane to get damaged making water leakage inevitable. Most times the seeping water is contaminated with chloride from deicing materials which makes the concrete susceptible to corrosion related damage such as cracking and spalling.

This project is being conducted in collaboration with Ohio's Research Initiative for Locals (ORIL). This research was initiated by ODOT to establish the sources, causes and effects of inadequate waterproofing at joints and develop preventive measures through careful evaluation of alternatives on the state system. The scope of work was expanded to incorporate aspects specific to the local system such as: (1) analysis of adjacent precast reinforced concrete box-beams to establish the sources, causes and effects of inadequate waterproofing at the joints; (2) an evaluation of peel-and-stick waterproofing as a membrane alternative, (3) an analysis of grouting options/alternatives for keyway joints; and (4) develop preventive measures for existing and new box-beam bridges. The results of this research will provide a basis for better preparation of local officials to deal with system degradation of these structure types and maintenance of existing structures in addition to providing an opportunity for improvements in planning and design of new structures.
**Project Title:** Transportation Curriculum Coordination Council (TC3)  
**Research Agency:** AASHTO  
**Status:** Active  
**State Job #:** 134873  
**Start Date:** October 1, 2013  
**End Date:** June 30, 2016  
**Technical Lead:** Victoria Beale

**Researcher:** AASHTO  
**RFP #:** 134873  
**Classification:** Program

**Abstract:**

Through contributions to a 5-year pooled fund (TPF 5-(046)), the TCCC has developed a Core Curriculum Matrix comprised of five program areas (Construction, Materials, Maintenance, Safety, and Employee Development) and provided training competencies for a wide variety of disciplines within each subject area. The curriculum is used by State and local DOTs in their efforts to establish training programs and to develop specific courses for their technical personnel. It is also being used by the TCCC to guide its development of course materials to be shared nationwide. The curriculum matrices are designed to be a living document that will grow as the program continues to evolve; accordingly, the curriculum will be maintained on the TCCC website (www.nhi.fhwa.dot.gov/tccc) and will be updated periodically as new disciplines, course materials, and technologies emerge.

The pooled funds under the previous TCCC support project have been supplemented by FHWA Office of Asset Management, Office of Pavement Technology, and National Highway Institute to cover expenses related to training development and other activities. Such an extensive level of funding from the FHWA program offices has enabled them to support the TCCC to a level far beyond what was contributed by the States to the pooled fund. Because of current funding levels under FHWA appropriations, a similar level of funding support from FHWA cannot be expected. It is therefore critical that State involvement be secured for a new pooled fund project for continued support of the TCCC.

**SCOPE:**

This project will be for the creation of a new pooled fund with similar goals to support the TCCC. It will be used for the further development of core curriculum, development of training materials, and tools for sharing training materials. Following is a list of initial activities that will be performed to continue the sharing of training and qualification resources among the transportation industry, while revising and developing identified core training materials and short courses.
**Abstract:**

Roadside O-D surveys have historically been conducted by the Department or its consultants. These surveys require staff to stop all traffic on each surveyed road and therefore can be costly and bothersome to motorists. Furthermore, the Department prefers not to stop traffic on Interstate Routes (IR) for these surveys. Surveys were conducted at over 700 locations from 1995-1997 at a cost of around $7M for the purpose of TDM estimation. Between 1997 and 2002, surveys were conducted at 10 cities to determine the need for bypasses or other transportation improvements. In 2008, surveys were conducted around Allen County to expand the TDM study area. In 2009, the Department studied the use of Automatic License Plate Recognition (ALPR) cameras to capture the through traffic on IR 75 through Allen County. However, the ALPR cameras are only able to collect the traffic that is traveling the entire IR through the study area as only 4 cameras are owned by the Department.

Third-party OD datasets have recently become commercially available for transportation planning purposes. These datasets are produced from various types of data and can be purchased from Inrix, Airsage, ATRI and others.

This research project will determine whether third-party datasets are able to replace roadside O-D surveys. Datasets will be obtained for the Lima-Allen County Regional Planning Commission (LACRPC) model area from at least three vendors and will be compared to the 2008 Cordon Survey and 2009 ALPR study for Allen County. Trip purposes will be imputed from the datasets as best as possible if they are not already commercially available. O-D matrices (both Internal-External (I-E) and External-External (E-E)), time of day (TOD) patterns and trip purposes will be compared. Resident vs. non-resident may also be compared.
Project Title: Bubble Plate Implementation

Research Agency: Ohio University

Status: Active

Start Date: February 4, 2014

End Date: September 23, 2016

Technical Lead: Becky Humphreys

Researcher: Gayle Mitchell

State Job #: 134881

RFP #: 2014-IP1

Abstract:

The Ohio Department of Transportation (ODOT)'s Research Section in collaboration with the ODOT Office of Hydraulic Engineering is executing an in-house implementation study to further investigate findings and recommendations provided by Dr. Gayle Mitchell on the recently completed research project "Exfiltration Trenches for Post Construction Storm Water Management for Linear Transportation Projects." In support of this study, ODOT has requested the services of Dr. Mitchell and her team to fabricate and deliver two single and two double bubble plate filtration devices. These devices will be placed in various locations and monitored for performance assessment.
**Project Title:** Evaluation and Analysis of Liquid Deicers for Winter Maintenance  
**Research Agency:** University of Akron  
**Status:** Active  
**Start Date:** July 16, 2014  
**End Date:** October 1, 2016  
**Technical Lead:** Frank Phillips  
**Researcher:** Bill Schneider  
**State Job #:** 134933  
**RFP #:** 2015-01  
**Classification:** Standard  
**Project Type:** Maintenance

**Abstract:**

The purpose of this research is to provide stakeholders with information that will allow them to make informed decisions about safety for the traveling public as well as the cost effectiveness of each product available.

Ohio has a plethora of liquid deicers commercially available and the Ohio Department of Transportation would like to evaluate which deicers have minimal impacts on the environment, low corrosiveness, high melting capacity, and are compatible with ODOT’s equipment and materials. This research will evaluate ODOT’s current practices in the field and recommend deicers for various conditions. The recommended deicers will rank favorably in cost, have minimal environmental impact and corrosiveness. Melting capacity, longevity, compatibility and availability will also be considered.

There are four main objectives:
1. Determine the deicers that are compatible with ODOT’s equipment and materials with the lowest environmental impact and corrosiveness, and the highest melting capacity.
2. Conduct laboratory and field tests to evaluate the best deicers under various temperature, environmental, and roadway conditions.
3. Recommend deicers for various conditions that rank favorably in cost, minimal environmental impact, and minimal corrosiveness, melting capacity, longevity, compatibility and availability.
4. Evaluate the feasibility of implementation for liquid deicers based on ODOT’s current equipment and storage capabilities.

This project is being conducted in collaboration with Ohio’s Research Initiative for Locals (ORIL).
Abstract:

This research project should help ODOT prepare a specification that will increase the probability of achieving crack free, long-lasting decks. The research will develop a state-of-the-art bridge concrete that will give a unique consideration to coming up with the best mix characteristics that will ultimately extend bridge life and delay (or eliminate) the need to replace decks prior to superstructure replacement.

The two main objectives of this study:
1. The bridge deck will be crack-free immediately after construction.
2. The bridge deck has the strength and serviceability characteristics that will allow it to perform for up to 75 years of active service.
Project Title: Analysis of Ground Tire Rubber (GTR) in Mix Design on Local Roadways in Ohio

Research Agency: Ohio University

Researcher: Munir Nazzal

State Job #: 134989

RFP #: 2015-ORIL4

Status: Active

Start Date: September 2, 2014

End Date: September 2, 2016

Classification: ORIL

Project Type: Materials

Technical Lead: Perry Ricciardi

Abstract:

For decades, transportation agencies have considered the incorporation of crumb rubber, now referred to as ground tire rubber (GTR), in asphalt mixtures to enhance the durability and longevity of pavements. In addition to the improvements in pavements, GTR has demonstrated the potential for positive environmental impacts through its reuse of recycled tires. While the benefits of using GTR appear to be great, the initial cost to implement GTR can often render the material as being cost-prohibited. ODOT has various specifications concerning asphalt mix designs (e.g.: Nos. 446 and 448) including GTR (e.g.: No. 887). While these specifications address the utilization of materials on interstates and highways, their direct application to local roadways may not be appropriate. Factors such as variations in traffic volume and traffic patterns (e.g.: intersections) may influence the performance of GTR resulting in the ODOT specifications being either over or under designed for local roads. Furthermore, advances in technology over the years have increased the options available to transportation agencies in regards to both application methods and products. Since 2005, GTR has been used on approximately 33 local roads and 3 state highways. This presents Ohio with the opportunity to analyze the actual in-field performance of GTR, assess the pros and cons of using the material, and determine if the life-cycle cost of the materials offsets the installation costs.

The goal of this two-phased research project is to assess the true life-cycle cost of GTR mixes on local roads within Ohio and identify opportunities for GTR to be more affordable. The objective is to develop specifications and supplemental QC/QA testing and acceptance criteria for GTR additive/mixture use on municipal and local roads. The results of this research will provide local officials with enhanced knowledge and a field validated assessment of the life-cycle cost of GTR enhanced mixes on its use and performance. The development of a specification for GTR use on local roads will encourage uniformity and provide clear guidance. This information will be of assistance to local decision makers in managing budgets and the proper utilization of GTR on their respective projects.
Project Title: Hydraulic Engineering Research On-Call Services (ROC)

Research Agency: Ohio University  
Researcher: Shad Sargand

Status: Active  
State Job #: 134993  
RFP #: 2015-12

Start Date: August 13, 2014  
End Date: August 13, 2016

Classification: Standard

Technical Lead: Jeff Syar

Project Type: Hydraulics

Abstract:

The Ohio Department of Transportation (ODOT) is a large state agency charged with management and maintenance a vast transportation system in Ohio. ODOT strives to execute its charge in the most effective and efficient manner possible. Frequently, ODOT encounters situations where low cost, short term research services are needed to meet immediate needs for system management and maintenance improvements. Some of the short term research needs may go unmet due to the immediacy of the need and the perceived long delay in navigating ODOT’s research process. To address this problem, ODOT has developed a “Research on Call” (ROC) procurement process to secure research services for low cost, short term research in advance of identifying specific research needs.

ODOT will identify small research projects that will be considered part of the ROC contract. ODOT will send a notification e-mail to the researcher identifying the project scope and requirements.

The researcher has three weeks to respond to the written task request with the following information: Work Plan, Budget, Schedule, and Deliverables. ODOT will respond to that “proposal” within two weeks. Once there is an agreement between the researcher and ODOT, the researcher will receive an official project acceptance letter. The researcher may not begin work on the project until they have received the official project initiation letter via email from ODOT’s Research Section.
### Geotechnical Engineering Research On-Call Services (ROC)

**Project Title:** Geotechnical Engineering Research On-Call Services (ROC)

**Research Agency:** University of Akron

**Researcher:** Robert Liang

**State Job #:** 134994

**RFP #:** 2015-13

**Status:** Active

**Start Date:** August 29, 2014

**End Date:** August 29, 2016

**Classification:** Standard

**Project Type:** Geotechnical

**Technical Lead:** Chris Merklin

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**Abstract:**

The Ohio Department of Transportation (ODOT) is a large state agency charged with management and maintenance a vast transportation system in Ohio. ODOT strives to execute its charge in the most effective and efficient manner possible. Frequently, ODOT encounters situations where low cost, short term research services are needed to meet immediate needs for system management and maintenance improvements. Some of the short term research needs may go unmet due to the immediacy of the need and the perceived long delay in navigating ODOT's research process. To address this problem, ODOT has developed a "Research on Call" (ROC) procurement process to secure research services for low cost, short term research in advance of identifying specific research needs.

