

**Mississippi**  
**Department of Transportation**  
**RESEARCH WORK PROGRAM**  
**'SPR-1(73)', Part II**  
**M560**

**For the Fiscal Period**  
**October 1, 2013 to September 30, 2014**



**Prepared by the**  
**Mississippi Department of Transportation**  
***RESEARCH DIVISION***

**James C. Watkins, P.E.**  
**State Research Engineer**  
**In Cooperation with the**  
**U.S. Department of Transportation**  
**Federal Highway Administration**

# Mississippi Research Work Program 2014

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AASHTO Accreditation Program (AAP) ..... **Error! Bookmark not defined.**

AASHTO Safe, Reliable, and Secure Transportation Operations (SAFETY)..**Error! Bookmark not defined.**

## Mississippi Research Work Program 2014

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### **GENERAL COMMENTS ON RESEARCH WORK PROGRAM FOR FISCAL YEAR 2014**

The SPR Part II research work program allocation for FY 2014 totals \$2,227,528.00 and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$126,567.88 for FY 2014, a TRB Correlation Service contribution of \$32,217.28, AASHTO Technical Services Program contributions totaling \$87,200.00, SHRP2 funding of \$92,456.97, and pooled-fund studies totaling \$ 300,000.00 as detailed in the program tabulation and narrative included in this document. The NCHRP funding is 5.5% of the SPR Parts I and II allocation. The SHRP2 funding is 4% of the SPR Parts I and II allocation. These are funded using SPR Part II funds. This work program tabulation also includes renewal statements for all on-going line items. The renewal statements for state studies contain financial information including total study budget, total expenditures to date, and cost estimates for fiscal year 2014. Also included in the renewal statements for state studies are narrative descriptions of study objectives, accomplishments of the past year, and work planned for fiscal year 2014. Beginning and completion dates are shown for each state study. Line items other than state studies have narrative descriptions of scope, objectives and anticipated activities along with a cost estimate. These tabulations and renewal statements constitute the FY 2014 research work program. The pooled fund studies, the TRB Correlation Service, SHRP2, and NCHRP as described herein are funded with 100% SPR Part II funds (no state match). The 38 line items in the tabulation mentioned above include only those items for which there is a state match (80/20) in the funding. Additional projects using either 100% federal non-SPR funds or 100% state funds that are administered by Research Division are also described in this document. State study numbers in this work program are the same as those currently being used, and they will remain the same in all correspondence Study proposals for future submissions will be numbered sequentially.

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
<b>Existing State Studies &amp; Internal Line Items</b>										
1	Long-Term Pavement Performance (LTPP)	N/A	10/1/2011	9/30/2014	\$0.00	\$7,982.82	\$5,000.00	\$4,204.91	James C. Watkins	MDOT
2	Implementation of Research Projects	N/A	10/1/2011	9/30/2014	\$0.00	\$320,731.42	\$365,000.00	\$389,600.74	James C. Watkins	MDOT
3	Technology Transfer	N/A	10/1/2011	9/30/2014	\$0.00	\$103,657.54	\$100,000.00	\$119,918.30	James C. Watkins	MDOT
4	Pavement Management	N/A	10/1/2011	9/30/2014	\$0.00	\$269,059.97	\$300,000.00	\$296,366.33	Cindy Smith	MDOT
5	Skid Collection	N/A	10/1/2011	9/30/2014	\$0.00	\$109,369.95	\$50,000.00	\$6,519.30	Marta Charria	MDOT
6	Information and Data Collection Technology	N/A	10/1/2011	9/30/2014	\$0.00	\$103,215.43	\$110,000.00	\$110,812.55	Reginald Jenkins	MDOT
7	Performance Measures	N/A	10/1/2011	9/30/2014	\$0.00	\$55,938.73	\$85,600.00	\$75,991.93	Adam Aleithawe	MDOT
8	Research Contract Liaison	N/A	10/1/2011	9/30/2014	\$0.00	\$76,317.34	\$64,000.00	\$79,433.69	Robbie Vance	MDOT
9	Minor Research Studies	N/A	10/1/2011	9/30/2014	\$0.00	\$28,461.57	\$25,000.00	\$960.00	James C. Watkins	MDOT
10	Implement the 2002 Design Guide for MDOT (Phase II)	170	3/1/2004	12/31/2013	\$1,237,838.26	\$948,300.72	\$289,537.54	\$26,619.65	Harold Von Quintus	Applied Research Associates

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
11	In-House Support to State Study 170	171	3/1/2004	12/31/2013	\$350,000.00	\$65,820.59	\$15,000.00	\$0.00	William Barstis	MDOT
12	Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking	184	10/1/2005	9/30/2014	\$218,224.00	\$119,549.79	\$98,674.21	\$51,983.05	Farshad Amini	Jackson State University
13	In-House Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking	185	10/1/2005	9/30/2014	\$30,000.00	\$870.79	\$3,000.00	\$0.00	Cindy Smith	MDOT

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
14	Consultant Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking	186	10/1/2005	12/31/2014	\$20,400.00	\$14,900.00	\$5,500.00	\$0.00	Randy Ahlrich	Burns Cooley Dennis, Inc.
15	Performance Specification for Chemically Stabilized Layers	206	11/1/2008	12/31/2013	\$239,703.00	\$222,618.44	\$17,084.56	\$50,000.53	Isaac Howard	Mississippi State University
16	Open Graded Friction Course for HMA Pavements	207	10/1/2007	12/31/2013	\$135,000.00	\$135,000.01	\$0.00	\$1,879.58	Tom White	Mississippi State University

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
17	Laboratory Testing and Evaluation of Near Surface Properties of Flexible Pavements Due to Bituminous Surface Treatments	211	10/1/2008	12/31/2013	\$330,000.00	\$301,391.34	\$28,608.66	\$80,802.82	Isaac Howard	Mississippi State University
18	I55 Integrated Diversion Traffic Management Benefit Study	223	10/1/2009	12/31/2013	\$152,810.00	\$147,571.53	\$5,238.47	\$30,965.03	Li Zhang	Mississippi State University
19	Evaluating Alternative Mowing Regimen and the Use of Native Grasses and Wildflowers on Roadside Right of Ways	228	10/1/2009	12/31/2013	\$135,044.00	\$121,063.21	\$13,980.79	\$33,024.78	John Guyton	Mississippi State University

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
20	Instrumentation & Computational Modeling for Evaluation of Bridge Substructures Across Waterways	229	10/1/2009	12/31/2013	\$150,000.00	\$19,267.16	\$130,732.84	\$0.00	Wei Zheng	Jackson State University
21	Evaluation of Short Statured Species for Rapid Establishment on Mississippi Roadsides	234	10/1/2010	6/30/2014	\$213,482.47	\$179,973.24	\$33,509.17	\$23,448.38	Barry Stewart	Mississippi State University
22	Evaluation of Fertility Practices During Roadside Establishment in MS to Minimize Nonpoint Source Pollutants	240	10/1/2010	12/31/2013	\$292,186.30	\$239,660.83	\$52,525.46	\$118,638.16	Jac Varco	Mississippi State University
23	Aggregate Absorption in HMA Mixtures	245	10/1/2013	12/31/2013	\$90,501.91	\$32,087.67	\$58,414.24	\$23,819.08	Allen Cooley	Burns Cooley Dennis, Inc.

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
24	Development of Laboratory Mix Design Procedures for RAP Mixes	246	3/1/2012	12/31/2013	\$98,483.71	\$27,531.70	\$70,952.02	\$20,171.74	Allen Cooley	Burns Cooley Dennis, Inc.
25	Influence of Cementitious Materials on Shrinkage of Bridge Deck Concrete	247	3/1/2012	12/31/2014	\$99,821.14	\$76,281.12	\$29,076.02	\$33,216.00	Robert Varner	Burns Cooley Dennis, Inc.
26	Full Depth Reclamation for High Traffic Applications	250	2/1/2012	12/31/2015	\$291,975.80	\$81,841.13	\$110,000.00	\$44,263.50	Isaac Howard	Mississippi State University
27	In-House Support to Full-Depth Reclamation for High-Traffic Applications	251	2/1/2012	12/31/2014	\$6,000.00	\$0.00	\$6,000.00	\$0.00	William Barstis	MDOT
28	Acceptable Vibrations on Green Concrete	252	2/1/2012	12/31/2013	\$79,907.61	\$71,373.32	\$3,413.71	\$52,501.85	Seamus Freyne	Mississippi State University

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
29	Driver Speed Limit Compliance in School Zones: Assessing the Impact of Sign Saturation	253	2/1/2012	12/31/2013	\$78,177.60	\$77,863.46	\$125.56	\$30,710.53	Lesley Strawderman	Mississippi State University
30	A Synthesis Study of Noncontact Nondestructive Evaluation of Top-down Cracking in Asphalt Pavements	255	2/1/2012	12/31/2013	\$71,500.00	\$37,077.85	\$34,422.15	\$37,077.85	Waheed Uddin	University of Mississippi
31	Analyzing the Impact of Intermodal-Related Risk to the Design and Management of Biofuel Supply Chain	259	10/1/2013	12/31/2014	\$99,642.00	\$0.00	\$74,731.50	\$0.00	Sandra D. Eksioglu	Mississippi State University
32	Guidelines for PCC Inputs to AASHTOWARE Pavement ME Design	260	10/1/2013	12/31/2014	\$22,500.00	\$0.00	\$18,000.00	\$0.00	Chetana Rao	Rao Research and Consulting, LLC

