Georgia Department of Transportation

ANNUAL IMPLEMENTATION REPORT

for

GDOT RESEARCH ADVISORY COMMITTEE

OFFICE OF MATERIALS AND RESEARCH
RESEARCH & DEVELOPMENT BRANCH

AUGUST 23, 2012

INTRODUCTION

This report is the first Annual Implementation Report presented to the Research Advisory Committee (RAC) of the Georgia Department of Transportation (GDOT), which convenes each year. The report summarizes implementation activities for two primary sets of research conducted under the GDOT Research and Development (R&D) program by the Office of Materials and Research (OMR): (1) contract research completed since the last RAC meeting that has either been implemented or is pending implementation; and (2) examples of ongoing implementation under the Transportation Pooled Fund (TPF) program. Contract research is normally funded with 80% federal/20% state, State Planning and Research (SP&R) dollars, while TPF projects are funded with 100% federal SP&R dollars.

All research activities are intended to solve a particular problem or provide useful information. R&D projects contain work elements to ensure that GDOT implements research findings and new technologies. Consequently, each research project that is approved for conduct is approved with implementation of its findings as the project goal and within the official project objectives (*GDOT Research and Development Manual, 2012*).

The report is organized into two sections. The first section covers contract research completed since the last RAC meeting that has either been implemented or is pending implementation. This research is organized according to the Research Technical Advisory Group (RTAG) that its subject is most pertinent to (Asset Management, Mobility, Policy/Workforce, or Safety). The second section provides examples of ongoing implementation under the Transportation Pooled Fund (TPF) program.

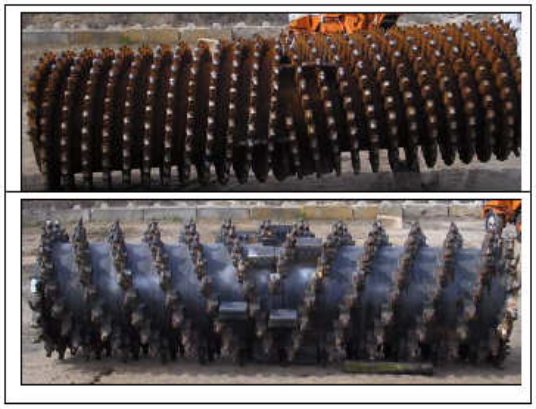
The projects discussed in both sections below demonstrate that both federal and state research dollars are being well leveraged to conduct and implement research with tangible benefits to GDOT and the traveling public. This research is in direct alignment with GDOT strategic goals, and the implementation products provide enhancements to a cross-section of major divisions within GDOT (i.e. Planning, Engineering, Construction, and Operations). This in turn supports GDOT's overall mission to provide a safe, seamless, and sustainable transportation system that supports Georgia's economy and is sensitive to its citizens and environment.

I. CONTRACT RESEARCH

ASSET MANAGEMENT

Research Project (RP) 07-07: Assessing Techniques and Performance of Thin Open-Graded Friction Course/Porous European Mix Overlay on Micromilled Surface (Completed 09/05/11)

Technical/Implementation (T/I) Manager: Sheila Hines, Office of Materials and Research (OMR)



The micromilling technique for milling asphalt surface mix is being successfully implemented by Georgia DOT (GDOT), following research by a Georgia Institute of Technology/Auburn University team led by Dr. James Lai (Georgia Tech). In this two-part study, GDOT evaluated micromilling as a pavement preservation technique in conjunction with thin asphalt overlays. The research team first summarized the results of using micromilling for a deteriorated open-graded friction course (OGFC) and overlaying it with a new OGFC on I-75 near Macon. This was the first time (summer 2007) to GDOT's knowledge that OGFC had been placed directly on top of a micromilled surface. Micromilling more precisely milled the deteriorated OGFC than conventional milling and produced a much finer surface texture. Since new OGFC was placed on top of the milled surface without a new asphalt layer being necessary, large cost savings were realized while stringent smoothness requirements were maintained. The first part of the study confirmed that the surface texture requirements established for the I-75 project, which allowed variable depth milling, were achievable and cost effective, and that a laser road profiler (LRP), routinely used by GDOT for quality acceptance of pavement smoothness, could be viable for surface texture quality acceptance if it was retrofitted with software generating surface texture parameters.