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Project Title: Forensic Study of Early Failures with Unbonded Concrete Overlays

Research Agency: Ohio University

Researcher: Shad Sargand

State Job #: 134996

RFP #: 2015-06

Status: Active

State Job #: 134996

End Date: April 13, 2017

Classification: Standard

Start Date: August 13, 2014

Technical Lead: Aric Morse

Project Type: Pavements

Abstract:

The Ohio Department of Transportation (ODOT) has constructed over 350 lane miles of Unbonded Concrete Overlays (UBCO). For the most part these overlays have performed as expected. However, occasionally an UBCO is constructed which performs below expectations.

The objective is to determine the mechanisms of failure responsible for each distress evident at the time of the study. The goal being to tie these mechanisms to the design, construction and/or materials practices or standards that can be modified to gain better performance and eliminate or delay these types of problems in the future. The research is expected to result in a better understanding of how to design and construct an unbonded concrete overlay. Ultimately, this research is expected to produce cost savings by preventing premature distress formations in unbonded concrete pavement overlays and reducing future maintenance costs to those projects through improved performance of the overlays.
Project Title: Evaluation and Design of a TL-3 Bridge Guardrail System Mounted to Steel Fascia Beams

Research Agency: RoadSafe LLC

Status: Active

State Job #: 134997

RFP #: 2015-ORIL1

Researcher: Chuck Plaxico

End Date: May 5, 2017

Classification: ORIL

Project Type: Structures

Technical Lead: Sean Meddles

Start Date: January 5, 2015

Abstract:

For structures with concrete bridge decks, the railing system is typically connected to the deck. However, for bridges on Ohio’s local road system, non-concrete bridge decks (e.g. timber, asphalt filled steel stay-in-place forms, fiber reinforced composite, etc.) are very common and require the railing connection to be located on the fascia beam. Although this fascia mounted system is performing well on the local system, a crash tested version is not available and it is ineligible for use on federal aid projects. Research is needed to evaluate and, if necessary, improve the design of a bridge guardrail system with steel bridge posts mounted to steel fascia beams.

The goal of this two-phased research project is to analyze and design a steel fascia beam mounted railing system for use on Ohio’s local transportation system. The objective is to obtain MASH TL-3 approval of the designed system to allow for its use on federal aid and credit bridge projects. Since the connection would occur at the beam as opposed to the deck, the application of the system would be suitable with a myriad of bridge deck types. The ability to utilize materials other than concrete for bridge decks results in substantial cost savings for locals. Furthermore, the use of an approved railing system will enhance the overall safety of the traveling public and confidence in Ohio’s local transportation system.
Project Title: Effectiveness of Wildlife Mitigation Treatments on the Nelsonville Bypass

Research Agency: Ohio University

Researcher: Deborah McAvoy

State Job #: 135024

RFP #: 2015-02

Status: Active

State Job #: 135024

End Date: April 17, 2017

Classification: Standard

Start Date: November 17, 2014

Project Type: Environmental

Technical Lead: Matthew Perlik

Abstract:

U.S. Route 33 Nelsonville Bypass is a three-phase, 8.5-mile new construction of four-lane highway through Athens and Hocking County Ohio with a large portion bisecting Wayne National Forest, Ohio's only National Forest. The Ohio Department of Transportation (ODOT) has worked closely with resource agencies and the Wayne National Forest to incorporate several mitigation treatments to protect wildlife in the area. The project was designed to restrict wildlife access to the highway to reduce vehicle wildlife interactions. However, the design also incorporated several features to make it permeable to wildlife migration.

This research will determine if the wildlife treatments are functioning as intended. This is important as a large amount of capital investment was made in these treatments. Further, this research will assist ODOT in designing these treatments for future projects, or indicate that they are not effective.
Project Title: Performance Comparison of Abutment and Retaining Wall Drainage Systems

Research Agency: University of Akron

Researcher: Junliang (Julian) Tao

Status: Active

State Job #: 135025

RFP #: 2015-05

Start Date: October 6, 2014

End Date: April 6, 2017

Classification: Standard

Project Type: Construction

Technical Lead: Jim Welter

Abstract:

Drainage behind abutment walls and retaining walls is vital to the performance of the abutment and approach slabs as it relates to potential settlement and rideability. The drainage system must retain the soil backfill while allowing water to pass out from behind the wall providing hydrostatic relief. Lack of proper drainage behind abutment and retaining walls can cause damage to the abutment walls, retaining walls, approach slabs, and expansion joints. Settlement at these locations can cause unsafe driving conditions.

This research will conduct a benefit analysis comparing ODOT’s current process of two feet of porous backfill with prefabricated composite drainage systems. The benefit analysis should reflect systems with potential to demonstrate a cost benefit. To accomplish this research, the scope of work should be divided into two phases. Phase 2 is contingent upon successful completion of Phase 1 and written authorization from ODOT’s Research Program. The scope of work should include, at a minimum, the activities noted below. Additional tasks may be included in the proposal by the research team as appropriate to ensure achievement of research objectives.
Project Title: Inspection, Repair, Retrofit Procedures, and Design Recommendations for Non-Redundant Steel Structures

Research Agency: University of Cincinnati

Researcher: James Swanson

Status: Active

State Job #: 135031

RFP #: 2015-ORIL6

Classification: ORIL

Start Date: November 3, 2014

End Date: May 3, 2016

Technical Lead: Michael Brokaw

Project Type: Structures

Abstract:

There are approximately 1500 structures in Ohio with the designation of fracture critical. Of these, approximately 900 pony trusses reside on the county system. As a result, counties are responsible for conducting specialized arms-length inspections on the fracture critical members (FCM) of these structures every twenty four months, in addition to the annual routine inspection. The FCM inspections are both costly and difficult to perform often due to the location of the members. While the tension zones in the steel pony members are categorized as fracture critical per FHWA's Bridge Inspection Reference Manual (BIRM), a detailed analysis may prove otherwise. Research is needed to develop a modeling standard to analyze these structures and establish protocols, consistent with provisions outlined by FHWA, in order to refine fracture-critical designations.

The goal of this research is to provide analytical evidence and protocols that allow for the reduction of the number of fracture critical members to inspect on pony trusses utilized on Ohio's local roadway system. In addition to the analytical goal, there is an objective to develop a repair/retrofit procedure to eliminate non-redundancy or fracture critical elements of pony trusses, thereby transitioning from a non-redundant to quasi-redundant designation. The results of this research will provide local engineers with enhanced knowledge and understanding of the function of this structure type. It will also aid to educate bridge inspectors as to the actual in-field performance of pony trusses. Positive findings from this research will position locals for potential savings in terms of cost and time through the elimination of excessive and onerous inspections. This would further increase the desirability of the pony truss as a viable option to own and maintain; thereby, expanding its consideration for use by local transportation officials.
Abstract:

The first research project recently concluded, and provided ODOT with a dashboard for monitoring ice events on the bridge stays. ODOT manages these icing events by closing lanes or the bridge as appropriate. To assist the operators in making these decisions, a real-time icing monitor, referred to as the “ice dashboard” was developed and a local icing weather station was installed on the VGCS. The dashboard integrates the local sensor information, regional weather and historical icing behavior of the bridge in a graphical manner that puts key information for managing icing events at the operators’ fingertips. Since its inception, ODOT operations has routinely used the dashboard to aid in making decisions about managing icing events.

There are two immediate issues with the present dashboard and sensor suite that need addressed through creation of an implementation project:

1. The dashboard has been transferred to the district in a stand-alone configuration. This has several implementation shortcomings from an operational perspective: ODOT needs to gain familiarity with the IT aspects of operating the dashboard and the current configuration does not have the interconnectivity, ability to grow as weather events occur, and transparency and flexibility to make it as robust as ODOT desires.

2. The sensor suite cannot directly detect the presence and state of ice on the stay.

The objective of this proposal is to locate and configure the dashboard app to maximize the utility to the operators of the VGCS. It is desired to do this as quickly as possible while maintaining the functionality of the dashboard through the upcoming winters of 2014-2015 and 2015-2016. District 2 has defined the requirements that the dashboard meet at the end of this project. In the long-run, to be effective in aiding the operators to make better decisions about managing icing events, the dashboard must be used and become a part of the culture of protecting the traveling public in an icing event. In addition, it must be hosted in an economical manner.
**Project Title:** Graphical Design Task Order

**Research Agency:** Please Select

**Status:** Active

**State Job #:** 135071

**RFP #:** 2015-22

**Researcher:** Vicky Fout

**State Job #:** 135071

**End Date:** June 30, 2016

**Classification:** Program

**Technical Lead:** Vicky Fout

**Project Type:** Planning

**Start Date:** December 15, 2014

**Abstract:**

This project will help publicize the transportation planning and research work occurring at ODOT. This will take the form of a task order to procure graphical design services on an as needed basis. This task order will aid in technology transfer activities, encourage implementation of findings, and overall enhance the final products developed through planning and research activities.
**Project Title:** Validation and Calibration of Finite Element of Forces in Wingwalls  

**Research Agency:** E. L. Robinson Engineering of Ohio, Co.  

**Researcher:** Jamal Nusairat  

**Status:** Active  

**State Job #:** 135085  

**RFP #:** 2015-17  

**Research Agency:** E. L. Robinson Engineering of Ohio, Co.  

**Researcher:** Jamal Nusairat  

**Status:** Active  

**State Job #:** 135085  

**RFP #:** 2015-17  

**Classification:** OPREP  

**Project Type:** Geotechnical  

**Start Date:** November 1, 2015  

**End Date:** March 1, 2018  

**Technical Lead:** Steve Taliaferro

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**Abstract:**

ODOT has been designing and installing bridges using abutments and wingwalls with turnback support using drilled shafts placed in bedrock, as recommended in the 2007 ODOT Bridge Design Manual and 2012 AASHTO LRFD Specifications. This construction technique is more economical and adapts well to site conditions in Ohio. The design has been simulated using 3-dimensional finite element models [e.g. E.L. Robinson Engineering, 2013 for ALL-75-0703 Bridge], but there is insufficient data to validate these models. The models indicate that the dominant force is uplift from the drilled shafts.

To validate the finite element models and ensure the design concept is safe, sound, and economical, it is proposed that a new bridge in Ohio be instrumented to obtain the data. The instrumentation would be designed to measure the amount of load and the stress (critical stress) transferred from the abutment to the wingwall at the interface and the forces in the drilled shafts, whether caused by loads or by environmental factors such as temperature changes or soil moisture.

The research will benefit ODOT in understanding the behavior of the drilled shafts supporting abutments during construction and service life. The research will help in understanding the load mechanism and help improve the design methodology for similar type of substructures in addition to some design guides to be included in the ODOT Bridge Design Manual.
Project Title: Understanding the Soil Plugging Mechanism in Large Open Ended Pipe

Research Agency: Case Western Reserve University

Project Type:

State Fiscal Year: 2017 Work Program

Research, Development and Technology Transfer

Project Title: Understanding the Soil Plugging Mechanism in Large Open Ended Pipe

Research Agency: Case Western Reserve University

Researcher: Bill Yu

RFP #: 2015-14

Status: Active

State Job #: 135103

Classification: OPREP

Start Date: June 1, 2015

End Date: June 1, 2018

RFP #: 2015-14

Classification: OPREP

Technical Lead: Jawdat Siddiqi

Project Type:

Abstract:

Research is needed to study the soil plugging mechanism in large open-ended pipe. The knowledge will help to design methods to foster the development of soil plug in large diameter pipe piles used in ODOT projects. The results from this study will also help to develop guidelines on the design, construction, and QA/QC of large diameter pipe piles in transportation projects.