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/ Actual Start Date	Proposed/ Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
33	Turbidity Monitoring and Equipment Evaluation at MDOT Construction Sites	261	10/1/2013	12/31/2014	\$125,000.00	\$0.00	\$100,000.00	\$0.00	Bobby Moseley	Thompson Engineering
34	Evaluation of the WatchDog Weather Station to Reduce Drift from MDOT Spray Trucks	262	10/1/2013	12/31/2015	\$77,748.00	\$0.00	\$49,696.00	\$0.00	John Byrd	Mississippi State University
35	Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements	263	10/1/2013	12/31/2014	\$350,000.00	\$0.00	\$250,000.00	\$0.00	Allen Cooley	Burns Cooley Dennis, Inc.
36	District Traffic Control support to Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements	264	10/1/2013	12/31/2014	\$50,000.00	\$0.00	\$40,000.00	\$0.00	Bill Barstis	MDOT

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	Principal Investigator	Agency/Co
					<b>Total Technical Assistance</b>		\$1,104,600.00	\$1,083,808.00		
					<b>Total State Studies Excluding Tech Assistance</b>		\$1,248,224.00	\$659,125.00		
					<b>Total All Continuing 80/20</b>		\$2,352,824.00	\$1,742,933.00		

## Mississippi Research Work Program 2014

Mississippi FY2014 Work Program (100% Federal and 80%/20% State Funded Studies)										
Line Item	Project/Study Name	Study #	Proposed/Actual Start Date	Proposed/Actual End Date	Total Study Budget	Total Expenditures to Date	FY2014 Budget	FY2013 Expenditures	PI	Agency/Co
<b>New State Studies for FY2014</b>										
37	Research Division Support to Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements	265	10/1/2013	12/31/2014	\$50,000.00	\$0.00	\$40,000.00	\$0.00	Bill Barstis	MDOT
38	Field Aging Effects on Asphalt Mixed at Different Temperatures and Hauled Different Distances	266	3/1/2014	12/31/2016	\$150,000.00	\$0.00	\$32,142.86	\$0.00	Isaac L. Howard	Mississippi State University
					<b>Total New Studies</b>		\$72,143.00			
					<b>Total All 80/20 Expenditures</b>		\$2,424,967.00	\$1,742,933.00		

## Mississippi Research Work Program 2014

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<b>100% Federally Funded FY2014 Studies</b>		
<b>Continuing Pooled Funds</b>		
	<b>FY2013</b>	<b>FY2014</b>
Accelerated Performance Testing on the 2012 NCAT Pavement Test Track	\$0.00	\$295,000.00
Southeast Transportation Research Consortium	\$5,000.00	\$5,000.00
<b>Total Continuing Pooled Funds</b>	<b>\$300,000.00</b>	<b>\$300,000.00</b>
SHRP2	\$0.00	\$92,456.97
Mississippi Participation in NCHRP	\$523,590.00	\$121,803.52
Transportation Research Board Correlation Service	\$110,135.00	\$32,217.28
<b>Total Continuing Pooled Funds + SHRP2 + NCHRP and TRB</b>		<b>\$546,477.77</b>

## Mississippi Research Work Program 2014

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New Pooled Fund Studies for FY2014		
	FY2013	FY2014
Improving the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis	\$0.00	\$15,000.00
<b>Total New Pooled Funds</b>		<b>\$15,000.00</b>
<b>Total All Pooled Funds</b>	<b>\$300,000.00</b>	<b>\$315,000.00</b>
<b>Total All Pooled Funds plus SHRP2/NCHRP/TRB</b>		<b>\$561,477.77</b>

## Mississippi Research Work Program 2014

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<b>AASHTO Technical Services Program</b>		
	<b>FY2013</b>	<b>FY2014</b>
AASHTO Accreditation Program (AAP)	\$0.00	\$6,666.67
AASHTO Equipment Management Technical Services Program (EMTSP)	\$0.00	\$3,000.00
AASHTO Cement and Concrete Reference Laboratory (CCR)	\$0.00	\$6,666.67
AASHTO Materials Reference Library (AMRL)	\$0.00	\$6,666.66
AASHTO Product Evaluation Listing (APEL)	\$0.00	\$1,200.00
AASHTO National Transportation Product Evaluation Program (NTPEP)	\$0.00	\$12,000.00
AASHTO Technical Service Program to Develop AASHTO Materials Standards (DAMS)	\$0.00	\$5,000.00
AASHTO Load and Resistance Factor Design (LRFD)	\$0.00	\$10,000.00
AASHTO Technical Implementation Group (TIG)	\$0.00	\$6,000.00
AASHTO Transportation System Preservation Technical Service Program (TSP2)	\$0.00	\$20,000.00
AASHTO Safe, Reliable, and Secure Transportation Operations (SAFETY)	\$0.00	\$10,000.00
<b>TOTAL AASHTO TSP</b>		<b>\$87,201.00</b>
<b>TOTAL Pooled Funds Including AASHTO, NCHRP &amp; TRB</b>		<b>\$648,678.00</b>

## Mississippi Research Work Program 2014

### Summary of Work Program Expenditures and Budget FY2013-FY2014

	<u>FY2013</u>	<u>FY2014</u>
<b>SPR PART II ALLOCATION</b>	\$ 2,306,885.00	\$ 2,306,885.00
Obligation Authority	\$ 2,227,528.00	\$ 2,227,528.00
Less NCHRP (Estimated)	\$ (121,803.52)	\$ (121,803.52)
Less TRB (Estimated)	\$ (31,947.29)	\$ (32,217.28)
Less Continuing Pooled Fund Studies	\$ (395,000.00)	\$ (300,000.00)
Less Rejoined Pooled-Fund Studies	\$ -	\$ -
Less New Pooled-Fund Studies	\$ -	\$ (15,000.00)
Less AASHTO TSPs	\$ (74,200.00)	\$ (87,200.00)
Less SHRP2	\$ (92,456.97)	\$ (92,456.97)
<b>TOTAL 100% Federal Expenditures</b>	<b>\$ (715,407.78)</b>	<b>\$ (648,677.77)</b>
Plus previous FY Closeout from FMS	\$94,802.00	\$600,023.20
Plus Carryover from FMIS Previous FY (from Federal Funds Worksheet)	\$738,404.79	N/A
<b>SPR Available for 2013 &amp; 2014 Part II Work Program</b>	<b>\$ 2,345,327.01</b>	<b>\$ 2,178,873.43</b>
plus STATE MATCH	\$469,065.40	\$435,774.69
<b>TOTAL AVAILABLE FROM SPR PART II</b>	<b>\$ 2,814,392.41</b>	<b>\$ 2,614,648.12</b>
Less Internal Line Items	\$ (1,083,807.75)	
Less State Study Expenditures Through 7/31/2013	\$ (557,828.45)	
Less Estimated State Study Expenditures 8/1/12 - 9/30/13	\$ (101,294.07)	
Less Projects Closing in FY13	\$ (202,375.97)	
Less Encumbered funds From FY 20xx	\$ (724,890.00)	\$ (200,000.00)
<b>Total State Match Expenditures</b>	<b>\$ (2,670,196.24)</b>	<b>\$ (200,000.00)</b>
Estimated FY20xx Carryover (Total Available + Previous FY Balance)		\$2,558,844.29
<b>TOTAL FUNDS AVAILABLE</b>		
Less FY20xx State Studies & Internal Expenditures		\$ (2,110,395.40)
Contingency Funds	\$144,196.17	\$448,448.89

## Mississippi Research Work Program 2014

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### Mississippi Participation in Other Research Projects 100% State Funded (Non-SPR)

	<b>Budget Program FY 2013</b>	<b>Previous FY Expenditures</b>	<b>Total Expended to Date</b>	<b>Total Study Budget</b>
<b>Implement the 2002 Design Guide for MDOT (Phase II)</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$502,297.00</b>	<b>\$500,000.00</b>
<b>PI: Harold Von Quintus</b>				
<b>Field Aging Effects on Asphalt Mixed at Different Temperatures and Hauled Different Distances</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$8,600.00</b>	<b>\$64,942.70</b>
<b>PI: Isaac L. Howard</b>				

## Continuing State Studies and Technical Assistance Line Items

### LINE ITEM 1

#### Long-Term Pavement Performance (LTPP)

This line item is for support of the Long-Term Pavement Performance (LTPP) program begun under the Strategic Highway Research Program (SHRP) and now a part of the Federal Highway Administration (FHWA). Activities covered include site nomination, site verification, historic data searches, support for material sampling and field-testing, construction supervision, and technology transfer activities associated with LTPP and SHRP product implementation. Activities associated with the new SHRP II program as outlined in the current authorization will also be supported by this line item.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$3,500.00
Employee Benefit	\$980.00
Materials, Supplies, and Services	\$520.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
Total	\$5,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 2

### Implementation of Research Projects

This line item funds Research Division activities relating to implementation of research studies. Implementation Activities consist of field and office activities that apply research results to the solution of operational problems in the transportation area. Examples of these activities are:

1. Applying new products and/or procedures in the field to specific field problems.
2. Short-term field and/or office technical support in trouble-shooting and design.
3. Assistance in development of specifications and tests to implement new products or procedures.
4. Identifying areas in which research is required.
5. Initial preparation costs associated with proposed research.