In the second part of the study, the following were evaluated on a micromilling/OGFC inlay project on I-95 near Savannah: (1) micromilling a pavement with different underlying layers than those on the I-75 project; (2) viability of the LRP, retrofitted with software, for measuring both smoothness and surface texture; and (3) stringency of the surface texture requirements. The I-95 study confirmed that (1) large cost savings can be realized by replacing conventional milling with micromilling; (2) the LRP retrofitted with software was viable for measuring both surface texture and smoothness on micromilled surfaces, and hence as a quality acceptance/performance measurement tool; and (3) variable depth milling is necessary to ensure reasonable surface texture compliance without sacrificing smoothness.

The findings of this research have provided the following benefits to GDOT and the general public:

- Implementation of micromilling as a GDOT pavement preservation technique in conjunction with thin asphalt overlays;
- Confirmation of variable depth micromilling as necessary for ensuring reasonable surface texture compliance without sacrificing smoothness;
- Use of the laser road profiler for measuring both surface texture and smoothness on micromilled surfaces, and hence as a quality acceptance/performance measurement tool;
- Savings of approximately $11 million on two interstate projects by replacing conventional milling with micromilling

- Estimated annual savings of $3 million via use of micromilling, in lieu of conventional milling, for removal of Porous European Mix (an OGFC) over Stone Matrix Asphalt.

RP10-10: Georgia Concrete Pavement Performance and Longevity (Completed 02/27/12)

T/I Manager: Rick Deaver, OMR

The objective of this study was to study the performance and longevity of concrete pavements in Georgia by analyzing historical concrete pavement condition survey data. The study has been implemented in the Office of Maintenance's Georgia Pavement Management System (GPAMS). The study will also assist OMR's Mechanistic Empirical Pavement Design Guide (MEPDG) Implementation team with implementing the MEPDG within GDOT and with an upcoming MEPDG implementation study to begin in late summer of 2012. The study will also assist implementation of an ongoing study on a concrete module for GPAMS.

RP 10-26: Durability of Precast Prestressed Concrete Piles in Marine Environment: Reinforcement Corrosion and Mitigation, Part 2 (Completed 06/03/12)

T/I Manager: Paul Liles, Office of Bridge Design

The purpose of this research was to determine methods which could be applied economically to mitigate corrosion of reinforcement in precast prestressed concrete piles in Georgia's marine environment. Mechanisms of deterioration of the concrete in piles in Georgia's marine environment were identified. Use of limestone aggregate was discontinued to mitigate damage from biological attack where the Cliona Lampa sponge was found to create extensive boreholes in the limestone aggregate, thus severely degrading the strength of the concrete. Sulfate attack also was shown to degrade the strength of the concrete. A new high performance marine concrete (HPMC) mix design

and specification for HPMC were proposed and are being evaluated by GDOT. The HPMC would provide for piles with 75-100 year service lives.

A guideline for the coastal locations of where to use HPMC is being implemented. Extensive corrosion studies showed that normal A416 steel prestressing strand (steel type 1080) is subject to rapid initiation of corrosion due to pitting in the crevices between the stranded wires. Use of the HPMC is expected to reduce this early corrosion because of the very low permeability of the concrete to chloride ions and because of the concrete's much higher resistance to carbonation attack.

To ensure service life of 100 years and more, stainless steel prestressing strands were developed and tested. These strands are now being used to build test piles before the final implementation of stainless steel for prestressing reinforcement is used for piles in coastal bridges. A follow-up GDOT research project, RP 11-34, "Corrosion-Free Precast Prestressed Concrete Piles made with Stainless Steel Reinforcement – Construction, Test and Evaluation," is currently ongoing and will compare performance of piles made with stainless steel strands to piles with conventional prestressing strands.