The goal of this research is to study the soil plugging mechanism in large open-ended pipe piles, especially for typical types of soils in Ohio. These will include a systematic collection of the existing experience on the design and construction of large open-ended pipe piles, conduct model experiments and computational modeling, and analyze the field data from ODOT construction projects. The longer term goal is to improve the design and construction method for large open ended pipe piles.
The Anthony Wayne Bridge, Ohio's only suspension bridge, is undergoing an extensive rehabilitation. Prior to taking action to preserve the cables, ODOT must decide what measures to take to evaluate the condition of the cables, how best to rehabilitate the cables to slow their aging and how to monitor the degradation in the cables' strength as they age.

The three goals of this study are:
1. Determine the current condition of the main cables.
2. Determine a rehabilitation technology to most efficiently and economically slow their aging.
3. Select a long term monitoring strategy that accurately tracks the changes the condition of the cables over time.

This research should help ODOT make decisions for preserving the cables.
Abstract:

The goal of this research is will assist ODOT develop and evaluate a real-time system, which can automatically collect the Turning Movements Information at signalized intersections using signal control information and video detection data. To achieve this goal, the researcher, will be working in a partnership with Akron Metropolitan Area Transportation Study and the City of Akron’s Traffic Engineering Division.

Currently, Turning Movements Information is collected manually with handheld devices in the field, which is tedious and labor intensive involving high cost. Previous efforts on this problem relied on a mathematical model by solving an O-D matrix in which the turning movements represent distributions of the arriving flow at each intersection approach. However, such a matrix cannot be mathematically solved with using supplementary volume data from the local detectors; yet previous studies showed that the results from the O-D method are not accurate. Therefore, driven by the need to identify vehicle turning movements automatically in different geometric and traffic control conditions, an Automatic turning Movement Identification System (ATMIS) has been developed in the transportation Laboratory of The University of Akron. By interfacing with existing signal controller and detection devices, the system was tested in a laboratory environment using video from the field. The results from the preliminary lab experiment showed that the methodology is very promising and it can potentially be expanded and enhanced for field applications.
Project Title: Fundamental Evaluation of the Interaction between RAS/RAP and Virgin Asphalt Binders

Research Agency: Ohio University

Status: Active

State Job #: 135143

Start Date: August 3, 2015

End Date: August 3, 2017

Researcher: Munir Nazral

RFP #: 2016-14

Classification: OPREP

Project Type: Materials

Technical Lead: David Powers

Abstract:

The results of project will lead to designing and producing durable asphalt mixes containing RAS/RAP, to lowering the life cycle costs of pavements as well as improving their environmental impacts, to the development of sustainable pavement structures in Ohio. This will allow ODOT to have more insight into how the RAS/RAP and virgin new binders interact with each other. This will then guide ODOT in how to specify the usage of RAS/RAP in the future to ensure long lasting pavements.

The asphalt mixture producers and ODOT increased the use of the readily available recycled materials such as Reclaimed Asphalt Pavement (RAP) and Recycled Asphalt Shingles (RAS) in flexible pavement mixtures. However, using RAS and higher amounts of RAP in new paving mixtures may cause the resultant mixture to be more prone to load and non-load associated cracking and adhesion/cohesion failures during the service life of the pavement. The main objective of this project is to study the interfacial zone between the RAS/RAP and virgin asphalt binders and evaluate its properties that affect the fatigue cracking and moisture damage resistance of mixtures containing RAP and RAS materials.
Abstract:

This is for technical editing services for final reports that are not conducive to communicating the results in a clear and concise manner. Recently, we have received draft final reports from Researchers incapable of revising the report to communicate the research and findings in an organized, clear fashion. The technical reviewers have commented it takes a couple hours to review a small portion of the report.

A request for qualifications was issued to various firms, and CTC & Associates LLC was selected. A personal services contract will be issued for these services. The services include a complete review for content, clarity, grammar, and style. Services will be billed at an hourly rate per the agreed upon contract.
Project Title: Route Optimization for ODOT Snow Plow Trucks, Phase 1

Research Agency: University of Akron

Researcher: Bill Schneider

Status: Active

State Job #: 135157

RFP #: 2015-23

Classification: Standard

State Job #: 135157

Start Date: June 11, 2015

End Date: December 1, 2016

Technical Lead: Jamie Hendershot

Project Type:

Abstract:

ODOT employs a variety of specialty equipment such as Epoke® bulk spreaders and the Viking-Cives TowPlow as part of its winter maintenance fleet. In addition to optimizing the snow and ice routes for its standard snow plow trucks, ODOT wants to determine the best way to implement the specialty equipment within its fleet. Through advanced route optimization, specialty equipment may be included in the analysis to determine the optimal locations to deploy various types of equipment under different weather severity scenarios.

This project is divided into two phases. The first phase includes a pilot study for District 1 (located in northwestern Ohio) and District 10 (located in southeastern Ohio). Phase I results will determine whether or not to move forward with Phase II, which will include the remaining districts. Authorization for Phase II will be made in a separate request based on the results of Phase I.
**Project Title:** Investigate Feasibility of GPR to Measure In-Place Density of New Asphalt Pavement

**Research Agency:** Infrastructure Management and Engineering, Inc.

**Researcher:** Arudi Rajagopal

**State Job #:** 135158

**RFP #:** 2016-15

**Status:** Active

**Start Date:** August 3, 2015

**End Date:** April 3, 2017

**Classification:** OPREP

**Technical Lead:** Craig Landefeld

**Project Type:**

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**Abstract:**

Investigate Feasibility of GPR to Measure In-Place Density of New Asphalt Pavement

Density of asphalt mixtures is one of the most important properties to monitor during construction of hot mix asphalt pavements. Density is deemed important in asphalt pavement construction since it influences the void structure of the asphalt mixture. When the air voids are lower than a specified value, the constructed pavements will experience rutting, shoving and bleeding due to plastic flow. When the air voids are higher than a specified value, the mixture will allow water and air to permeate into the structure resulting in water damage, oxidation, raveling and cracking. Since density of an asphalt mixture varies throughout its life, the voids also vary proportionally. The voids must be low enough initially to prevent permeability of air and water and high enough after a few years of traffic to prevent plastic flow.

Traditionally, density has been measured in the laboratory using core samples. However, cores provide data at only a limited number of random locations. Some organizations supplement cores with data from a nuclear or electrical density gauge. The Ohio Department of Transportation requires the contractors obtain cores to determine in-place density of the compacted mixture as a percentage of the average QC Maximum Specific Gravity (MSG) for the production day the material was placed. In Ohio, data from the cores are used to calibrate the electrical density gauge. At the end of the job, the department marks ten locations for taking core samples. The core samples are tested by the State to verify density of compacted asphalt mixture.

Extensive research completed in Finland in the late 1990s verified the ability to measure asphalt air void content with Ground Penetrating Radar (GPR). The air void values were obtained from GPR-based dielectric measurements using a small number of cores for calibration. The researcher's objectives and goals include documenting GPR technology as applied to measurement of asphalt mixture in-place density, design and develop a statistically valid field and lab experiment, compare GPR data with results from cores and electric gauge, process the data and generate information that can assist ODOT to develop QC/QA specifications for acceptance of the compacted asphalt mixtures. Some of the benefits of this study are that GPR is non-destructive, it can provide rapid measurements with immediate results, compared to core sampling at isolated spots, data sampling can encompass up to 100 % of the paved area and the results can depict quality and uniformity of density through the project.
Project Title: Evaluation of Safety Practices for Short Duration Work Zones

Research Agency: Texas A&M Transportation Institute

Researcher:

Status: Active

State Job #: 135201

RFP #: 2016-01

Classification: Standard

Start Date: August 24, 2015

End Date: September 1, 2017

Technical Lead: Shawn Rostorf

Project Type:

Abstract:

As part of our mission statement the Ohio Department of Transportation (ODOT) has determined that improved safety is a core focus area. The department would like to eliminate fatalities in our short duration (less than 24-48 hours) work zones. This research is mostly concerned with safety during a variety of activities requiring our maintenance crews to work adjacent to fast moving high volume traffic.

The goal of this research is to identify cost effective and safer alternatives to the current procedures used by ODOT maintenance crews during short duration work zone operations. The main objectives of this research are to evaluate the current ODOT safety practices, identify and conduct a preliminary assessment of temporary traffic control alternatives (devices and methods) and recommend temporary traffic control alternatives for further evaluation. The findings from this research will either validate current ODOT practices or result in recommendations for improvements to ensure the safe and efficient flow of traffic in short duration maintenance operations.
Abstract:

The Ohio Department of Transportation (ODOT) maintenance crews maintain approximately 43,000 lane miles of open roadside ditches. These activities allow storm water to readily exit the roadway, eliminate obstructions, and restore ditches to their proper shape. Open roadside ditches impact the functional and environmental aspects of the transportation system. When the ditches are not maintained they can obstruct the necessary and designed flow of storm water from the roadway. That can lead to safety concerns of water and/or ice on the roadway as well as premature roadway failure from saturated subsurface.

The researcher will work closely with ODOT maintenance crews in Putnam and Mahoning County to research how to improve upon ODOT’s current roadside ditching process and provide recommendations on how to improve safety, production and cost effectiveness. To accomplish this research, the scope of work should be divided into two phases. Phase 2 is contingent upon successful completion of Phase 1 and written authorization from ODOT’s Research Program. Phase 1 of the research requires a comprehensive look at how ODOT currently maintains roadside ditches, and will provide recommendations on how to increase efficiency and decrease labor hours. Environmental issues are a major concern for the department and need to be considered in the first phase by making recommendations for BMP’s dealing with erosion and sediment control.
<table>
<thead>
<tr>
<th><strong>Project Title:</strong></th>
<th>AASHTOWare Project 3.01 Software</th>
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<td><strong>Researcher:</strong></td>
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<td><strong>Project Type:</strong></td>
<td>Administration</td>
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<td><strong>Abstract:</strong></td>
<td>Ohio's participation in the AASHTOWare Project 3.01 Joint Software Development Project. Project is to develop AASHTOWare Project 3.01 software, which is a unified web-based software product consisting of four distinct functional areas including AASHTOWare Project Preconstruction, AASHTOWare Project Civil Rights &amp; Labor, AASHTOWare Project Construction &amp; Materials, and AASHTOWare Project Estimation.</td>
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### Project Title:
AASHTOWare Project Bids

### Research Agency:
AASHTO

### Status:
Active

### State Job #:
135234

### Start Date:
July 1, 2015

### End Date:
June 30, 2016

### Researcher:

**RFP #:** Annual-AASHTOWare BID

### Classification:
Program

### Project Type:
Administration

### Abstract:
Currently, the AASHTOWare Project Expedite software supports electronic bidding and has done so for over twenty years. Understandably, it is imperative that this system be kept current with evolving technology and business requirements. This proposed software development effort involves developing the AASHTOWare Project Bids software as the replacement for the existing AASHTOWare Project Expedite software with enhanced functionality to meet evolving technology and transportation agency business requirements.

The development of the AASHTOWare Project Bids software will result in an efficient and modernized code base incorporating the more than twenty years of industry experience gained throughout the lifespan of the AASHTOWare Project Expedite software. AASHTO will then be able to offer value through better compatibility with the latest operating environments of licensees and bidders, improved performance, and more efficient, cost effective maintenance and enhancement efforts throughout the product lifecycle.
Project Title: Bridge Condition Index for Transportation Asset Management in Ohio

Research Agency: The Ohio State University

Researcher: Abdollah Shafieezadeh

Status: Active

State Job #: 135240

RFP #: 2016-17

Start Date: July 15, 2015

End Date: November 15, 2017

Classification: OPREP

Project Type: Structures

Technical Lead: Jared Backs

Abstract:

This research proposes a practical and efficient measure called bridge condition index (BCI) for reliable condition assessment of Ohio bridges through effective utilization of ODOT’s bridge databases. The products of this research will directly contribute to the strategic goals of ODOT in maintaining Ohio’s transportation systems and enhancing their efficiency, safety, and capacity.