Research information for implementation may originate from MDOT's Research Program (in-house and Contract), including both completed and ongoing studies; from other state transportation agencies' experiences and research; from national and international sources, from the FHWA; and from major research sources such as NCHRP, Corps of Engineers, etc.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$255,000.00
Employee Benefit	\$102,000.00
Materials, Supplies, and Services	\$1,000.00
Travel and Sustenance	\$7,000.00
Conference Registrations	<u>\$0.00</u>
 Total	 \$365,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 3

### Technology Transfer

This activity funds Research Division activities relating to the distribution of information about transportation technologies to any of MDOT Research Division's transportation customers.

Examples of technology transfer activities include:

- making presentations of research results to various groups such as universities and technical societies
- participation in user group meetings, conferences, seminars and training courses
- distribution of research results
- inputting research and research-in-progress (RIP) results into the Transportation Research Information Service (TRIS)
- producing and distributing a MDOT Research Newsletter

NOTE: The SPR WORK PROGRAM-PART I (SPR-1(52)), provides direct support to the Center for Technology Transfer (T2) at Jackson State University, and those activities and funds are not included in the above line item, Technology Transfer.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$39,000.00
Employee Benefit	\$12,320.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$48,680.00
Conference Registrations	<u>\$0.00</u>
Total	\$100,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 4

### Pavement Management

This item covers the activities of the Research Division relating to the development, implementation, maintenance and operation of the Department's Pavement Management System. The Pavement Management System database serves as an important resource for Departmental sponsored pavement related research.

Activities include awareness of national pavement management state-of-the-art and practice, administration of field data collection and statewide database development, administration of pavement condition survey contracts, quality assurance for condition surveys, in-house software development, administration of contract software development, planning and conducting in-house training, administration of contract pavement management research, implementation of pavement management research and annual distress surveys associated with MDOT's maintained pavement projects.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$233,066.00
Employee Benefit	\$65,858.48
Materials, Supplies, and Services	\$537.76
Travel and Sustenance	\$537.76
Conference Registrations	<u>\$0.00</u>
Total	\$300,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 5

### Skid Collection

This item covers the skid data collection activities of the Research Division to ensure that MDOT provides acceptable surface skid resistance for the traveling public. This line item includes skid collection for new construction acceptance, product evaluation, and quality assurance of contractor-collected skid data, and periodic maintenance and calibration of the skid collection vehicle.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$35,000.00
Employee Benefit	\$9,800.00
Materials, Supplies, and Services	\$3,000.00
Travel and Sustenance	\$2,200.00
Conference Registrations	<u>\$0.00</u>
Total	\$50,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 6

### Information and Data Collection Technology

This activity funds Research Division activities relating to the budgeting, purchasing, managing, updating, programming and servicing of all of the equipment and software.

Examples of Information and Data Collection Technology activities include:

- Budgeting for and purchasing upgrades to existing equipment and software
- Keeping up with new technology to allow the division to stay current with industry developments
- Working with staff to resolve hardware and software issues in a timely manner
- Managing the network for the division which includes backing up servers and day-to-day, week-to-week, and month-to-month maintenance
- Programming in-house applications for use in the division
- Loading pavement management condition data every two years
- Helping to diagnose and repair division nondestructive testing equipment and computers
- Maintaining Research Division intranet website and support for research related postings on MDOT's "GoMDOT" webpage

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$85,000.00
Employee Benefit	\$23,800.00
Materials, Supplies, and Services	\$1,200.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
Total	\$110,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 7

### Performance Measures

This line item includes the study of performance measures for Research and other divisions. It involves in-house support to any contracted studies, as well as salaries and time for internal task force meetings, data analysis, etc.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$59,920.00
Employee Benefit	\$25,680.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
Total	\$85,600.00

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## LINE ITEM 8

### Research Contract Liaison

This line item covers the division's contracting, work program preparation assistance, monitoring of quarterly progress reports, and payment of pooled funds, NCHRP, TRB, and other federally funded programs. Included are such tasks as completion of ADMs, close communication with Consultant Services Unit, assistance with Commission agenda items, completion of FHWA payment forms, tracking of project status and expenditures, and review and publication of quarterly progress reports and final research reports.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$46,080.00
Employee Benefit	\$17,920.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
Total	\$64,000.00

# Mississippi Research Work Program 2014

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## LINE ITEM 9

### Minor Research Studies

Low cost/short duration projects may be done without being put into a process of clearances and competing with other programs. An example of such a project is an experimental feature evaluation.

The Research Advisory Committee will establish a resource threshold to be met before requiring any project be put into a centralized clearinghouse/priority setting process. Current operating procedures are to conduct research projects where the expenditure ceiling is expected to be under \$10,000 and the project duration is expected to be one year or less.

These are based on selection and approval by the Research Engineer, following an appropriate review of District needs and literature review.

Additionally, support for national efforts coordinated by organizations such as AASHTO, will be funded by this line item.

#### Cost Estimate for FY 2014

Salaries (Regular Employees)	\$15,000.00
Employee Benefit	\$4,200.00
Materials, Supplies, and Services	\$1,800.00
Travel and Sustenance	\$4,000.00
Conference Registrations	<u>\$0.00</u>
Total	\$25,000.00

# Mississippi Research Work Program 2014

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**LINE ITEM:** 10

**STATE STUDY NUMBER:** 170

**TOTAL STUDY BUDGET:** \$1,237,838.26

**TOTAL STUDY COST TO DATE:** \$948,300.72

**DATE STARTED:** 11/03/2003

**COMPLETION DATE:** 12/31/2013

## Implement the 2002 Design Guide for MDOT (Phase II)

**RESEARCH AGENCY:**

Applied Research Associates

**PRINCIPAL INVESTIGATOR:**

Harold Von Quintus

### Objective:

Applied Research Associates, Inc. is finalizing the development of the Mechanistic-Empirical Pavement Design Guide (MEPDG) for Design of New and Rehabilitated Structures through NCHRP Project 1-37A. The MEPDG incorporates mechanistic-empirical pavement design principles and allows highway agencies to develop cost-effective and reliable designs by systematically considering climate, material properties, construction variability, and traffic to predict pavement performance. This design process is a total departure from the process utilized in the current AASHTO design procedure, requiring the designer to make trial selection of materials and layer thicknesses and evaluating their performance under projected loadings over the design life of the pavement.

The objective of this study is to implement the MEPDG for Mississippi DOT. The following issues will be addressed in this study:

- Provide for training of Design Guide users and other stakeholders
- Develop and execute a plan for securing the appropriate design input data on material and traffic characterization, and other design inputs
- Conduct sensitivity analyses and make comparisons of MEPDG designs with current procedure
- Develop and execute a plan for calibration of Guide performance and distress models

### Progress:

#### FY 2005:

Work on project tasks was slowed at MDOT's request in anticipation of recommendations from NCHRP Project 1-40 which is reviewing NCHRP 1-37A deliverables. However, work continued, especially on

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those tasks not affected by NCHRP 1-40. The following tasks have either been completed or progress made during this FY:

- Preliminary sensitivity analysis is completed
- Completed establishment of materials and traffic estimation procedures and default values
- Progress made on performing detailed sensitivity analysis of Design Guide software
- Progress made on setting up a laboratory and field testing program
- Progress made on finalizing the selection of pavement sections for use in calibrating/validating the design guide performance models
- Progress made on preparing a Phase II Interim report that documents the research results for FYs 04 and 05 and will provide a detailed research plan for the next 24 months.

### **FY 2006:**

Either the following tasks have been completed or progress made during FY 06:

- Project staff attended the December 2005 NCHRP 1-40 meeting in Washington, D.C.
- Subgrade material tests were completed including tests on materials sampled for MDOT SS 179 and ARA reviewed the resulting test results.
- Continued to coordinate and acquire pavement inventory and performance data for subsequent calibration/validation of the MEPDG performance models. Work directly related to actual calibration/validation of these models has been suspended or slowed at the request of MDOT to ensure incorporation of the latest NCHRP 1-40 results.

### **FY 2007:**

Work continued on project tasks that were not directly impacted by the delay in NCHRP 1-40. These included developing a procedure to determine the suitability of pavement performance data for local validation and calibration of MEDPG distress models. The procedure was used to determine the suitability of new pavement sections for local calibration and validation of distress models. The procedure and analysis results were documented in the form of a technical memorandum and submitted to MDOT. The project team also reviewed NCHRP 1-37A and 1-40 recommendation and current research to determine state-of-the-art in testing stabilized base/subbase materials. The review results were used to finalize the test procedure to use for testing of stabilized materials. We also continued coordinating, acquiring and reviewing pavement inventory and performance data on selected pavement sections.

Laboratory testing of candidate materials to develop material libraries continued with the assistance of Burns Cooley Dennis (BCD), Inc. During FY07, BCD completed resilient modulus testing for all subgrade samples. Tests on granular (base/subbase) materials were also initiated. Work on granular materials included coordinating with districts to select representative materials, acquiring representative materials and initiating testing.

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Fifteen material types were selected based upon comments from MDOT district materials engineers. During FY07, six of the materials were obtained and tested.