RP 09-03/10-21 Transportation Asset Management Research

T/I Manager: Angela Alexander, Division of Organizational Performance Management (DOPM)

RP 09-03, "Best Practices in Selecting Performance Measures and Standards for Effective Asset Management"

This project assessed and provided guidance on performance measures and standards for effective Transportation Asset Management (TAM). Performance measures are indicators of system effectiveness and efficiency. Asset Management is the combination of management, financial, economic, engineering and other practices applied to physical assets with the objective of maintaining a desired level of service. Thus, performance measurement and management are critical components of an effective TAM system. The study was conducted through a literature review, a survey of the 50 states, an internal review of GDOT's TAM capabilities and performance measurement and management procedures. As performance management is an evolving practice, various agencies are at different levels in measuring and managing performance. GDOT used the results of this study to measure its progress against other states and to evaluate the appropriateness of the performance measures and process it was currently using. GDOT also used the study to evaluate the completeness of its TAM Plan at the time in comparison to other states.

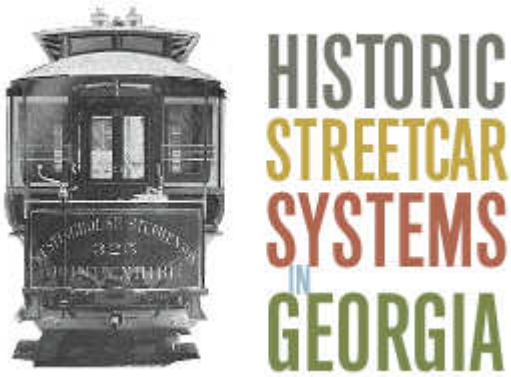
RP 10-21, "Comprehensive Transportation Asset Management: Risk-Based Inventory Expansion and Data Needs"

The objective of this research project was to identify a broad range of assets that should be considered in a comprehensive TAM system and determine the data needs and risks associated with these assets. Specifically, the research looked at ancillary transportation assets and developed a benefit-cost-risk framework and supporting tool that could be used to evaluate and prioritize which assets were best suited for systematic

management. The project focused on ten main ancillary asset classes: culverts, earth retaining structures, guardrails, mitigation features, pavement markings, sidewalks (and curbs), street lighting, traffic signals, traffic signs and utilities and manholes, and one information asset: data. A literature review and targeted survey were conducted to determine the state of the practice in ancillary TAM and collect data for the development of the evaluation framework. As a result of this research, DOPM has identified the preferred assets to move forward as it develops its TAM system.

MOBILITY

RP 10-02: Historic Streetcar Systems of Georgia Context Study (completed 01/31/12)
T/I Manager: Sara Gale, Office of Environmental Services



The Historic Streetcar Systems of Georgia Context Study has already proven a useful tool to the Office of Environmental Services (OES) in identifying, interpreting, and assessing the significance of resources associated with the 19th-20th century Atlanta streetcar system. The context is available as a free download on the GDOT website, and a geodatabase is available for use both internally and externally so that planners, designers, and preservationists alike can readily identify and consider potential effects of projects on streetcar resources, such as tracks, car barns, or landscape features. The GIS group from GDOT's IT Division has already added it to the standard datasets available in ArcGIS, which means that anyone working in that program can quickly add these data as a layer. The goal is that both designers and environmental specialists can quickly assess the presence and potential impacts to streetcar resources when going through the transportation planning process.

OES continues to work with the company that wrote the context and created the geodatabase to develop training for implementation of the context. From that training a collection of case studies will be developed. These tools will be published on a website, in development, that will also provide a location to download the context and geodatabase. OES is tentatively planning the training to take place in October 2012. A display was installed on the 4th floor of the OGC to showcase this project and the exemplary work completed by the project team. A presentation about the context and implementation was presented at the meeting of Transportation Research Board ADC50 (Historic and Archaeological Preservation in Transportation) this past July in Lancaster, PA. It was very well received, and representatives from other DOT's asked for copies of the document.

POLICY/WORKFORCE

RP10-18: Impact of Environmental Justice Analysis on Transportation Planning (Completed 08/23/11)

T/I Manager: Tom McQueen, Office of Planning

The objectives of the study were to determine the state of the practice of Environmental Justice (EJ) in transportation, assess the status of EJ implementation at GDOT, and make recommendations for next steps for the agency to enhance its capabilities for demonstrating EJ outcomes.