A number of state DOTs and federal agencies have developed and implemented several bridge performance measures. An essential component of bridge management systems is performance measures which assist bridge owners in taking appropriate maintenance, rehabilitation, and repair (MR&R) actions to right bridges at the right time and cost. These metrics are useful for a specific set of goals that are defined based on the type of decisions to be made by stakeholders; however, they do not fully satisfy the set of requirements mentioned previously. This is due to a number of factors such as (1) inability to properly represent the condition state of bridges and indicate critical needs for bridge preservation, (2) large subjectivities in determination of involved parameters, (3) unavailability of some key data required for the calculation of the metrics, and (4) high complexity of procedures, among other factors.
Abstract:

The main objective of this study is to provide guidance on the selection of concrete slab thickness required to achieve long term performance considering the effect of slab dimensions, concrete slab support, and climatic conditions on critical stresses. The study will include proposed changes to the design, construction, and material procedures/specifications that, if adopted and implemented, will significantly increase PCC pavement lifetimes and reduce maintenance costs.

Although concrete pavement has shown its evidence for a long last time in service, sometimes it still experiences functional failure and premature failure. ODOT has conducted extensive research focused on improving concrete pavement performance. The rigid pavement design procedure in the 1993 AASHTO Guide for the Design of Pavement Structures, in which a slab thickness can be selected and will result a great improvement in concrete terminal serviceability, is a good example of improving concrete pavement performance. However, other factors also play a major role in concrete pavement performance. This is a 28 month project will be conducted by Dr. Shane L. Gilkey of Ohio University in collaboration with Ohio Concrete, Inc.
Project Title: Synthesis of Research on Load Capacity of Concrete Slabs Without Plans

Research Agency: University of Cincinnati

Researcher: Richard Miller

Status: Active

State Job #: 135245

RFP #: 2016-ORIL2

State Fiscal Year: 2017

End Date: March 1, 2017

Classification: ORIL

Project Type: Structures

Abstract:

Approximately 6,550 small span concrete slab bridges exist in Ohio. Of these bridges, approximately 1,234 (19%) do not have any plans. Many of these structures, still in-service today, were built decades ago; some dating as far back as the 1930s. The vast majority of these bridges are on the local system as less than 20 can be found on state routes. Some counties have as many as 30 of these slab bridges with no plans while other counties find a significant portion of their inventory (approximately 31% or 133 bridges) comprised of these structures all without plans. While these structures are routinely inspected and given a general appraisal rating, a mechanism for load rating these structures is either unavailable or unknown by county engineers. As a result, county engineers rely on past performance and engineering judgment to determine the approximate load capacity of the structure. This likely leads to an overly conservative evaluation. Exacerbating this issue, recent developments in industries, such as oil and gas, have some counties experiencing sudden and significant increases in heavy truck traffic on these structures. These bridges were not built with the expectation of the size and quantity of this traffic. In order to optimize the usefulness of these bridges and ensure the safety of the traveling public, a simple, low-cost scientifically-based method for determining the load capacity of these structures is needed.

The goal of this research is to identify a simple, low-cost, reliable method for county and city engineers to use to evaluate the load capacity of concrete slab bridges without plans. The objective of this research is to perform an in-depth synthesis study to identify the current state of practice and, if an established method is not identified, indicate the future steps necessary in order to achieve the stated goal. The results of this research will aid in optimizing the usefulness of these structure, provide increased confidence in the structure's performance and anticipated lifespan, and enhance the overall safety of the traveling public. As larger and heavier vehicles continue to expand their use of the local system, having greater confidence in the load capacity of these structures becomes a more pressing concern. This research will not only improve the understanding of the current condition of these structures, but assist local transportation officials in understanding their true capacity and limitations.
Abstract:

The Ohio Department of Transportation (ODOT) has, as one of its guiding principles, to be the standard of excellence for winter maintenance. In support of this principle, it is essential to have efficient and effective processes in terms of material acquisition, storage, and distribution. Currently, ODOT procures salt for winter maintenance activities through a twice a year, multi-vendor bid process. The awarded contracts are inclusive of materials for the State as well as various local entities (e.g.: cities, townships, counties).

The goal of this research is to optimize ODOT's salt processes from procurement to utilization. The objectives of this research are to: (1) establish a methodology for assessing ODOT's processes, (2) develop a matrix of best and current practices with a focus on procurement, storage and logistics as well as additional areas identified by the researcher as appropriate, and (3) identify recommendations to handle short, mid, and long term improvements for contract, logistics, storing and maintenance of salt.

Salt is the number one expense for maintenance materials. To be good stewards with the states funds, ODOT is looking to minimize spending and increase service. Some potential benefits of this research study include eliminating ineffective processes, increasing efficiencies, decreasing time delays and cost savings.
Project Title: No Boundaries Roadway Maintenance Practices

Research Agency: CTC & Associates LLC

Researcher: Kim Linsenmayer

Status: Active

State Job #: 135247

RFP #: 2016-20

Start Date: September 1, 2015

End Date: June 30, 2017

Classification: Pooled Fund Studies - Lead

Project Type: Maintenance

Technical Lead: John Stains

Abstract:

Through this pooled fund project, the Ohio Department of Transportation will work with other State Departments of Transportation (DOTs) to facilitate the implementation of promising non-snow and ice maintenance innovations and technologies. This project provides 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. This project is a continuation of the previous project initiated and led by the Missouri DOT TPF-5(239). In addition, it will capture and build on the momentum created by the Maintenance Peer Network.

Scope of Work:

We request that participating states contribute $10,000 each for the fiscal years 2015 through 2017.

1) Identify promising innovations and technologies ready for implementation within Maintenance activities, developed by the participating State DOTs, non-participating DOTs and outside entities.
2) Develop marketing plans for selected ready to deploy innovations and technologies
3) Organize training classes about specific research topics for member State DOTs.
4) Develop searchable database where innovations and research projects developed across the country can be identified and accessed.
Project Title: Structural Benefits of Concrete Paving of Steel Culvert Inverts  
Research Agency: Ohio University  
Researcher: Teruhisa Masada  
Status: Active  
State Job #: 135248  
RFP #: 2016-ORIL3  
Start Date: November 1, 2015  
End Date: March 1, 2017  
ORIL  
Classification: ORIL  
Technical Lead: Doug Gruver  
Project Type: Hydraulics  

Abstract:

Over time, a steel culvert invert will experience invert material loss due to corrosion and abrasive flow. The material loss progresses from minor perforations to ultimate invert loss if corrective action to protect the culvert invert is not taken. Invert material loss can lead to erosion of the supporting backfill which is an integral component for the structural integrity of a steel culvert. A common corrective maintenance action is to place 4-6 inches of concrete onto the invert of the steel culvert for the bottom 1/3 of the rise of the culvert. Light reinforcing mesh is attached to the culvert and concrete is poured and shaped to the bottom of the barrel in most applications. If total invert loss or significant backfill erosion has occurred and the exiting shape is unaffected, additional measures may be required such as: additional reinforcing steel and replacement of the backfill with cementitious materials.

This corrective maintenance action is cost effective and widely used because it seals the culvert invert, prevents backfill loss, and provides a protective layer between the abrasive flow and the steel material. However, the impact of this corrective maintenance action on the structural integrity of the culvert is unknown. Additionally, it is unknown if additional reinforcement is required when there is total invert loss and the existing shape is unaffected. While it is clear that the pipe has been weakened by the loss of the steel section, it is unclear if the stiffness of the added concrete compensates and restores the culvert to its original strength. Furthermore, once the floor is sealed with concrete, inspectors are unable to visually confirm additional damage to the remaining steel. This could adversely impact load capacity ratings causing some culverts to receive a higher load rating than is actually warranted. Research is needed to verify the viability of this practice and provide engineers with scientifically-based guidance on its proper application.

The goal of this research is to enhance the understanding of the mechanics of steel culverts and the impact that this common corrective maintenance action has on the structural integrity of the steel culvert. The objectives of this research are to: (1) determine and quantify the influence the repair has on the structural integrity of the culvert system, (2) determine if additional reinforcing steel is required when there is total invert loss, and (3) develop a scientifically-based, cost effective, repeatable methodology engineers can use to evaluate repairs to steel culvert inverts with deteriorated inverts. The results of this research may influence ODOT's current standard specifications for metal culverts (item 611.11). The findings will enable engineers to make more informed decisions on which culverts are ripe for the invert rehabilitation and the most appropriate application of this practice.
Project Title: Structures Research On-Call Services

Research Agency: Ohio University

Researcher: Eric Steinberg

Status: Active

State Job #: 135250

RFP #: 2016-19

Start Date: August 1, 2015

End Date: August 1, 2017

Technical Lead: Tim Keller

Abstract:

The Ohio Department of Transportation (ODOT) is a large state agency charged with management and maintenance a vast transportation system in Ohio. ODOT strives to execute its charge in the most effective and efficient manner possible. Frequently, ODOT encounters situations where low cost, short term research services are needed to meet immediate needs for system management and maintenance improvements. Some of the short term research needs may go unmet due to the immediacy of the need and the perceived long delay in navigating ODOT’s research process.

The objective of "Structures Research Services" is to establish an on-call contract with a research team possessing strong expertise in the field of structural engineering to conduct low cost, short term research in advance of identifying specific research needs.

RESEARCH TASKS:
Specific research tasks will be determined as needs arise. Potential research topics may include, but are not limited, to the following:
1) Assist with forensic investigations when concerns are raised about a bridge
2) Investigate physical properties and structural behavior on unique and special bridges to model and determine forces, capacities, failure, modes, etc.
3) Investigate the loadings within critical gusset plates using a photo-elastic material to better understand how the loads transfer through the gusset plate
4) Determine MSE wall long term stability and maintenance recommendations
5) Investigate concrete slab full depth cracking in continuous structures - causes and recommendations to alleviate cracking
Abstract:

Road User Maintenance Agreements (RUMAs) are legal agreements between local governments and for-profit organizations outlining the responsibility for road construction and repairs resulting from excessive damage to local infrastructure caused by those organizations’ activities. These RUMAs can also stipulate travel routes for heavy equipment haulers in order to ensure safety and help minimize damage to roadways as well as specify testing methods and rating criteria organizations are required to follow. The recent boom in the oil and gas industry in eastern Ohio has brought the use of RUMAs to the forefront. In 2012, Ohio passed Senate Bill 315 which requires well operators to enter into RUMAs or demonstrate a good-faith effort to do so. ODOT in collaboration with the Ohio Department of Natural Resources, the County Engineer’s Association of Ohio, and various local transportation officials created a RUMA template to assist local governments in developing RUMAs, but is not a mandated/standard document. Many counties and townships have taken this template and modified it to meet their specific purposes. As a result, a plethora of RUMA versions are in existence within Ohio. As industries such as oil and gas, wind power, coal, and timber expand or relocate production in Ohio, the utilization of RUMAs varies. The variations in requirements, language, and execution of Ohio RUMAs can lead to confusion not only among local governments, but also with the organizations/industries attempting to enter into these agreements. The issue is further complicated as some local governments may be using RUMAs in situations where they are not necessarily appropriate. A fair amount of research has been conducted nationally on the subject of RUMAs; however, it is not necessarily easily manageable or accessible to local transportation officials. A focused synthesis study to identify the current best practices for RUMAs is needed.