### **FY 2008:**

A majority of the project activities was related to task 7 and task 9, which have been defined as:

- Task 7: Select pavement sections to be used in the validation and local calibration process,
- Task 9: Assemble data for validation and calibration of MEPDG performance prediction models

These tasks are being conducted simultaneously for efficiency and have involved a great deal of coordination and communication with MDOT staff. ARA reviewed the distress data elements in the MDOT pavement condition databases and provided a format for MDOT to provide pavement performance, layer design, and construction activity schedules. ARA received and organized MDOT data for new flexible pavements; new rigid pavements, composite overlay flexible pavements, and overlay rigid pavements. By the end of FY 2008, ARA will complete the following:

1. Review the data for completeness and quality.
2. Prepare list of sections that show reliable, consistent, and predictable performance data trends over time (i.e., distress does not decrease with time or waver over time) so that MDOT can retrieve materials and construction data for sections in the list.
3. Evaluate materials and construction data received and exclude sections without vital materials data will be excluded for further data collection.

In addition other administrative issues were addressed including the transition to the new key project staff from ARA.

### **FY 2009:**

A majority of the project activity was related to the following tasks of the project:

- Task 7: Select pavement sections to be used in the validation and local calibration process,
- Task 9: Assemble data for validation and calibration of MEPDG performance prediction models
- Task 12: Recommend input levels needed for design inputs
- Task 15: Prepare final project report and design manual

These tasks are being conducted simultaneously for efficiency and have involved a great deal of coordination and communication with MDOT staff. ARA reviewed the distress data elements in the MDOT pavement condition databases and selected candidate sections that cover all the pavement types identified for use in the calibration of the distress models.

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1. Review the data for completeness and quality.
2. Prepare list of sections that show reliable, consistent, and predictable performance data trends over time (i.e., distress does not decrease with time or waver over time) so that MDOT can retrieve materials and construction data for sections in the list.

MDOT is currently assisting ARA with the collection of materials and construction data so that only those sections with all necessary information can be included in the calibration database. MDOT is collecting data in a format provided by ARA. During the collection of data by MDOT, ARA has assisted MDOT staff by responding to several questions regarding data necessary for the MEPDG and significance in the overall performance models, traffic inputs, etc. In addition, ARA has also extracted data from LTPP database to collect information on Mississippi sections and those in the neighboring states.

ARA has prepared preliminary drafts of the Design Manual and Software Implementation Guide that has been reviewed by MDOT.

ARA has fully executed the subcontract with BCD, Inc. for the testing of granular subbase, chemically stabilized base, and subgrade materials. A final report has been received by ARA along with the test data. Likewise, ARA has fully reviewed the material test data and reports prepared by Mississippi State University and The University of Mississippi for testing HMA and PCC materials.

In addition other administrative issues were addressed. The PI has met with MDOT during FY 2009 to discuss technical issues on this project including those aspects relevant to modifications that can be made to the software. ARA has also prepared and responded to MDOT as needed towards a contract modification to extend the time and budget for this study.

### **FY 2010:**

A majority of the project activities in FY 10 is for the following tasks:

- Task 7: Select pavement sections to be used in the validation and local calibration process (after review of construction, materials, and traffic data)
- Task 9: Assemble data for validation and calibration of MEPDG performance prediction models
- Task 10: Back-Calculation of elastic layer moduli from FWD deflection basins
- Task 11: Validation and calibration of the MEPDG performance prediction models.
- Task 12: Recommend input levels needed for design inputs
- Task 13: Evaluate design results using Mississippi calibrated models
- Task 14: Develop training materials and train DOT personnel
- Task 15: Prepare final project report and design manual

ARA expects that tasks majority of these tasks will be initiated in FY 09 and completed in FY 10 pending the availability of construction, materials, and traffic data from MDOT in a timely manner.

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## **FY 2011:**

Assembly of calibration data, coordination with MDOT to collect information necessary for calibration.

## **2012:**

- Assisted MDOT with developing field and laboratory test plan.
- Developed groundwater table depth tool.
- Provided technical assistance to MDOT with MS-ATLAS capabilities.

## **FY 2013:**

1. Assembly of calibration data, and coordination with MDOT to collect information necessary for calibration. All cone files were set up and completed for the local calibration. This included using the best available information based on historical files and as built construction data.
2. Developed tool for determining the depth to ground water for use in Calibration as well as for design.
3. Completion of the local calibration process for both flexible and rigid pavements. Local calibration factors will be defined within the last quarter of fiscal year 2013 to eliminate bias and reduce the standard error of the estimate for all transfer functions. These factors will be used in the training scheduled for fiscal year 2014.
4. Coordinate with MDOT in establishing and selecting non-LTPP sites for use in calibration. High priority sites were identified for field investigations. These field investigations, however, we postponed for the future.
5. Reviewed & Customized NCAT's Climate Files for Project Analysis. These files were used in predicting pavement performance and in defining the local calibration factors.
6. Defined the impact of normalized axle load spectra based on data provided by MDOT at each of the projects sites included in the local calibration process. The global and local normalized axle load spectra was used to define the difference in bias and standard error for the estimate in making recommendations for the future in collecting this data.
7. Finalize MDOT's design manual in using the ME Design software. This item will be completed in the last quarter of fiscal year 2013.
8. Prepared the first draft of the power point presentation and other training course materials to be used in fiscal year 2014 in training MDOT personnel in using the ME Design software. The training course materials will be completed within the last quarter of 2013.

## **Plans for FY 2014**

1. Application of the local calibration of the ME Design distress transfer functions for both flexible and rigid pavements. Local calibration was completed in fiscal year 2014 - this effort is to demonstrate application of those factors. The local calibration was based on a fewer number of sections and without using any field investigations. Without the field investigations limits the number of rehabilitation sections included in the local calibration process.
2. Complete the final research report and design manual for MDOT in day to day practice. The design manual will be used in the training of MDOT personnel in use of the ME Design software. Comments from MDOT will be addressed in the first quarter of fiscal year 2014.

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3. Training of MDOT personnel in the use of the ME Design software. Training will be scheduled during the first quarter of fiscal year 2014.
4. Determine or prepare procedure for MDOT to use in determining the effect of Truck Overloads.
5. Determine if there is any consistent and statistical difference in the local calibration factors (consistent bias and difference in standard error of the estimate) between the LTPP and non-LTPP sites. If consistent differences are found, these will be used in prioritizing the number and type of non-LTPP sites recommended for field investigations.
6. Finalize field investigation procedure and recommend the sites considered high priority for the field investigations for future fiscal years.

**Cost Estimate for FY 2014** \$289,537.54

# Mississippi Research Work Program 2014

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**LINE ITEM: 11**

**STATE STUDY NUMBER: 171**

**TOTAL STUDY BUDGET: \$350,000.00**

**TOTAL STUDY COST TO DATE: \$65,820.59**

**DATE STARTED: 11/03/2003**

**COMPLETION DATE: 12/31/2013**

## **In-House Support to State Study 170**

**RESEARCH AGENCY:**

MDOT

**PRINCIPAL INVESTIGATOR:**

William Barstis

### **Objective:**

This study will be conducted to support the State Study 170, "Implement the 2002 Design Guide for Mississippi DOT." The construction, traffic and materials data will be obtained for approximately 132 existing pavement sections. In addition to this data, pavement coring and FWD testing will be required for 24 of these pavement sections. Coordination between the six District Materials Engineers, the MDOT Central Laboratory and the private testing firm will be required to ensure that the requisite materials testing is conducted on representative samples of subgrade soils, crushed rock base course materials and chemically stabilized soil materials. Review the input/output data related to the customized Mechanistic-Empirical Design Guide software as well as the developed training materials including courses, seminars and manuals that will be delivered to MDOT as a result of the referenced study.

### **Progress:**

#### **FY 2005:**

Pavement performance data was provided to the principal investigator of SS No. 170 for numerous pavement sections located throughout the state. Collection of requisite MDOT construction and materials data for several of these pavement sections was performed and the data submitted to the principal investigator. Several coordination meetings were held to support this data retrieval and submission process.

#### **FY 2006:**

We continued to collect requisite data for calibration/validation of performance models.

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### **FY 2007:**

The work performed included the development of distress data in an Excel spreadsheet acceptable by ARA. The construction, traffic and materials data for many of these sections were also obtained and delivered to ARA. In addition to data collection some of the work included review of multiple reports and following recent developments in the M-E PDG software.

### **FY 2008:**

MDOT completed submission of current and historical data from relevant pavement condition surveys to ARA. Construction records were sent for many original asphalt pavement structures for review by ARA. Work also included the review of multiple reports and studies pertaining to the development, calibration and implementation of the ME-PDG.

### **FY 2009:**

The work completed by MDOT included the submission of data from relevant pavement condition surveys to ARA. Much of this year's efforts revolved around extracting relevant data from microfilm records. All currently available microfilm has been scanned. In addition to these roadway sections, multiple PCC sections located outside the state of Mississippi were reviewed for use in the calibration effort. MDOT also began efforts in obtaining traffic data for the relevant sections located throughout the State.

### **FY 2010:**

Work for the FY 2010 included the continuation of submitting construction and traffic records for all pavement structures. In addition, MDOT will begin to conduct field testing of rehabilitated pavement structures throughout the state.

### **FY 2011:**

Work for the FY 2011 included the continuation of submitting construction and traffic records for all pavement structures. In addition, MDOT will begin to conduct field testing of rehabilitated pavement structures throughout the state.

### **FY 2012:**

MDOT will continue provision of data to ARA as needed. Coring and field work will be included.

### **FY 2013:**

MDOT collected requisite data for calibration/validation of performance models.

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### **Plans for FY 2014:**

Coordinate AASHTOWare Pavement ME Design workshop for December 4-5, 2013. Review final report for SS No. 170 and MDOT Pavement Design Manual.