The Office of Planning (OP) currently meets/complies with the relevant Federal requirements and is taking the EJ research report under advisement as to enhancements to consider. This is the prudent route in light of the recent MAP-21 legislation signed by President Obama. In the months to come, USDOT will be developing and issuing preliminary regulations and rules for MAP-21, and OP plans to determine how the findings and recommendations of the EJ research will be applicable to any changes for MAP-21.

RP10-05: Developing Strategic Systems Supporting Communities of Practice in GDOT (Completed 12/01/11)

T/I Manager: Rick Smith, Office of Training and Development

The goal of this research project was to develop a strategy for effectively implementing the SharePoint system as a resource to develop, support, and build Communities of Practice (CoP) within GDOT and with GDOT's strategic partners. The implementation of the strategies recommended in this study will be core activities of the second phase of the study, GDOT research project RP 11-37, "Implementing Communities of Practice in the Georgia Department of Transportation," which is currently ongoing. To facilitate the implementation of the strategies under the ongoing study, the research team has assigned a post-doctoral research fellow to the Office of Training and Development.

SAFETY

RP 09-11: Optimization of Safety on Pavement Preservation Projects (Completed 09/16/11)

T/I Manager: Eric Pitts, Office of Maintenance

GDOT is actively seeking opportunities to incorporate safety improvements into its current pavement preservation program. Accordingly, an enhanced resurfacing program is being developed that can effectively incorporate safety improvements into GDOT's existing fast-paced resurfacing program. With the assistance of the Office of Maintenance (OM) and the Office of Traffic Operations (OTO), the following steps toward incorporating safety improvements into the pavement preservation program have been accomplished:

(1) proposal of (a) an enhanced pavement resurfacing program that incorporates selected low-cost safety improvements; (b) a report template

for identifying safety concerns and road upgrade needs; (c) a safety index that accounts for historical accident, fatality rate, and pavement condition; and (d) a safety-incorporated PACES rating for reprioritizing pavement resurfacing projects;

(2) case study to demonstrate the proposed methods using one project

Next steps in implementation are to (1) obtain finalized criteria for selecting low-cost safety improvements, based on OTO statistical analysis of GDOT's crash data; (2) integrate data from various sources, including crash data, pavement data (GPAM), and road characteristics data; (3) develop a search and reporting function using crash data and GPAM data; and (4) work with OM and OTO to practically incorporate low-cost safety improvements into pavement resurfacing program using the proposed methods.

II. POOLED FUND STUDIES

TPF-5(267) Accelerated Performance Testing on the National Center for Asphalt Technology Pavement Test Track

GDOT has actively sponsored the National Center for Asphalt Technology (NCAT) Pavement Test Track at Auburn University since its inception in 2000. For each of the four, 3-year testing cycles to-date, accelerated pavement testing has been conducted on 1-3 GDOT-funded test sections at the Track. Benefits from the testing cycles include the following: (1) confirmed rutting resistance of polymer-modified Superpave mixes, allowing these mixes to be used with significant cost savings in lower volume interstates in lieu of Stone Matrix Asphalt (SMA); and (2) confirmed use of SMA on high-volume interstates and state routes with Average Daily Traffic (ADT) of over 50,000.

http://www.eng.auburn.edu/research/centers/ncat/facilities/test-track.html

TPF-5(130): Development of Guide Specifications for Bridges Vulnerable to Coastal Storms and Handbook of Retrofit Options for Bridges Vulnerable to Coastal Storms

The objective of this project was to develop a guide specification and a handbook of retrofit strategies and options to mitigate damage to highway bridges subject to coastal storm hydrodynamic factors, and recommend improvements for bridges in coastal

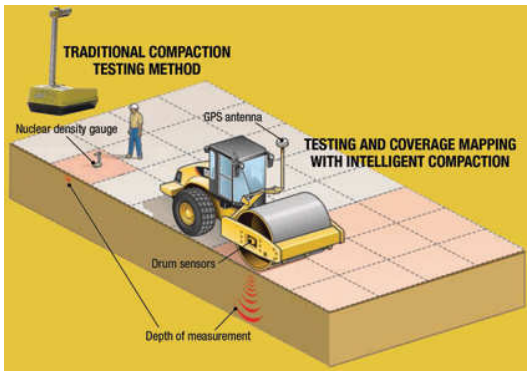
environments. The research findings have been adopted as an AASHTO Guide Specification for bridges that are susceptible to storm surge. The Office of Bridge Design (OBD) will consider using the guide specification whenever it designs a bridge that is susceptible to coastal storm surge.