The goal of this research is to conduct a synthesis of current practices related to the development and execution of RUMAs. The objective of this research is to identify current best practices and provide recommendations for RUMA development to assist Ohio’s local transportation officials. The results of this research will highlight the practices that have produced the best return on investment in a clear and concise manner. This will provide inexperienced agencies with a better understanding on how to approach these agreements while more experienced agencies will have exposure to different philosophies and applications. Not only will local governments benefit from this research, but the industries/organizations that typically enter into these agreements may also benefit. This research can provide them with a better understanding of what local governments are trying to accomplish with RUMAs. A thorough review of the findings may also help industries to anticipate what may be required by the RUMAs used in specific counties, thereby helping them to estimate potential costs and efforts for the their expanded development into a particular region.
Project Title: Evaluation of Roadway Subsurface Drainage on Rural Routes
Research Agency: Ohio University
Status: Active
State Job #: 135252
Start Date: September 7, 2015
End Date: September 8, 2017
Technical Lead: Daniel Wise

Researcher: Roger Green
RFP #: 2016-05
Classification: Standard
Project Type: Maintenance

Abstract:

The Ohio Department of Transportation (ODOT) is experiencing significant premature pavement failures (e.g. rutting, potholes, pavement distresses) on rural routes as a result of multiple overlay projects over multiple years. ODOT believes this has been caused by poor subsurface drainage leading to premature pavement failures. Currently ODOT experiences high costs when using contractors for installation of aggregate drains when tied to resurfacing projects.

The researcher is to conduct an in depth analysis of ODOT’s current method of addressing saturated subbase issues prior to resurfacing projects and provide recommendations on how to cost effectively increase the longevity of pavement in rural areas by developing a matrix of alternatives that will compare and contrast solutions. The researcher will also provide an analysis of current equipment, materials and technology (e.g. rock saws, compactor, and equipment to run those) available for handling subsurface drainage installation for current resurfaced roads and future resurfacing projects.
## Project Title:
Update Regional Skew Characteristics of Annual Peak Flows Through StreamStats

### Research Agency:
U.S. Geological Survey

### Researcher:
Greg Koltun

### Status:
Active

### State Job #:
135255

### RFP #:
2016-12

### Start Date:
October 1, 2015

### End Date:
January 31, 2018

### Technical Lead:
Jeff Syar

### Classification:
OPREP

### Project Type:
Hydraulics

### Abstract:

Accurate flood-frequency characteristics are required to design safe bridges and culverts. Unfortunately, flood-frequency characteristics can be determined directly only at stream crossings located at or near streamflow-gaging stations with long periods of peak-flow record. Consequently, at most stream crossings, flood-frequency characteristics must be estimated. Those estimates typically have been determined from regional regression equations for streams that are unregulated and drain predominately rural areas. The last such set of regional regression equations developed for Ohio was based on peak-flow data collected through water year 2001.

The goals of this research are to (1) evaluate and update regional estimates of skewness in peak-flow time series, (2) update flood-frequency estimates for Ohio streamflow gages based on the updated regional skew information and peak-flow data collected through water year 2014, (3) develop new regional regression equations relating selected basin characteristics to peak flows with annual exceedance probabilities ranging from 0.5 to 0.002, and (4) implement the regional regression equations in the U.S. Geological Survey's StreamStats application (http://streamstats.usgs.gov).
**Project Title:** Evaluating the Particle Size Distribution of Ohio's Stormwater Runoff  
**Research Agency:** The Ohio State University  
**Researcher:** Jon Witter  
**Status:** Active  
**State Job #:** 135258  
**End Date:** July 1, 2018  
**RFP #:** 2016-07  
**Classification:** Standard  
**Project Type:** Hydraulics  

**Technical Lead:** Becky Humphreys  

**Start Date:** November 1, 2015  

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**Abstract:**

With the creation of the United States Environmental Protection Agency's (U.S. EPA) Clean Water Act (CWA), our surface waters are more protected. Implementation of section 402 of the CWA requires the Ohio Department of Transportation (ODOT) to obtain coverage under a National Pollutant Discharge Elimination System (NPDES) general permit to discharge stormwater runoff from ODOT's owner/operated storm sewer system. To comply with one aspect of this permit, ODOT is required to address Post-construction Water Quality Best Management Practices (BMPs) that require the removal of 80% of particulate matter (PM) measured as total suspended solids (TSS) from stormwater runoff. Although, the permit does not specify the particle size distribution (PSD) to use when testing the separation (sequestration) efficiency of a BMP, understanding PSD is an important factor when assessing impacts to receiving streams.

The research goals and objectives are to quantify the PSD generated on the roadway system and transported in roadway stormwater runoff. The research will provide data specific to PM associated with Ohio roadways that will allow ODOT to better assess and determine new or revisions to the current post-construction water quality BMPs in ODOT’s Location and Design Manual Volume 2, which in turn will allow ODOT to better demonstrate removal efficiencies specifically associated with Ohio roadway PM; the ultimate goal being able to demonstrate compliance with OEPA's CGP requirements.
| Project Title: Reduction of Bridge Deck Cracking through Alternative Material Usage |
|---------------------------------|-------------------------------------------------|
| Research Agency: University of Akron | Researcher: Anil Patnaik |
| Status: Active | State Job #: 135260 |
| Start Date: September 1, 2015 | End Date: January 1, 2018 |
| Technical Lead: Waseem Khalifa | RFP #: 2016-11 |
| Classification: OPREP | Project Type: Structures |

Abstract:

During previous and ongoing research into cracking behavior, epoxy coated bars (ECB) have been identified as contributing to the problem of wider cracks although it may not be the cause. However, the problems caused by ECB can be solved by adding either polypropylene fiber or basalt fiber Minibar to concrete, or by using alternative coatings/coated bars. The goal of this research is to reduce the extent and severity of cracking in bridge decks through alternative material usage. The project will provide a basis for the Department to deal with potential system degradation in structural slab bridges, and minimization of cracking in new structural slab bridges, thereby reducing the life cycle cost and increasing the longevity of such bridges. This is a 24 month project conducted by Dr. Anil Patnaik of the University of Akron in collaboration with Euclid Chemical Company and BASF Corp.
International Registration Plan (IRP) is an agreement among 48 states, 10 Canadian Provinces and the District of Columbia whereby a motor carrier can register commercial vehicle fleets for travel in all IRP jurisdictions by filing the paperwork with the home (base) jurisdiction. Fees associated with the registration of these vehicles are apportioned to each IRP jurisdiction based on various factors including total mileage driven within a given jurisdiction. As an IRP participating state, Ohio's Department of Public Safety (ODPS) coordinates the apportionment of IRP registration fees between Ohio and other participating states. In addition, ODPS coordinates the distribution of registration revenue between Ohio's various state agencies, counties, townships, and municipalities.

While registration revenue is distributed to local public agencies, there is a perception of a disconnect between the percentage provided to locals versus the actual impact commercial vehicle fleets have on local roads. While the state system is designed to accommodate large quantities of commercial vehicles, local roads are less equipped and are therefore more susceptible to pavement deterioration and stress promulgated by these types of vehicles. As a result, local governments may find it necessary to perform rehabilitation and repair activities more frequently or even earlier than anticipated. However, the revenue stream from the registration of these vehicles does not seem to be keeping pace. A locally conducted case study has identified a situation in which this disparity exists. There is a presumption that this is not an isolated event and local governments may be missing out on revenues needed to maintain the integrity and safety of Ohio's local roadways. Research is needed to investigate the overall impact of IRP truck registration to Ohio counties and to provide recommendations for improvements (if warranted).

The goal of this research is to expanded upon a previously conducted study (SJN: 134988) aimed at assessing the economic impact of non-Ohio registered commercial vehicle fleets based within Ohio jurisdictions. The objective of this new project is to provide recommendations for short- and long-term solutions to address the registering and/or fee allocation process for IRP registration within Ohio. The findings of this research will either support or disprove a perception of disproportionate funding allocations related to IRP registration revenue. As a result, this will enhance the state's ability to ensure the appropriate retrieval and allocation of IRP registration revenue for maintaining Ohio's roadways. It will also equip local officials with the tools needed to conduct their own investigations as the economic and business situation of their locality changes over time.
Project Title: Dedolomitization and Alkali Reactions in Ohio-Sourced Dolostone Aggregates

Research Agency: Bowling Green State University

Researcher: John Farver

Status: Active

State Job #: 135267

RFP #: 2016-13

Start Date: September 21, 2015

End Date: January 21, 2017

Technical Lead: Mickey Cronin

Classification: Student Study

Project Type: Materials

Abstract:

The data collected from this project could provide petrographical and chemical evidence of dedolomitization of Ohio’s dolostone aggregate sources over regular intervals of time using different methods, and will contribute to ODOT’s new concrete freeze thaw test parameters.

The goal of this project is to employ state-of-the-art scientific/analytical methods for sample characterization and analysis including using Polarized Light Microscopy (PLM), Scanning Electron Microscopy (SEM) with Energy Dispersive X-ray microanalysis (SEM/EDS), and X-ray Powder Diffraction (XRD) to identify the presence of dedolomitization in Ohio-sourced dolostone aggregates and concretes produced using these aggregates. This project will be overseen by Dr. John R. Farver of Bowling Green State University.
**Project Title:** Operation & Maintenance of a Statewide Crest-Stage Stream Gauging Network in Ohio  
July 2015 - June 2019

**Research Agency:** Ohio Department of Natural Resources

**Researcher:** Branden Vonins

**State Job #:** 135268

**RFP #:** 04-B (FY 16-19)

**Status:** Active

**Start Date:** August 7, 2003

**End Date:** August 7, 2021

**Classification:** Standard

**Technical Lead:** Becky Humphreys

**Project Type:** Hydraulics

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**Abstract:**

**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:**

1. Annually published the instantaneous stream-flows above the base-peak flow in the Ohio District Water Resources Data Report.
2. 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.
3. The Final report will be written to summarize the entire project at the completion of 20 years of data collection.
Project Title: Earthen Berm Noise Reduction Analysis

Research Agency: Burton Planning Services, LLC

Researcher: Kimberly Burton

Status: Active

State Job #: 135272

RFP #: 2015-11

Start Date: October 19, 2015

End Date: October 19, 2016

Classification: Standard

Project Type: Environmental

Technical Lead: Noel Alcala

Abstract:

ODOT constructs approximately 12 miles of new concrete noise barriers each year. This can result in unforeseen costs during the construction of the barrier, and also assumes typical maintenance costs. ODOT would benefit from having another option for a noise barrier that can be frequently constructed with lower construction and maintenance costs. ODOT’s Office of Environmental Services has found very little data and research about the benefit of earthen berms compared to concrete and fiberglass with regard to the abatement of noise, and is interested in determining the benefits of an earthen berm noise barrier.

The primary objective of this research is to determine the acoustic benefit of various earthen berm heights compared to same height concrete barriers. This analysis should also address whether a shorter earthen berm provides the same acoustic benefit as a taller concrete barrier. Another objective is to determine the cost benefit to using earthen berms in lieu of the concrete barrier.
Project Title: Crack Resistance and Durability of RAS Asphalt Mixtures

Research Agency: Auburn University

Researcher: J. Richard Willis

Project Type: Materials

Status: Active

State Job #: 135305

End Date: November 6, 2016

Technical Lead: David Powers

RFP #: 2016-03

Abstract:

Recent national sustainability efforts by such organizations as FHWA and state legislatures and DOTs have led to increased use of reclaimed asphalt shingles (RAS) and higher reclaimed asphalt pavement (RAP) contents. In addition, state DOTs spend over 20% of their budgets on asphalt and can receive substantial cost savings by increasing use of RAS and RAP. This occurs by decreasing the amount of virgin asphalt binder (derived from crude oil) required in RAS and RAP asphalt mixes. Virgin asphalt binder is the most expensive component of asphalt mixtures even though used in small amounts by weight. There is, however, a point of diminishing returns. As asphalt mixtures have less and less virgin binder an increase in durability issues become evident resulting in increased maintenance costs and lower expected life. The way most DOTs deal with this is to put higher amounts of RAS and RAP in lower asphalt layers and lower amounts in surface asphalt mixtures.