**Cost Estimate for FY 2014** \$15,000.00

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**LINE ITEM:** 12

**STATE STUDY NUMBER:** 184

**TOTAL STUDY BUDGET:** \$218,224.00

**TOTAL STUDY COST TO DATE:** \$119,549.79

**DATE STARTED:** 11/10/2005

**COMPLETION DATE:** 09/30/2014

### Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking

**RESEARCH AGENCY:**

Jackson State University

**PRINCIPAL INVESTIGATOR:**

Farshad Amini

**Objective:**

The conclusions and recommendations from Phase I State Study No. 174, Potential Applications of Paving Fabrics to Reduce Reflective Cracking, substantiated the development of this project. The primary objective is to conduct long-term monitoring of the performance of a flexible pavement which includes a paving fabric between the in-situ pavement and an HMA overlay. A comprehensive testing, monitoring, and analysis program is proposed, where twelve 500-ft pavement test sections are constructed on an existing two-lane highway, and then monitored for seven years. Particular attention is directed towards investigating the influence of overlay thickness on long-term performance. A comparison between the performance of paving fabric treatment systems for milled and non-milled surfaces, as well as a comparison between the performance of paving fabrics on sealed and non-sealed surfaces will be reported. In addition, a cost-benefit analysis will be performed to develop total life cycle costs for each section. This project, by accomplishing the above objectives, will provide a fundamental understanding of the behavior of paving fabric systems to reduce reflective cracking, and will offer practicing engineers a valuable alternative for more effective schemes during pavement rehabilitation strategies.

**Progress:**

**FY 2007:**

The test site was selected. A site visit was conducted to examine the initial conditions. FWD testing was performed on the road for the test sections. A crack survey was done on the existing pavement of all test sections before milling, sealing, or overlay placement. The distress data collection is generally in accordance with the "Distress Identification Manual for the Long-Term Pavement Performance Project, SHRP-P-338". Full depth coring was done on the existing pavement of all test sections before milling, sealing, or overlay placement. The specifications for the installation of the paving fabric sections were modified and finalized. The construction of the paving fabric sections included a test section, and the 12

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research sections. The construction process was closely monitored. The monitoring including quality control during construction to ensure that the paving fabric systems have been installed in accordance with the specifications.

### **FY 2008:**

A comprehensive construction report indicating the results of the test section, the 12 research sections, process during quality control, the equipment, testing, and the lessons learned and recommendations was prepared. The initial crack survey analysis was also completed during this year.

### **FY 2009:**

The first annual survey was completed. One paper titled "Lessons Learned from Construction of Paving Fabric Systems to Reduce Reflective Cracking in Pavements" was presented at the Mississippi Transportation Institute (MTI) Conference held in Choctaw, MS in October 2008.

### **FY 2010:**

The second annual survey was completed and analyzed during this year. The distress data collection was in accordance with the "Distress Identification Manual for the Long-Term Pavement Performance Project, SHRP-P-338" (SHRP, 1993). The data is used to determine the effectiveness of the paving fabric systems. Quarterly progress reports were submitted.

### **FY 2011:**

The third annual survey was completed during this year. The data is used to determine the effectiveness of the paving fabric systems. In addition, three core samples from each of the twelve test sections were taken to determine the thickness and conditions of each section. This data will be used during the evaluation of the crack growth.

### **FY2012:**

The fourth annual survey was completed during this year. The data is used to determine the effectiveness of the paving fabric systems. In addition, three core samples from each of the twelve test sections were taken to determine the thickness and conditions of each section. This data will be used during the evaluation of the crack growth.

### **FY 2013:**

The fifth annual survey was completed during this year. The data is used to determine the effectiveness of the paving fabric systems. This data will be used during the evaluation of the crack growth.

### **Plans for 2014:**

The sixth annual crack survey will be completed and analyzed during this year. The distress data collection will generally be in accordance with the "Distress Identification Manual for the Long-Term

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Pavement Performance Project, SHRP-P-338” (SHRP, 1993). The crack data from the prior preconstruction crack survey will be compared to the subsequent annual crack data. An analysis of the crack growth for the last six years will also be done at the end of next year. This will be done to evaluate the effectiveness of the paving fabric systems to reduce reflective cracking.

**Cost Estimate for FY 2014** \$98,674.21

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**LINE ITEM:** 13

**STATE STUDY NUMBER:** 185

**TOTAL STUDY BUDGET:** \$30,000.00

**TOTAL STUDY COST TO DATE:** \$870.79

**DATE STARTED:** 11/10/2005

**COMPLETION DATE:** 09/30/2014

### **In-House Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking**

**RESEARCH AGENCY:**

MDOT

**PRINCIPAL INVESTIGATOR:**

Cindy Smith

#### **Objective:**

This study will be conducted to support the proposed study "Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking." The required tasks include:

1. FWD field testing and evaluation of requisite overlay of proposed pavement for inclusion in Phase II study.
2. Operation of the MDOT profiler to obtain video images of the pavement surface one time prior to construction of the twelve test sections and nine times subsequent to construction.
3. Mapping of cracks on the video logs for submission to Jackson State University.
4. Traffic control will be required to facilitate FWD testing by MDOT and pavement coring operations by Burns, Cooley, & Dennis, Inc.
5. Review of one construction report, three progress reports, and one final report.

#### **Progress:**

##### **FY 2007:**

A crack survey was done on the existing pavement of all test sections before milling, sealing, or overlay placement. MDOT used the profiler to collect crack data and review the data. The distress data collected was in accordance with the "Distress Identification Manual for the Long-Term Pavement Performance Project, SHRP-P-338" (SHRP, 1993).

The construction process was monitored for the research sections. An initial crack survey was performed of the test sections using the MDOT profiler immediately following completion of construction.

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### **FY 2008:**

MDOT collected data for the third survey of the research sections. In addition to collecting the third set of data, MDOT continued to map all distresses from the first, second and third surveys and submitted the results to JSU. The first draft of the construction report was completed by JSU and reviewed by MDOT during the past fiscal year.

### **FY 2009:**

MDOT collected data for the third survey of the research sections. In addition to collecting the third set of data, MDOT continued to map all distresses from the surveys and submitted the results to JSU.

### **FY 2010:**

Collected the data for the annual survey and submit same to JSU.

### **FY 2011:**

Collected the data for the annual survey and submit same to JSU.

### **FY 2012:**

Data was collected and submitted to JSU.

### **FY 2013:**

Annual data collection was performed and analyzed.

### **Plans for 2014:**

In FY2014 the project will wrap up.

**Cost Estimate for FY 2014** \$3,000.00

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**LINE ITEM:** 14

**STATE STUDY NUMBER:** 186

**TOTAL STUDY BUDGET:** \$20,400.00

**TOTAL STUDY COST TO DATE:** \$14,900.00

**DATE STARTED:** 01/30/2006

**COMPLETION DATE:** 12/31/2014

## **Consultant Support to State Study No. 184 - Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking**

**RESEARCH AGENCY:**

Burns Cooley Dennis, Inc.

**PRINCIPAL INVESTIGATOR:**

Randy Ahlrich

### **Objective:**

This project will provide consultant support to the proposed study "Long-Term Field Monitoring and Performance of Paving Fabric Interlayer Systems to Reduce Reflective Cracking." The required tasks include:

1. Provide guidance on selection of paving fabric.
2. Provide guidance regarding paving fabric construction for inclusion in construction bid documents.
3. Monitor construction of test sections.
4. Perform requisite coring of pavement test sections.
5. Review the construction report, three progress reports and the final report.

### **Progress:**

#### **FY 2007:**

Full depth coring was done on the existing pavement of all test sections before milling, sealing, or overlay placement. One full-depth core was extracted from all test sections except for the 2 control sections. 3 full depth cores were extracted from each of the 2 control sections. BCD also monitored the construction process for the research sections.

#### **FY 2008:**

BCD reviewed draft of construction report prepared by JSU. No other work was performed this year.

#### **FY 2009:**

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No work performed during FY 09.

**FY 2010:**

No work was done in FY10.

**FY 2011:**

No work was done in FY11.

**FY 2012:**

No work was done in FY2012.

**FY 2013:**

No work is planned for FY2013.

**Plans for FY 2014:**

1. Obtain three full-depth field cores from each of the ten test sections.
2. Review final report

**Cost Estimate for FY 2014** \$5,500.00

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**LINE ITEM:** 15

**STATE STUDY NUMBER:** 206

**TOTAL STUDY BUDGET:** \$239,703.00

**TOTAL STUDY COST TO DATE:** \$222,618.44

**DATE STARTED:** 01/11/2008

**COMPLETION DATE:** 12/31/2013

## Performance Specification for Chemically Stabilized Layers

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Isaac Howard

### Objective:

The proposed project will develop a performance specification for chemically treated pavement layers (lime, fly ash, and cement). A significant amount of laboratory testing of stabilized soils will be utilized, including previous stabilization research performed for MDOT. Numerical analysis will be performed using the finite element method to determine thresholds for the performance specification. MEPDG software will also be used to perform a sensitivity analysis.

### Progress:

#### FY 2008:

During FY 2008 no meaningful activities were performed on this project. Recent events have caused significant priority shifts within MDOT related to new construction, primarily material costs. This project requires a full scale test section, and therefore has been temporarily tabled at the consent of the MDOT Research Division.

#### FY 2009:

Work accomplished during FY 09 dealt with planning of test data to be collected in companion studies. This project is intended to use data collected by other entities and use the data toward the goal of development of a draft performance specification. Other efforts focused on literature review and preliminary investigation.