TPF-5(128): Accelerated Implementation of Intelligent Compaction Technology for Embankment Subgrade Soils, Aggregate Base, and Asphalt Pavement Material

The major objectives of this study were to (1) accelerate development of Intelligent Compaction (IC) QC/QA specifications for subgrade soils, aggregate base and asphalt pavement material; (2) develop an experienced and knowledgeable IC expertise base within participating state DOT's; and (3) identify and prioritize needed improvements to, and/or research for, IC equipment and field QC/QA testing equipment.

GDOT's participation in this study resulted in a let project incorporating IC of asphaltic concrete on a Park-and-Ride lot on US 19/41 in Clayton County. The IC requirements stated that the in-place Graded Aggregate Base (GAB) was to be mapped (stiffness) and that all lifts of asphaltic concrete were to be compacted using IC rollers. The IC rollers were successful in identifying areas of weak base which contributed to locations of higher in-place air voids of the asphaltic concrete. Another useful finding was that areas where the GAB was primed, in accordance with GDOT specifications, resulted in higher stiffness values for the asphaltic concrete.

(Graphic reprinted from the Federal Highway Administration's April 2010 issue of *Focus*, www.fhwa.dot.gov/publications/focus/)



(Illustration sources from Caterpillar Inc. and Iowa State University)

Specifications have been developed using IC for soils and embankment and asphaltic concrete. GDOT is currently in the process of letting a number of projects utilizing IC for soils and embankment. Additionally, a separate project is scheduled to be let in fall 2012 requiring IC rollers for use on the asphaltic concrete. IC is now part of FHWA's "Every Day Counts" initiative, so participation in this study has enabled GDOT to be ready to implement this initiative sooner than non-participating states.

TPF-5(106): Guidelines for Designing Bridge Piers and Abutments for Vehicle Collisions

The objectives of this research were to study the magnitude of the design force and the applicability of the AASHTO LRFD bridge design specifications for abutments and piers

located within a distance of 30.0 ft. of the edge of the roadway, or within a distance of 50.0 ft. to the centerline of a railway track. The vehicle impact findings have been incorporated into the AASHTO LRFD specifications. OBD implements the findings whenever it designs a bridge over a roadway that is susceptible to vehicle impact using the AASHTO LRFD specifications.

TPF-5(068): Long-Term Maintenance of Load and Resistance Factor Design Specifications

The main objective of this study was to provide timely assistance to the AASHTO Highway Subcommittee on Bridges and Structures in interpreting, implementing, revising, and refining the AASHTO load and resistance factor design (LRFD) documents. The long-term maintenance of the specifications is done every year when the LRFD specifications are revised and reprinted. OBD implements the revised specifications whenever it designs a bridge using LRFD.

SPR-3(040)/TPF-5(037): Southeast Superpave Center

The main objective of this research was to support implementation of products from the Strategic Highway Research Program (SHRP) dealing with Superpave. Training opportunities through the Southeast Superpave Center have provided technicians and engineers in GDOT with the appropriate skills needed to perform Superpave binder and mix design testing. On-site training and certification has also been provided for GDOT as well as contractor and consultant technicians. A total of 160 technicians/engineers have been certified to perform Superpave mix designs for Georgia since Superpave was implemented in Georgia in 1997. Asphalt binder training for Georgia DOT personnel has been conducted both at the National Center for Asphalt Technology (NCAT) and at the GDOT central laboratory in Forest Park, Georgia. A total of 41 GDOT and industry technicians have been certified to perform binder testing in Georgia.