Recent ODOT project work with RAS suggest current methods and limits may exceed what is desired for performance. Historically, performance benefits of RAS and RAP have been quantified by measuring rutting resistance, which will always improve with harder aged binders and less amounts of softer virgin binders. However, durability performance entails far more than rutting. It also entails crack propagation resistance, fatigue resistance, moisture damage resistance and raveling resistance as well as performance in freeze/thaw conditions in northern climates such as Ohio.

The researcher's goals and objectives will include determining suitable test methods and equipment for testing of RAS, RAP and virgin mixtures in order to distinguish expected crack propagation resistance and durability performance of each. Phase 1 of the work will be to evaluate, with ODOT liaison concurrence, available methods and equipment to determine which is best suited for further work. Phase 2, with written authorization from ODOT’s research office, will perform extended testing using the selected method to prove its suitability and allow recommendations for specification limits and test standards to be made. If Phase 2 is authorized, the researcher will be asked to develop a proposal for the approved solution(s) and an addendum to the contract will be issued by the Research Section.
Abstract:

The Nelsonville Bypass was constructed through the Wayne National Forest (WNF) in an area that harbors one of the few remaining populations of Ohio's endangered Timber Rattlesnake (Crotalus horridus). In 2015, Ohio University researchers' radio tracked Timber Rattlesnakes in WNF to evaluate the impact of the bypass on this population. Although snake-exclusion fencing was constructed to prevent rattlesnakes from trespassing onto the right-of-way (ROW), rattlesnakes and other reptile species continued to cross the fence to access edge habitat, roadcuts, and riprap (stone erosion control and drainage structures) installed in the ROW.

The goal of this research is to evaluate the impact of the highway on the Timber Rattlesnake population. Of particular interest is the effect on their habitats within the ROW and established mitigation structures. The objective is to develop recommendations for ROW habitats along the Nelsonville Bypass that would limit or reduce further disturbance to state endangered rattlesnakes. ODOT maintains a world-class transportation system, and has also strived to have a world-class environmental program. This research will help to inform the optimal placement of wildlife exclusion fencing in future roadway projects, and inform decisions to regrade and revegetate the highway cuts within the Nelsonville Bypass ROW to reduce maintenance and lessen the cost burden to taxpayers.
Abstract:

The purpose of this research is to better understand any challenges county crews and district staff might encounter using the standard process, identify ways to eliminate barriers to implement these practices and develop a streamlined process to facilitate design and implementation, and test the new process through further implementation of projects.

The primary goal for the proposed research is to make implementation of Natural Channel Design (NCD) based practices and the use of alternative construction materials for maintenance accessible and obtainable with a reasonable amount of effort by county forces and district staff. This goal is critical to the future adoption of these practices as ODOT county forces and staffs are not likely to willingly adopt practices that are appreciably more difficult to implement than current maintenance approaches. To address this goal we propose the following objectives:

1. Identify pilot projects and test/evaluate implementation process by county forces at two sites. Work with ODOT Research Section Project Manager and County Garage forces to identify two pilot project sites and aid county forces and district staff through the design and construction phases.

2. Identify a process and/or necessary steps to streamline implementation of future projects. Based on the findings of the initial implementation projects, make recommendations and develop a process to streamline future maintenance projects.

3. Test the new process by implementing additional projects. Utilize the new process to implement three additional projects.

4. Summarize project findings in a final report. Summarize project findings and make any additional recommendations for further streamlining the maintenance process for NCD practices.
**Project Title:** Bonded Concrete Overlay (BCO) Cost Effectiveness Evaluation  
**Research Agency:** Ohio Department of Transportation  
**Researcher:**  
**Status:** Active  
**State Job #:** 510029  
**RFP #:** IH-005  
**Classification:** In-House  
**Project Type:** Pavements  
**Start Date:** December 8, 2014  
**End Date:** June 30, 2017  
**Technical Lead:** Adam Au

**Abstract:**

The project is to place a 2.7 mile bonded concrete overlay in District 11 in FY2016 and monitor the pavement performance. This test section performance will be compared to other rehabilitation options using existing degradation curves and allow an evaluation using a life cycle cost analysis.

ODOT does not currently consider using concrete overlays for minor rehabilitation strategies. The goal of this research project is to determine whether the increased initial construction costs are justified based on pavement performance improvement and longer life cycle.

This project will be 60 months long under Adam Au in Office of Pavement Engineering.
**Project Title:** Evaluation of Optional and/or Replacement Concrete Sealers  
**Research Agency:** Ohio Department of Transportation  
**State Job #:** 526980  
**RFP #:** 2012-27  
**Status:** Active  
**Start Date:** September 15, 2012  
**End Date:** February 15, 2018  
**Classification:** In-House  
**Project Type:** Materials  
**Researcher:**  
**Technical Lead:** Maria Kerestly  

**Abstract:**

The purpose of this research is to investigate application issues, to study the performance of the epoxy-urethane concrete sealers, and to do a comparative study on the durability of the epoxy-urethane sealers and three new participating concrete sealer products.

In 2008, the Office of Materials Management (OMM) was receiving numerous calls from the districts concerning failures of concrete sealers. OMM investigated these failures and found that the problems were not due to material issues. The findings of the investigations led to the creation of a PowerPoint presentation on the best application practices for epoxy-urethane concrete sealers. The presentation was the result of a cooperative effort between OMM and the producers of the currently approved epoxy-urethane concrete sealers. In the presentation, the epoxy-urethane producers stressed the importance of the proper preparation of concrete surfaces in order to achieve optimum sealer performance. Concrete sealing was then formatted under a new work type, Work Type 57. The presentation became the bases of the training required under Work Type 57. As the training was implemented, the number of reported sealer failures decreased.

Concrete sealer applicators were spending more time and effort trying to achieve the properly prepared concrete surfaces that were required. Consequently, they expressed a desire for a more user friendly sealer product to be approved by the State of Ohio. Contractors wanted sealer products requiring less surface preparation time.

At the district level, the focus was increasingly toward aesthetics. Districts wanted new sealer products that did not create the unsightliness of the highly visible epoxy-urethane failures.
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<td>Evaluation of Post Flooding Shoulder Reconditioning</td>
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<td>Evaluation of Partial Depth Pavement Repairs on Routes Heavily Traveled by Amish Horse and Buggies</td>
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<td>Longitudinal Joint Repair Best Practices</td>
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<td>14</td>
<td>Moored Aerostat Systems (MAS) for Transportation, Incident Management, and Infrastructure Assessment</td>
<td>24</td>
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<td>15</td>
<td>Street Intersection Characteristics and Their Impacts on Perceived Bicycling Safety</td>
<td>16</td>
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<td>16</td>
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<td>Condition Evaluation of In-Service Chemically Stabilized Subgrades in a High Sulfate Environment</td>
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<td>Catch Basin Inserts for Ohio Roadways</td>
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<td>Structural Design Methodology for Spray Applied Pipe Liners in Gravity Storm Water Conveyance Conduits</td>
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<td>20</td>
<td>Best Practices for Chip Sealing Low-Volume Roads in Ohio</td>
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<td>Optimizing the Effective Use of RAP in Local Roadways</td>
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<td>Use of Crushed Recycled Glass in the Construction of Local Roadways</td>
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Abstract:

The objective of this study is to facilitate the appropriate use of design exceptions through the evaluation of the safety performance of design exceptions and mitigation techniques used for their implementation. This will provide a wider range of design values for ODOT to achieve greater success in implementing appropriate design solutions. This research will a) summarize past design exceptions by documenting their frequency and reason for use; b) evaluate the effect of mitigation actions as a result of design exceptions; and c) determine any safety implications stemming from adopting design policies and practices related to design exceptions.
Project Title: Evaluation of Asphalt Base Course Construction and Acceptance Requirements

Research Agency: Please Select

Status: Proposed

State Job #: 135324

End Date:

Researcher:

RFP #: 2017-01

Classification: Standard

Project Type: Construction

Technical Lead: Craig Landefeld

Abstract:

ODOT currently accepts asphalt base material (301 and 302) utilizing plant data, method based compaction techniques specifying roller types, weights, and coverage requirements. Reduction in staffing and observed premature base failures cause concern with these current construction process requirements. We would like to evaluate the effectiveness of ODOT’s current methods and investigate whether additional testing (at the mix plant, in-place, mix design, etc.) of asphalt base materials are warranted.

The goal of this research is to improve ODOT’s current acceptance methods, which will improve the quality of asphalt base pavement construction. Review other states pavement design, mix design, and acceptance methods for asphalt base courses to identify best practices and potentially improve ODOT processes. Evaluate whether ODOT’s current state of practice for acceptance of asphalt base courses is adequate and provides repeatable and uniform pavement courses. If not, identify improvement opportunities for construction and acceptance procedures for asphalt base courses (Phase 1). Provide suggestions for modifications to ODOT’s current acceptance methods to improve the quality of asphalt base pavement construction (Phase 1).
**Project Title:** Protecting Piers of Overhead Structures From Degradation Due to Snow and Ice Chemical and Material Usage

**Research Agency:** Please Select

**Status:** Proposed

**State Job #:** 135323

**End Date:**

**RFP #:** 2017-02

**Classification:** Standard

**Project Type:** Maintenance

**Technical Lead:** Daniel Wise

**Researcher:**

---

**Abstract:**

The Ohio Department of Transportation (ODOT) is experiencing corrosive effects of road salt and snow and ice chemicals on bridge piers of overhead structures. The department is interested in determining the best method of protecting both newly constructed and previously constructed bridge piers. Currently the majority of the bridge piers are protected with an epoxy urethane coating. Over the years the epoxy urethane coating is worn off leaving the bare concrete exposed to direct exposure to snow and ice chemicals and abrasives.

ODOT is interested in the preservation of its assets. Bridge piers are an integral component of a structure asset and must be preserved. The department wishes to maintain/protect these assets in a way that will provide longer life and shorter cycles between maintenance/repair/replacement.

The objective of this research is to conduct an in depth analysis of ODOT's current bridge pier maintenance/protection for overhead structures process and provide recommendations on how to improve safety, production and cost effectiveness.
**Project Title:** Re-Rounding of Deflected Thermoplastic Conduit

**Research Agency:** Please Select

**Status:** Proposed
**State Job #:** 135322
**RFP #:** 2017-03

**End Date:**

**Technical Lead:** Matt Cozzoli

**Researcher:**

**Classification:** Standard

**Project Type:** Hydraulics

**Start Date:**

**Abstract:**

ODOT Construction and Material Specification (CMS) 611 requires a post installation inspection of thermoplastic conduit. The inspection includes visual observation for structural distress and a vertical deflection check via a mandrel or a laser profiler. Conduit exhibiting a vertical deflection exceeding 7.5% of the nominal diameter requires repair or replacement. The industry standard repair method for highly deflected thermoplastic conduit is to utilize a re-rounder to remove the vertical deflection of the conduit. The re-rounder restores the shape of the conduit by vibrating the backfill into consolidation. While the shape may be re-established by removal of the vertical deflection, the impact to the longevity, material properties, embankment above the conduit, and the conduit physical properties is unknown.

The goal of this research is to validate the use or non-use of re-rounding conduit as an option in the ODOT toolbox. Objectives of this research should focus on the effects re-rounding has on the pipe.

- Determine if re-rounding is a viable option to repair conduit deflection.
- Determine the maximum deflection at which this technique can and should be used.
Eastern Hellbenders (Cryptobranchus alleganiensis) are reclusive aquatic salamanders that are declining in population across their range, up to 80% decline in Ohio. They are currently listed as endangered by Ohio Division Natural Resources and are a candidate species for federal listing by US Fish and Wildlife Service. Due to their endangered status, ODOT must perform habitat assessment and presence/absence surveys at project sites. Currently, the most effective method to assess presence involves personnel wading in water, shifting and flipping large rock slabs or log jams, and visually searching for the species. This method is dangerous to surveyors and disruptive to the species and their habitat. Recent studies have successfully identified Eastern Hellbender presence using environmental DNA (eDNA). eDNA consists of genetic material found in the environment from sources such as feces, urine, hair, feathers, sloughed skin cells, and egg tissue. Several factors affect the detection of eDNA including production, transport and degradation. Study results have varied with respect to determining the density of population, however, all studies have consistently determined the presence of Eastern Hellbenders at known sites. Using a developed eDNA procedure, entire watersheds could be studied to determine Eastern Hellbender locations in relation to ODOT project sites. This approach could develop data which would eliminate entire reaches of Ohio streams from the need for further surveys for future ODOT projects.