#### FY 2010:

Progress was minimal during this period. The project was intended to begin with test data obtained from other sources, which did not end up being available. As a result, the majority of the intended project time allotment was used waiting for test data. In the spring of 2010, discussion began related to re-working the project scope to obtain test data. Progress in this regard progressed through the

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summer of 2010 by sending project members to the MDOT Materials Laboratory to learn the methods used by MDOT to collect existing data. The existing database of soil cement mix designs was obtained for investigation to allow selection of representative materials for use in laboratory testing of soil cement. Initial calorimetry work was performed to begin the process of selecting equipment and methods to attempt to measure maturity in soil cement for use in specifications. Suitable material samples were identified.

### **FY 2011:**

The approach to the study was modified near the beginning of FY 11 with MDOT approval. The new approach has similar goals but does not rely as heavily on data from other sources. Three soils and three cementitious materials were selected, obtained, and fundamental properties measured. The needed calorimetry (thermal profile) equipment was fabricated alongside a suitable mold and compaction apparatus to allow compacted specimen fabrication inside a plastic mold. Calorimetry testing, variability testing, and strength versus time testing were initiated and made some progress. All applicable soils from the MDOT database from the past five years were also obtained for use in analysis; preliminary analysis was performed.

### **FY 2012:**

The majority of the calorimetry, strength versus time, and strength variability testing was completed during FY 2012. Testing was also performed with multiple compaction methods and multiple curing protocols. The investigation and write up of the MDOT soil-cement database was also completed during FY 2012. Some literature review was completed, and some preliminary writing activities began. Two field tests were also conducted, where data was collected for analysis in FY 2013.

### **FY 2013:**

Performed some calorimetry (thermal profile testing) to compliment the majority of testing that had already been performed. Strength versus time testing was finished. Elastic modulus testing and wheel tracking were notable work performed during FY 13, and assembling the final report commenced in the later part of the FY. All testing was complete other than a few incidental re-tests due to analysis and thermal profile testing by the end of the FY. Data analysis was a fairly large component of the efforts during the latter half of FY 2013, both in terms of the laboratory and field test section data.

### **Plans for FY 2014:**

Complete thermal profile testing, complete incidental testing brought on by data analysis, and write the final report. The project is scheduled to be complete by December of 2013, so all other items other than corrections to the final report are scheduled for completion by December of 2013.

**Cost Estimate for FY 2014** \$17,084.56

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**LINE ITEM:** 16

**STATE STUDY NUMBER:** 207

**TOTAL STUDY BUDGET:** \$135,000.00

**TOTAL STUDY COST TO DATE:** \$135,000.01

**DATE STARTED:** 09/30/2008

**COMPLETION DATE:** 12/31/2013

## Open Graded Friction Course for HMA Pavements

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Tom White

### Objective:

Open Graded Friction Courses (OGFCs) decrease hydroplaning potential, spray, noise and underlying pavement temperature. Because of relatively high annual rainfall in the state, use of OGFC would significantly reduce hydroplaning potential, which is a major safety issue in Mississippi. Additional beneficial functions are reduction in spray, noise and underlying pavement temperature.

Research is proposed that will provide comprehensive tests, data, material evaluation, and performance results for OGFC. As a result, MDOT will be in a position to make decisions on broad application of OGFC throughout the state with respect to allowing materials, verification of mix design criteria, safety (hydroplaning and spray), noise and contribution to pavement structural capacity. Testing will be conducted in both the laboratory and the field. Field testing is proposed for test sections strategically located as to site and materials representative throughout Mississippi.

### Progress:

#### FY 2008:

There was finalization of the technical advisory committee and coordination with the committee on scope of work. A preliminary review of literature was accomplished to identify material types, specifications and mix design methods for open-graded friction courses (OGFC) coarser than used by the Mississippi Department of Transportation (MDOT) and for OGFC with rubber added to the mixture. The Florida Department of Transportation (FLDOT) was identified as having significant experience with a coarser OGFC and OGFC with rubber added.

Contact has been made with the FLDOT State Materials Engineer to clarify several points relative to their use of OGFC. These discussions are continuing. Aggregates and gradations have been identified for laboratory testing and mix designs. Sources of asphalt and rubber have also been identified. Bulk samples of all materials have been requested. Mix designs were initiated.

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### **FY 2009:**

A literature review was initiated and contacts made with other state DOTs and industry representatives to gather information on OGFC aggregate gradations, binder specifications and construction standard practice.

Current literature has been reviewed relative to scales of noise and equipment for noise measurement. This review indicated there has been significant advancement in equipment for measuring and recording noise and software for noise analysis. As a result, a number of vendors have been contacted to obtain information and specifications on appropriate equipment and software. Prices for equipment purchase or rental have been requested. A request is being prepared to modify the project budget to rent or purchase the equipment.

Target OGFC gradations have been met with stockpile aggregates obtained for the study. Binder samples have also been obtained. Inquiry was made with MDOT as to possible test sections for this calendar year.

### **FY 2010:**

The literature review chapter has been completed. Work was initiated on material and test plan chapters. Draft recommendations have been prepared for modifications to include rubber modified asphalt binder and MDOT 12.5 mm OGFC gradation and a 12.5 mm-Coarse OGFC gradation. Requirements for the rubber modified binder and 12.5 mm-Coarse OGFC gradation were modeled after FLDOT specifications. Binders included in the study are a PG 67-22 that is blended with rubber and a polymer modified PG 76-22 obtained from the same supplier. In the initial material test matrix, tests were proposed with a PG 76-22 blended with rubber. This was found not to be feasible because the resulting binder would not be workable. The PB 76-22 blended with rubber option will not be considered further.

Arrangements have not been made for field noise measurement equipment. The planned test section was not constructed. Options to access the equipment include renting, purchase new, and purchase demonstration units. Which option would be available would depend on when the test section is built. Short term rental could be most viable option.

As part of OGFC laboratory evaluation, laboratory equipment and protocol are being developed to use the field falling head permeability device applied in SS 201. The apparatus has been completed and preliminary tests conducted. Specimen geometry for the tests consists of a 19 to 25 mm OGFC cap compacted on a previously compacted dense core. A preliminary number of gyrations in the Superpave gyratory compactor have been identified. Sensitivity studies of the results to the test are continuing.

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### **FY 2011:**

Initial evaluation of the proposed coarse 12.5 mixture (modeled after FLDOT specifications) indicated the mixture would be unsatisfactory. As a result, the gradation was modified and the mixture with the modified gradation appeared to be satisfactory. Laboratory apparatus to test cores and slabs for falling head permeability were fabricated. The apparatus is compatible with components used for the field apparatus used to evaluate the OGFC constructed on I-55. In practice, 19 to 25 mm of OGFC is placed on a dense HMA. Tests on specimens with other than this geometry are not reasonable. Falling head permeability test results on I-55 have been used to select core and slab compactive efforts for the thin OGFC on dense HMA. A new shear device has been fabricated for use to determine shear strength and interface shear strength. A request has been made to include a test section of OGFC mixtures in a paving project this construction season.

### **FY 2012:**

During FY 2012 techniques were developed for compacting OGFC caps on dense base cores and OGFC surface layers on dense base slabs. The difficulty was that in the field, OGFC surfaces are not compacted to a specified density. As an alternative method for laboratory compaction control, the average time to drain for the I-55 test section was used as a target for compacting laboratory specimens. OGFC caps on dense base cores were compacted with the 6-in Marshall Hammer and OGFC surface layers were compacted on dense base slabs with a linear compactor. Techniques also were worked out for running the interface direct shear tests. Test results at 140°F reflect reasonable effect of normal (tire) pressure. Sound tests were run on specimens consisting of the OGFC caps on the dense base cores. Texture and friction tests were run on the OGFC/dense base slabs. Dynamic modulus tests on compacted OGFC cores were completed.

### **FY 2013:**

Testing except for friction and texture has been completed. Final report has been in preparation.

### **Plans for FY 2014:**

Friction and texture of OGFC specimens will be completed and final report prepared and submitted for review.

**Cost Estimate for FY 2014 \$0.00**

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**LINE ITEM:** 17

**STATE STUDY NUMBER:** 211

**TOTAL STUDY BUDGET:** \$330,000.00

**TOTAL STUDY COST TO DATE:** \$301,391.34

**DATE STARTED:** 01/05/2009

**COMPLETION DATE:** 12/31/2013

### Laboratory Testing and Evaluation of Near Surface Properties of Flexible Pavements Due to Bituminous Surface Treatments

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Isaac Howard

**Objective:**

The project will test all emulsions that at present can be delivered into Mississippi for sealing activities. The end product will be a draft performance/material acceptance specification for chip and scrub seal activities. The project will also investigate the benefits of fog seals via wheel tracking of pavement slabs treated with fog seals.

**Progress:**

**FY 2009:**

Work accomplished was primarily related to obtain slabs from pavements and subsequently to saw them into cores and other appropriate samples for testing. Vialit testing, viscosity testing, and frosted marble testing made up the majority of the testing performed. The Vialit testing made significant progress and should be completed in the relatively near future. Likewise, the majority of the viscosity testing should be complete in the relatively near future. Preliminary work related to sawing specimens for bending beam rheometer and dynamic shear rheometer testing also occurred alongside preliminary efforts to develop a long term performance test for seal treatments.