The goal of this research is to:
- Improve documentation of Eastern Hellbender distribution throughout Ohio streams through a comprehensive map
- Develop an effective and inexpensive method for presence/absence sampling for Eastern Hellbenders that can be used by ODOT’s Office of Environmental staff at future project sites
**Project Title:** Effects of Tree Canopy on Pavement Condition, Safety and Maintenance  

**Research Agency:** Please Select  
**Researcher:**  
**Status:** Proposed  
**State Job #:** 135320  
**RFP #:** 2017-05  
**Classification:** Standard  
**Project Type:** Maintenance  

**Abstract:**

It has been long thought at ODOT that tree canopy shading of pavement accelerates pavement deterioration by slowing the evaporation of water from the pavement surface. Damage occurs to the pavement during the winter months when water enters small cracks in the pavement, freezes and expands. Canopy shading also reduces the effectiveness of deicers by reducing the amount of solar energy able to reach the pavement. Solar energy enhances the melting effectiveness of deicers. The canopy also presents a safety issue for the traveling public as limbs may fall onto the roadway and in the path of motorists. ODOT’s current practice is to remove the tree canopy from the roadway where practical. This practice has been questioned by critics who claim any negative effects from the tree canopy on the pavement are unfounded and have not been properly researched.

This research project aims to determine whether or not ODOT’s current practice of removing the tree canopy from the roadway is necessary. The research should also document the positive and negative effects of canopy on the roadway pavement, safety and maintenance practices.

The goal of Phase 1 of this research is to develop a field monitoring plan (to take place in Phase 2) that will:

* Determine the effects of the tree canopy on the pavement, from pavement condition, maintenance and safety perspectives.
* Document and evaluate the year round effects that tree canopy has on pavement.
Abstract:

Several problems exist when performing maintenance on trench or slotted drains used on highways. Trench and slotted drains are commonly installed in roadway depressions along the shoulder or in gore areas. They are typically installed in these locations as a result of shallow pavement cross slopes that cannot be drained into a ditch or catch basin. The installation locations are a great collection point for storm water but they are also areas where road grit and trash collect. Trench/Slotted drains are effective at removing storm water from the roadway and preventing vehicles from hydroplaning. They are also effective at collecting road grit and trash and supporting vegetation growth. With the increased use of trench/slotted drains on highway reconstruction projects and the reduction of available man hours necessary for maintenance the drains are not being maintained. Without routine maintenance the road grit accumulates in the bottom of the drain and quickly gets root bound by noxious weeds and other vegetation. Once this happens it becomes very labor intensive to clean and reestablish flow. Even when annual maintenance is performed on these drains it is labor intensive and inefficient due to the accessibility of the drain and cleanout locations. The recommended cleaning procedure is to flush with water. This method is effective on drains that do not accumulate an abundance of road grit. However those locations that do accumulate road grit this method is ineffective and slow.

The purpose of this research is to conduct an in depth analysis of ODOT's current process for maintaining trench/slot drains and provide recommendations on how to improve safety, production and cost effectiveness.
Project Title: Assessment of Existing and Potential Volume Reduction for Post Construction Stormwater Management

Abstract:

Environmental Protection Agency (EPA) regulations require the implementation of post construction stormwater Best Management Practices (BMPs) into the design on many construction projects for post construction runoff. ODOT’s Location and Design (L&D) Manual Volume 2 outlines several BMPs that have been approved by the Ohio EPA for use on publicly funded transportation projects.

For many construction projects, ODOT must incorporate a post construction stormwater BMP into the design according to the requirements of Ohio EPA’s Construction General NPDES Permit. The post construction BMP requirements vary depending on the size and type of construction project. For larger projects that add significant impervious area outside of existing right of way, ODOT must incorporate post construction BMPs that address both water quality and quantity treatment. The most likely BMPs for a transportation project in Ohio that meet those treatment requirements are detention basins and bio retention cells. While these BMPs can be effective at meeting permit requirements, they tend to have a large footprint and sometimes drive the need to acquire additional right of way area. These BMPs can also pose a safety hazard from standing water. For certain construction projects, the footprint and safety concerns can limit their applicability to meet permit requirements.

Runoff that infiltrates into the ground is considered “treated” per the requirements of the Construction General NPDES Permit; however, BMPs that utilize infiltration to treat runoff must be located on HSG A or B soil types to be approved. Most soils that ODOT projects encounter are less conductive HSG C or D soil types. Currently, ODOT can only take credit for those BMPs that have been pre-approved by Ohio EPA. However, there are common features on roadway projects that likely contribute to overall volume reduction through infiltration and evapotranspiration. ODOT is not currently able to take credit towards permit compliance for these roadway features that may decrease runoff volume. Modifications to planted areas (such as soil amendments) may also be possible to increase the infiltration capacity of areas within the right-of-way.

The goal of this research is to develop additional options for post construction BMPs available to ODOT projects. This will better enable ODOT to identify ways to meet regulatory requirements as efficiently as possible.
Abstract:

Maintenance crews with Ohio Department of Transportation (ODOT) in Holmes County currently repair berm with additional aggregate when flooding occurs. The problem with this method is the aggregate simply washes away the next time the same area floods. Roads are crowned so water will run off the road from the center line, which causes water to flow to the side, and washes away the aggregate.

ODOT wants to find a permanent solution to this issue. Holmes County is looking for an answer on how to contain/keep the aggregate in place. Currently, heavy rains cause this issue several times a year. This area contains both hilly and curvy highway routes.

The purpose of this research is to look at ODOT’s current process(s) for reconditioning berms, and to determine if there is any existing or new processes that could be incorporated that would provide longevity to the areas that experience flooding and wash out.
Project Title: Evaluation of Partial Depth Pavement Repairs on Routes Heavily Traveled by Amish Horse and Buggies

Research Agency: Please Select

Status: Proposed
State Job #: 135316

End Date:

RFP #: 2017-09

Classification: Standard

Project Type: Maintenance

Technical Lead: Darrell Hood

Abstract:

As part of preserving pavement infrastructure and providing safe roads to the traveling public, the Ohio Department of Transportation (ODOT) performs pavement maintenance. Areas in the state with heavy horse and buggy traffic see frequent partial depth repairs because of the pavement distress. The frequent repairs are believed to be caused by the impact of the horse shoes on the pavement. In Holmes County the problem is compounded by an estimated additional four million tourists that visit the area each year.

With the advent of the Transportation Asset Management Program (TAMP) ODOT is refining our business process to be more "proactive" than "reactive" with a "Preservation Strategy". This research will help the DOT determine the most cost effective solution for construction and maintenance of routes with horse and buggy traffic. Additionally, this research will investigate alternate materials that may be adopted by communities using horse and buggy transportation to minimize damage.

The purpose of this research is to conduct an in depth analysis of ODOT's current practice of partial depth repairs on roads that experience substantial horse and buggy traffic in order to increase longevity and decrease costs.
Abstract:

The Ohio Department of Transportation (ODOT) is tasked with maintaining 49,078 lane miles. As part of this maintenance, ODOT is responsible for repairing longitudinal joints. In recent years, longitudinal joints have been experiencing premature failure at an increasing rate. ODOT has improved the construction of these joints through revisions to existing specifications; however, a significant amount of pavement remains throughout the state that was constructed using previously approved specifications. Three techniques are utilized by ODOT County Garages to repair these prematurely failing longitudinal joints on asphalt pavements. These methods include crack sealing, spray injection, and slot paving. While these repair methods appear to be working, it is estimated that their implementation is averaging 10% of the original pavement construction cost, carry considerable maintenance-of-traffic (MOT) requirements, and can place a significant burden on county work forces. In order to ensure the most appropriate repair is being performed at the optimum time to produce the greatest return-on-investment possible, research is needed.

The goal of this research is to optimize ODOT's decision process when choosing the best repair tool for longitudinal joints. The objective of this study is to provide ODOT with an empirically supported methodology to determine the "best" repair for our investment.
### Project Title:  Effective and Economical Cleaning of Pipes and Underdrains

### Research Agency:  Please Select

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<td>Brian Olson</td>
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### Abstract:

The Ohio Department of Transportation (ODOT) has embarked on a Transportation Asset Management Program (TAMP) that focuses on system preservation. Part of the focus points of this program is the cleaning of our underdrains. This cleaning is important for the preservation of the pavement to extend its life as long as possible.

Currently, ODOT uses a self-propelled “Vactor-Jet” for clearing and cleaning Small diameter pipes and underdrains. This piece of equipment is large and requires lane/shoulder closures to use. It cannot be driven off the pavement due to its weight. It is also expensive, which prohibits purchase of more than one or two. This limits the use due to mobilization and need to share. The “Vactor-Jet” type of equipment also has vacuum ability which is not always needed.

With a recent emphasis on underdrain maintenance as well as population growth, ODOT has a growing need to clear and clean pipes and underdrains. Underdrain maintenance is vital to extend pavement life and sub base condition. Clearing and cleaning pipes along the road as well as under the road also aids in the system preservation.

The purpose of this research is to conduct an in depth analysis of ODOT’s current practice of clearing and cleaning of pipe and underdrains and provide recommendations on how to improve safety, production and cost effectiveness.
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<th>Project Title:</th>
<th>Evaluation of Maintenance Procedures for Bridge Spalling on Parapet Walls</th>
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Abstract:

Ohio Department of Transportation (ODOT) county maintenance forces are responsible for removing unsound concrete (spalling) on parapet walls and deck edges from bridges over traffic. The work entails setting up extensive traffic control zones followed by removing the unsound concrete with small pneumatic jack hammers. Once the unsound concrete has been removed a new surface area has been created that is left unprotected from the deicing materials used during the snow and ice season.

The purpose of this research is to determine if there is a better way to remove the unsound concrete in lieu of pneumatic tools, the extent of removing unsound concrete before jeopardizing the safety of the bridge and the best method to seal/protect the newly exposed concrete surface to prevent further deterioration.

The purpose of this research is to conduct an in depth analysis of ODOT's current process for repairing spalling on bridge parapets and deck edges and provide recommendations on how to improve safety, production and cost effectiveness.
Abstract:

A common problem with existing remote sensing tools for highway operations is line-of-sight, coverage area, and availability and access in remote locations. That is, the Ohio Department of Transportation (ODOT) lacks effective and efficient capability for the deployment of mobile sensors capable of short suspense response for monitoring transportation infrastructure during project planning, construction monitoring, system and highway incident management. An efficient means to meet these needs is a low cost, Moored Aerostat Systems (MAS). Fixed towers and ground based sensors are height limited, immobile and only provide limited range coverage. Aircraft are expensive to operate, maintain, have higher liability and have limited endurance.

Recent advances in sensor technologies have been driven by high-speed and low-cost electronics, advanced software operations, novel signal processing methods, and advanced manufacturing technologies. New developments in these fields provide promising technical solutions especially for their use in incident management, condition assessments and inventory collection. Aerostats have the ability to provide coverage in remote and inaccessible locations over large areas compared to aircraft, but with persistence of days or weeks instead of minutes and hours. We are proposing the study of novel and advanced sensors applications on board a MAS to improve business processes in infrastructure assessment and inventory as well as advance interagency policy and procedures that support Incident Awareness and Assessment (IAA) for Quick Clear and incident response operations.

In addition to uses of the MAS for ODOT related applications, MASs can be utilized as a shared asset amongst other State of Ohio Agencies further leveraging the state's investment. Discovery or identification of these potential applications need to be realized as well as their most effective implementation strategies.

The goal of this research is to study the differing types of available advanced sensors on a Moored Aerostat System (MAS) for incident management and infrastructure assessment, as well as program development for the implementation of MAS systems for statewide employment.
<table>
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<th>Street Intersection Characteristics and Their Impacts on Perceived Bicycling Safety</th>
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**Abstract:**

This research originates from concerns on transportation safety with a specific focus on bicycling, which is in alignment with ODOT's third strategic focus area, Transportation Safety. The goal of this research is to identify the impacts of multiple intersection characteristics on people's perception of bicycling safety. The objective of this research is to develop a Perceived Bicycling Intersection Safety (PBIS) Model that will help decision makers make effective decisions to evaluate and increase bicycling safety perceptions at intersections. The documentation of the findings and the model will be applicable to ODOT and other state agencies, and the methodology will be transferable to other communities, locally and nationally, beyond the State of Ohio.
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<th>Cost-effective Uses of Lightweight Aggregate Made from Dredged Material in Construction</th>
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Abstract:

It is important for ODOT and local roadway agencies in Ohio to identify, investigate, and solve the urgent problems to maintain the transportation network in Ohio. Light Weight Aggregate (LWA) and LWA concrete have been identified as one of topics of interest by ODOT, however, the median average estimated cost of LWA in U.S. is $67.50/ton. The goal of this research is to help ODOT identify a much cheaper and readily available LWA that can potentially solve the bridge bumps and enhance the performance of HPC through IC and improve the durability of concrete bridge decks.

The objective of the student study is to examine the engineering properties of the LWA in the lab, in order to evaluate its potential for use as a fill material and an IC agent. The research team will work closely with Ohio EPA to ensure the product meets state environmental regulations.
Abstract:

ODOT’s Office of Pavement Engineering adopted a practice of reducing the pavement design thickness where chemical stabilization is performed (i.e., a pavement design credit). The ODOT districts are very motivated to take advantage of this to improve chemical stabilization, and to save money on pavement costs. The issue is that sulfates are not discovered during design; they are discovered during construction, which forces a decision on how to proceed using one of the following options:

- chemically stabilize, build the thinner pavement, and hope no adverse conditions develop; or
- do not chemically stabilize and somehow change the pavement build-up in construction.

This decision making is happening in real time, without data to guide the decision one way or another. This project will evaluate the chemically stabilized subgrade at recently constructed projects with both low and high sulfate levels to identify the physical and mineral properties of the chemically stabilized subgrade, which will determine if any adverse conditions have developed. The conclusions of this research should allow for ODOT to make better informed decisions with regards to performance/non-performance of chemical stabilization.
Project Title: Catch Basin Inserts for Ohio Roadways

Research Agency: To Be Determined

Status: Proposed

State Job #: 

End Date:

Technical Lead: Jon Prier

Researcher:

RFP #: 2017-19

Classification: Standard

Project Type: Hydraulics

Abstract:

The goal of this research is to identify options for expanding ODOT’s suite of approved post construction BMPs to meet NPDES Construction General Permit (OHC000004) requirements by considering BMPs that are inserted into catch basins. The research should determine if any commercially available catch basin inserts would provide sufficient treatment performance to be accepted as a post construction BMP to treat water quality as discussed in ODOT’s Location and Design Manual, Volume 2, Section 1115. ODOT would also like to assess the level of effort required to maintain the catch basin inserts. If catch basin inserts are identified that meet treatment standards and are acceptable from a maintenance perspective, ODOT would like to use this research to propose acceptance from OEPA of the inserts as an approved post construction BMP for transportation projects. The research will also be used to inform development of ODOT-specific acceptance specifications and maintenance procedures.
Project Title: Structural Design Methodology for Spray Applied Pipe Liners in Gravity Storm Water Conveyance Conduits

Research Agency: To Be Determined

Status: Proposed

Start Date:

End Date:

Technical Lead:

Researcher:

State Job #:

RFP #: 2017-20

Classification: Standard

Project Type: Environmental

Abstract:

Spray applied pipe liners is a trenchless technology that provides a method to structurally rehabilitate concrete and metal gravity storm water conveyance conduits with minimal impact to the travelling public. The liner consists of a cementitious or resin based material that is applied in an existing host storm water conveyance conduit via a centrifugal remote applicator or by manual application. Sufficient soil support and stabilization of the host conduit is required prior to placement of the spray applied liner. The liner will provide the structural load carrying capacity without the requirement to adhere to the host conduit. No single structural design methodology for a spray applied pipe liner currently exists. Vendors either apply design equations outlined in ASTM F1216, which are for Cured In Place Pipe (CIPP), or they use a variety of design approaches and conservatively select the maximum pipe liner material thickness.

Several DOT's have implemented structural spray applied pipe liners despite the lack of a national design standard or with the understanding that they will be designed according to CIPP design equations.

Objectives:
- Recommend a design methodology for both cementitious and resin based spray applied pipe liners for structural rehabilitation of gravity storm water conveyance conduits.
- Recommend a laboratory test method to verify the proposed structural design for conduits that have been rehabilitated using the spray applied pipe liner technology.
- Recommend an accelerated laboratory methodology to determine the liner material durability.
- Recommend laboratory material testing for both cementitious and resin based materials.
### Project Title:
Best Practices for Chip Sealing Low-Volume Roads in Ohio

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</table>

Abstract:

Chip seal is widely used as an effective, low-cost preventative maintenance treatment for low-volume roads across Ohio and around the country. In some instances, states have used chip seal on select high-volume roads. In Ohio, local entities who do not utilize the ODOT specification for chip seal (Item 422), tend to rely on previous in-house experience or contractors to determine materials and construction processes for chip seal. As a result, a variety of different methods have been utilized throughout the state. While some of these have resulted in acceptable and even excellent results, others may have not been as successful. As constraints on local budgets continue to tighten, the need to identify the best chip seal techniques and methods increases.

The goal of this research is to assess the current state of practice for chip sealing on county, township, and municipal-maintained roads. The objective is to develop a matrix of best practices for chip sealing low-volume roads in Ohio and design a study to aid in the future assessment of long-term performance creating protocols for data collection.

The results of this research will provide local officials with enhanced knowledge and understanding of chip sealing practices on local roadways in Ohio. This will enable local transportation engineers to confidently apply chip seal in methods that strive to maximize longevity while being cost effective. Ultimately, this research will provide the foundation for the development of scientifically-based guidance on chip seal practices that will aid locals in managing budgets and ensuring the fiscal integrity of local pavement preservation programs.
Abstract:

The practice of utilizing reclaimed asphalt pavement (RAP) in new asphalt mixtures has increased in recent years due to their economic and environmental benefits. Although the potential benefits are high, the majority of local public agencies (LPAs) in Ohio allow using only small percentages of RAP (i.e.: less than 10%) in their roadways, if any. There has been numerous studies on the use of RAP in asphalt mixtures; however, these studies focus on interstates and highways systems only. Because local roads have different traffic types, volumes and patterns requiring the use of different types of mixtures than those typically utilized for interstates and highways, the RAP may influence the performance of local roadways in a different manner. Bus routes, tighter lane width, roadway diet, underground utilities, ADA curb ramps, are some factors that are generally not considered for interstate and highway systems, but contribute to local road design and mixture utilization.

The goal of this research is to assess the feasibility of RAP in the surface course of municipal and local roadways. The objective is to develop cost effective mix design and quality control recommendations for RAP use on local roadways in Ohio that does not adversely affect the performance or durability of the asphalt mixtures.

The results of this research will provide local officials with enhanced knowledge and a field validated assessment of RAP. The findings of this research will either validate or disprove the perception that utilizing RAP in the asphalt surface course can lead to cost savings while either improving or maintaining performance. It is anticipated that the results of this research may be beneficial in terms of sustainability of local roadways as it maximizes the use of recyclable materials. This information will be of assistance to local decision makers in managing budgets and the proper utilization of RAP on their respective projects.
Abstract:

Glass cullet is produced from crushing waste glass collected in municipal and industrial waste streams to a uniform size. Currently, it is primarily used in Ohio in new glass container manufacturing; however, only clear glass cullet can be used. As a result, colored glass cullet has a relatively low market value as color sorting can be expensive. When market prices drop too low for long periods, some of the glass is sent to landfills instead of subsequent recycling because storage space can be limited or costly. One possible solution is using crushed glass in the construction of civil infrastructures. The Ohio DOT does not have a specification for using glass cullet as an aggregate. This is in part due to concerns with the propensity for glass to strip in the presence of moisture resulting in issues with asphalt binder sticking in the surface course and an overall lack of a consistent supply of product. Although ODOT has chosen not to pursue the incorporation of glass cullet in interstate and highway applications, some local public agencies (LPA) are of the opinion that there may be an appropriate application of this material in the local system.

The potential to mix crushed glass cullet into aggregates exists for many applications including roadway and parking lot base or leveling courses, glasphalt, pipe bedding and backfill, drainage material, fill and concrete. Using a recycled product, like crushed glass, can have environmental benefits to projects seeking Leadership in Energy and Environmental Design (LEED) or National Green Building Standard (NGBS) certification. Because local roads have different traffic types, volumes, and patterns requiring the use of different types of mixtures and aggregates than those typically utilized for interstates and highways, research is needed to analyze the application of recycled crushed glass on local transportation projects.

The goal of this research is to assess the feasibility of using crushed recycled glass as an aggregate in local roadway construction. The objective is to develop recommendations for implementing the use of crushed recycled glass in local roadway applications in Ohio that do not adversely affect the performance or durability of the pavement or structure.

The results of this research will provide local officials with enhanced knowledge of recycled glass cullet and its potential for use in local transportation projects. The findings of this research will either validate or disprove the perception that utilizing glass cullet as part of an aggregate mix is feasible in local roadway construction and can lead to cost savings while maintaining performance. The results of this research may also produce environmental benefits as it could maximize the use of a recyclable material and lead to a reduction in landfills and waste.
**Project Title:** Storm Water BMP Tool Implementation Testing  

**Research Agency:** GS&P/OH Inc.  

**Researcher:** Mark McCabe  

**Status:** Proposed  

**State Job #:**  

**RFP #:** 2017-ORIL4  

**End Date:**  

**Classification:** ORIL  

**Project Type:**  

**Technical Lead:**  

**Abstract:**

Gresham, Smith, and Partners (GS&P) completed the ORIL 2015-7 research project for the ORIL Research Initiative for Locals (ORIL) in September 2015. One of the primary deliverables from the research was a storm water best management practice (BMP) selection tool (Tool) targeted for use by Locals. The Tool’s performance was tested by the Technical Advisory Committee and GS&P for quality conformance. This new project will conduct a “pilot test” with up to three Local entities to confirm the ease of use of the tool and usefulness of the outputs as applied to actual projects over several months.

The goals of this project include providing training on use of the tool to individuals at each of the selected pilot groups, providing feedback to ORIL and providing information to guide potential future users and promotion of the BMP Selection Tool. The objective of this project will be to gather data on the tool to gain an understanding of the use of the tool and to determine the next steps for possible statewide implementation of the tool.
## Active Pooled Fund Projects

<table>
<thead>
<tr>
<th>Solicitation</th>
<th>Project Title</th>
<th>Project Duration (months)</th>
<th>FY 17 Commitments</th>
<th>Total Ohio Commitments</th>
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<tbody>
<tr>
<td>1</td>
<td>Solicitation Project Title</td>
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<td>1428 Utilization of Laser Induced Breakdown Spectroscopy (LIBS) for Real-Time Testing and Quality Control Monitoring of Aggregate Materials used in Highway Construction</td>
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$ 3,213,686.00