**FY 2010:**

One area of progress consisted of performing significant amounts of viscosity, frosted marble, bending beam rheometer, and sweep testing. Another area of progress was preliminary concept work related to a long term performance test of chip seals using a modified sweeping procedure. A preliminary concept has been developed. Plans have been initiated to obtain cores from field projects within Mississippi for use in development and calibration of the test procedure. Analysis has focused more on viscosity and frosted marble data as this testing has progressed ahead of other testing. Analysis of frosted marble data has indicated a potentially viable approach for evaluating traffic opening using data from frosted marble and sweep testing. Both the frosted marble and sweep tests were performed in the standard manner as well in a modified format.

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### **FY 2011:**

The majority of the needed BBR testing was performed during the year. All envisioned IDT testing was performed during FY 11. Some sweep testing and some effort was devoted to the long term performance test. The majority of the data collected in the study thus far has been reduced and placed into tables and figures suitable for the final report. Over 1,000 tests were conducted during FY 11 related to this project.

### **FY 2012:**

Data analysis began on data collected in previous FY's, with some analysis focusing on between test method parameters, not just within test method parameters. Over 400 hundred sweep tests were performed in FY 2012. Two test sections were monitored for the Long Term Performance Test (LTP), and laboratory work commenced on the LTP as equipment was designed, fabricated, and pilot scale testing was performed. Some effort was given to writing the final report for the study.

### **FY 2013:**

Continued to monitor LTP test sections, including continuing to obtain field cores for testing. Laboratory LTP work also continued. Bending Beam Rheometer (BBR) testing was largely complete by the end of FY 2013. Hundreds of BBR beams were tested during the FY. Data reduction and analysis was a key part of FY 2013. Most of the data from the entire study was reduced and the majority was analyzed during FY 2013.

### **Plans for FY 2014:**

Complete LTP testing, complete analysis, and write the final report. The project is scheduled to be complete by December of 2013, so all other items other than corrections to the final report are scheduled for completion by December of 2013.

**Cost Estimate for FY 2014** \$28,608.66

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**LINE ITEM:** 18

**STATE STUDY NUMBER:** 223

**TOTAL STUDY BUDGET:** \$152,810.00

**TOTAL STUDY COST TO DATE:** \$147,571.53

**DATE STARTED:** 03/29/2010

**COMPLETION DATE:** 12/31/2013

## I55 Integrated Diversion Traffic Management Benefit Study

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Li Zhang

### Objective:

Integrating diversion traffic from a congested freeway with traffic signal timing on parallel arterials could take advantage the capacities of freeway and arterials and that therefore forms an Integrated Corridor Management strategy. The objective of the project is to evaluate the benefits of freeway congestion relief by utilizing corridor-wide capacity in I-55 corridor. Possible strategies of a state of the practice approach and a state of the art approach are proposed and implemented first. Those strategies are evaluated in a calibrated simulation environment. The state of the practice approach would provide MDOT policy makers the information about the benefits that might be achieved under existing infrastructure while the state of the art approach would provide MDOT policy makers the information about the best possible benefits that can be achieved under ICM approach.

### Progress:

#### FY 2010:

The research team started the project after Jun. 1. Will finish literature review and system architecture tasks. Will work with Traffic Engineering Division to perform system architecture task.

#### FY 2011:

The Literature review about integrated corridor management has been conducted and finished. Two Meetings with MDOT traffic and planning divisions were held to discuss data collection efforts. Outreaches to Central Mississippi MPO in Jackson, City of Jackson and City of Ridgeland were conduct to get some feedback. A project progress meeting with the traffic engineering division was hold in Jackson, MS in May 19. City of Jackson was contacted to get traffic control device Information on the detour route. Traffic on detour routes (State Street) was surveyed. Raw data was processed to form AM/PM flow rate for further studies. AM/PM traffic patterns were studies as well. A traffic study report was formed for internal use and will be included in final project report. Instead of direct survey of traffic by project team, traffic volumes on I-55 freeway and ramp are attempted alternatively for the cost saving.

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Video images from MDOT ITS traffic cameras are being recorded. Software to count traffic from video images is sought for and will continue to seek. CORSIM traffic simulation models about I55 freeway and detour routes (Surface Street) have been built separately. Worked with Siemens and Temp Inc. to install an ACTRA system and prepared the lab test and development environment. System device and system architecture have been determined by working as MDOT and equipment providers.

### 2012:

In Federal FY2012, the research team focused on the diversion model development for real-time diversion traffic management. A real time algorithm was developed to solve the proposed model.

Specific accomplishments in FY2012 based on tasks are listed below. **Task 3: Base Line Traffic Simulation Model Development** – Existing traffic signal control and traffic detection inventory were reported. The research team conducted a field survey at major intersections in the Northern Jackson area. It covered all the arterials, including State St, County Line Rd, Lakeland Dr, Fortification St, Pearl St, and Frontage Rd, and a few local streets in the area. The research team inspected the devices in the cabinet, including the traffic signal controller, the conflict monitor, the detector units, load switches, and the flashers. The working condition of all the devices was also tested. In addition, the configurations of the loops were collected. The research team inspected the communication among the loops, the intersection, and the master controller.

**Task 4: An Expert System Approach.** The research team set up different thresholds to trigger different timing plans in ACTRA. For example, the timing plan switches when the traffic volume  $> 800$  vph on the minor approach, which is similar to TOD. However, when the condition reached a threshold, the signal timing plan didn't switch as planned. After investigation, the research team figured out that either the communication or the setup of ACTRA had a problem. The research team will work with Temple engineers to solve the problem in the next quarter. Since under the current system architecture, MDOT prefers to manually trigger the different division plan, this will not affect the project at all.

**Task 5 an Optimization Approach** – An optimization model to minimize the freeway delay and arterial delay was developed. The impacts of diversion on freeway delay and arterial delay were considered in the model. Four sets of variables, including the diversion volume, the traffic signal timing plans on arterials, the traffic signal coordination on arterials, and the ramp meter were optimized. **Subtask 5.1: Delay Model Development** – Two types of optimization models are being developed. The first type is a user-equilibrium model in which the travel time on the freeway segment is equal to the travel time on the diversion route. The second type is a system-optimum optimization model in which the average delay is minimized while the travel time on the freeway may be different from the travel time on the diversion route. In the model, freeway delay is calculated based on the travel time difference before/after diversion. An adaptive traffic signal optimization model was developed. The traffic pattern of the diversion flow was analyzed. The delay on the arterial was calculated based on the time-space graph. **Subtask 5.2: Algorithm Selection and Development** – Dynamic algorithms, including heuristic optimization methods and purely mathematical programming for real time optimization, were reviewed. A greedy algorithm with specific local search criteria was developed for signal optimization. **Subtask 5.3: Solution and System Integration** – The models and algorithms were integrated into the CORSIM simulation environment. The research team developed an interface for the IDTMS model using CORSIM run time extension. **Task 7: Final Report** – A report of the existing traffic signal devices, traffic detections, and their working conditions was developed. Discussions and recommendations regarding the existing software and hardware upgrades were provided in the report.

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### **FY 2013:**

1) Continuously reviewed literatures related to ICM and traffic signal optimization; 2) prepared data for inventories of existing traffic signal control devices and traffic detection devices along State St; 3) an offline optimization model for traffic signal coordination was completed; 4) conducted a case study to prove significant benefits could be obtained by performing traffic signal coordination. (offline offset optimization). 5) reviewed materials for Run-Time Extension of CORSIM to program in CORSIM; 6) developed online offset optimization algorithm for detour traffic. 7) developed a prototype for online offset optimization for detour traffic; 8) Finished programming for online offset optimization for detour traffic in CORSIM simulation; 9) Finished Task 5: An Optimization Approach of I-55 project; 10) conducted a case study for task 5.; 11) submitted a research paper of I-55 to TRB for considering presentation and publication.

### **Plans for FY 2014:**

1) Conduct another case study for I-55; 2) Finish Task 4: An Expert System Approach ; 3) complete Task 6: Benefit Studies; 4) Finish Task 7: Final Report and deliver the final report to MDOT

**Cost Estimate for FY 2014** \$5,238.47

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**LINE ITEM:** 19

**STATE STUDY NUMBER:** 228

**TOTAL STUDY BUDGET:** \$135,044.00

**TOTAL STUDY COST TO DATE:** \$121,063.21

**DATE STARTED:** 01/29/2010

**COMPLETION DATE:** 12/31/2013

### **Evaluating Alternative Mowing Regimen and the Use of Native Grasses and Wildflowers on Roadside Right of Ways**

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

John Guyton

#### **Objective:**

This three year project will determine if a limited mowing regimen is sufficient to make ROW maintenance more cost effective while increasing the beauty of Mississippi's ROWs. It will also identify additional propagules that may be useful in expediting the transition to natural ROWs and ascertaining motorist patience with the transition and perception of a more natural ROW. This project will begin to showcase some of the following benefits:

- Reduce vegetation expenditures by an average of over \$10-\$20 on the acres not mowed,
- Slow the rate of spread of invasive plants which require bare soil and disturbance for spreading along road ROW,
- Obscure visibility of roadside litter and trash,
- Increase roadside beauty due to occurrence of wildflowers, native bunch grasses and native pollinators (butterflies and hummingbirds),
- Increase food plants for wildlife species of old fields, prairies and meadows and
- Provide nesting habitat for wild turkey, rabbits and other ground-nesting birds and small mammals while discouraging deer.

#### **Progress:**

##### **FY 2010:**

Excellent progress has been made during the first phase of this study. Even with a slightly late start we are on schedule for most items. A graduate student with a native plant background has been hired and he has made remarkable progress familiarizing himself with Mississippi's native plants and meeting colleagues who can assist with difficult plant identification. The research plots have been identified, marked and surveyed. Spring and summer surveys of the propagules in a transect of each plot has been completed. The profile of the soil pH from the roadway through the research plots has revealed

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minimal variation. The plots have been mowed and woody vegetation has been removed. Signs are being installed.

### **FY 2011:**

We have completed a year of inventorying and monitoring the growth of plants in the research plots. We are using spotlight counts and trail cameras to monitor deer presence and activity in our research plots. Wildflower seeds have been planted twice in the research plots with little growth obvious. The seasonal internet wildflower guide has been finished for placing on the MDOT website.

### **FY 2012:**

Monitoring ROW vegetation is for the most part completed. We will continue monitoring a few interesting sites because of the interaction of natives and specific non-indigenous species (Johnson Grass, for example, where we have noticed reduced mowing appears to limit its height and spread). A second tour of state ROWs was completed to look at similar sites and the premowed state of vegetation in other areas of the state. Edward and I participated in IRB training in preparation for the public opinion survey. The camera wildlife surveys are completed. Our public opinion survey is in the final stages of IRB (Institutional Review Board) approval and we should be collecting data during August 2012. Presentations of the research were delivered at: the Mississippi Wildlife Society annual conference 2011 and an updated paper has been submitted for fall 2012, the Mississippi Transportation Institute, the MSU Landscape Symposium, the Prairie Wildflower Workshop, the MSU Graduate Student Symposium, the Southeastern Prairie Symposium at MSU, and the Mississippi Native Plant Society annual conference. Our research was featured in landmarks (Vol 7 No 2), the MSU Extension Service quarterly newsletter. Data entry is nearing completion.

### **FY2013:**

All ROW monitoring is completed and data analysis is in progress. The public opinion survey is incomplete but Edward assures me it is in progress. Presentations on various aspects of the research were made at the Mississippi Wildlife Federation and the Southeastern Society for Ecological Restoration.

### **Plans for FY 2014:**

The public opinion survey should be completed and tabulated. Edward's thesis should be very near complete and will contain a comprehensive analysis of the vegetation surveys.

**Cost Estimate for FY 2014** \$13,980.79

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**LINE ITEM:** 20

**STATE STUDY NUMBER:** 229

**TOTAL STUDY BUDGET:** \$150,000.00

**TOTAL STUDY COST TO DATE:** \$19,267.16

**DATE STARTED:** 01/29/2010

**COMPLETION DATE:** 12/31/2013

### **Instrumentation & Computational Modeling for Evaluation of Bridge Substructures Across Waterways**

**RESEARCH AGENCY:**

Jackson State University

**PRINCIPAL INVESTIGATOR:**

Wei Zheng

**Objective:**

A high degree of uncertainty exists for the prediction of lateral earth pressures applied to earth retention structures sited in the swelling clay deposits which exist throughout Mississippi. Current procedures for estimating these pressures are known to include some conservatism, by necessity. In consideration of the high degree of uncertainty in earth pressure estimates and the high costs of design inefficiencies, this research seeks to reduce these inefficiencies via the development of a rational procedure for evaluating stress states which may exist throughout the life of the retaining structure. This will be achieved through the introduction of soil suction measurements to conventional geotechnical analyses. The results of this research program would be subjected to prediction and validation in a field monitoring program involving a constructed retaining wall in an expansive clay deposit.

**Progress:**

**FY 2010:**

The research was promptly started when the project was granted. In 10/2009, an official meeting was held by the PI and Technical Advisory Committee (TAC) of the Mississippi Department of Transportation (MDOT). Implementation plan was discussed in detail on the meeting. The paperwork for the project funding was issued to Jackson State University (JSU) in 3/2010 by MSU, and the funding account was set up in 5/2010 by JSU. The PI had an undergraduate conduct a comprehensively literature review immediately after that. They found some advanced sensors which can be adopted in this project, including the load-cell scour sensor, the optical fiber bragg grating (FBG), the float-out transmitter sliding magnetic collar, the active sonar, and so on. They then intensively studied the sensor-based scour assessment technologies to choose an apparatus which would be used in the following field tests. In May, the Bridge Division of MDOT has provided the PI with the files of the bridge No. 127.9 on U. S. Highway 61. Meanwhile, the PI had recruited a research associate, who will join the research team in 9/2010.

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### **FY 2011:**

The report on literature review on applicable scour sensors and recommendation of selected scour sensors has been presented to MDOT/TAC and staff in Bridge division. The vendors of anticipated sensors have been invited to present further specification and application of these sensors through web-based seminars. After careful study of various sensors in terms of their applicable conditions, installation, durability, measurement reliability, cost, and maintenance, and communicate with MDOT/ACT, the suitable TDR (Time Domain Reflectometers) sensor is selected for the field implementation for the next phase. PI and his research team also have made efforts to develop a probabilistic framework for assessing the scoured bridges. As results, two research papers deal with scour motoring, "An Alternative Approach to Detecting Scour at Bridge Foundation", and "Assessment of Performance Reliability of Scoured Bridges Based on Probabilistic Inference with In-Suit Monitoring Data", were presented to the TRB Annual Meeting 2011.

### **FY 2012:**

The characteristics of different Time-domain reflectometer (TDR) sensors had been further examined and presented to the Technical Advisory Committee (TAC) of MDOT for future field implementation. As result, the TDR sensor developed by the Case Western Reserve University at Cleveland of Ohio was selected as the suitable scour monitoring sensor for further field evaluation. The SR 25 bridge #1.7A (Structure Key 11540) over the Pearl River in Lakeland Drive of Jackson was chosen as the site for the field test. The preliminary design and plan for the field evaluation of the selected TDR sensor was developed and represented to the TAC of MDOT. The researcher currently is in the process of revising the preliminary design and plan of field evaluation based on the comments made by the TAC, and particularly developing effective and efficient method for reliably validating the TDR sensor scour measurement. The computational model and risk assessment for facilitating decision-making under uncertainties had also been explored by the research team.

### **FY 2013:**

In the past year, the PI has communicated and worked with the vendor of the selected scour sensor, Dr. Bill Yu from the Case Western Reserve University, for the lab mock-up test of selected scour sensor system at the one hand, and worked on the computational framework for evaluating the scoured bridge at the other hand. The purchasing order for the selected scour sensor system, which included both scour sensor parts and wireless data transmission parts, had been issued by JSU to the vendor the Case Western Reserve University in November of 2012. The process of fabricating and testing the system by the vendor was unexpectedly slow. The vendor only developed and delivered the sensor parts in May, 2013, but did not provide the wireless data transmission parts, which transfer the data from scour sensor measurement. Meantime, based on the progress report provided to the PI by the vendor at the reporting time (see attachment), the vendor had fabricated and tested the wireless data transmission, but did not specify when he would deliver the wireless data transmission parts. The PI is now in communication with the vendor to let them to set the date for the delivery of the wireless data transmission parts. The PI has developed the computational procedures for probabilistic inference of scour damage from bridge vibration measurements, and examined relevant literatures to identify the

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acceptable probability of failure for scoured bridges to be  $10^{-3}$  annually for the existing system, which can be used for the management decision-making. The PI had also started preparing the test setting at JSU lab in May for the planned mock-up test of the scour sensor system.

### **Plans for 2014:**

It is expected that the vendor will deliver the wireless data transmission parts in coming August. Once the wireless data transmission parts are delivered to the JSU lab, the PI will work closely with the vendor to assemble the scour sensor parts and the wireless data transmission parts together. The lab mock-up test of the selected TDR scour sensor system, including simulating scour in the water tank, obtaining the measurement signals from the sensor through wireless networking system, and calibrating the measurement with the simulated scour, will be conducted for future field implementation. Meanwhile, PI will also further test the computational framework for detecting scour from vibration measurement as the supplement to the scour sensor measurement by using simulating data, as well as complete the computational framework for estimating the bridge performance reliability against failure, or the failure probability. It is planned that the TAC from MDOT will be invited to examine the pilot lab mock-up test, and have the meeting with PI to make suggestions for the field implementation of the selected scour sensor at the selected bridge site before the PI write the final project report.

**Cost Estimate for FY 2014** \$130,732.84

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**LINE ITEM:** 21

**STATE STUDY NUMBER:** 234

**TOTAL STUDY BUDGET:** \$213,482.47

**TOTAL STUDY COST TO DATE:** \$179,973.24

**DATE STARTED:** 02/02/2011

**COMPLETION DATE:** 06/30/2014

## Evaluation of Short Statured Species for Rapid Establishment on Mississippi Roadsides

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Barry Stewart

### Objective:

Mowing of Mississippi roadsides is very expensive yet necessary to maintain safety and aesthetics. Newly constructed sites need to be quickly established with turf. The objective of this project is to evaluate seed mixes that can strike a balance between rapid establishment and reduced mowing. New mixes with lower stature plants will be compared to currently used standards. Some mixes will include species known to be unpalatable to deer. Hydroseeding is the preferred method for planting roadsides. Various hydraulic media will be evaluated for rapid establishment and compared to currently used standard carriers. Factorial plot arrangements will allow evaluation of seed mixes and hydraulic media in the same experiments. This testing will need to be conducted at two locations in spring and two locations in fall for two years. An additional six months will be required to finalize data collection. An important step in reducing mowing will be to conduct an inventory survey on what species are currently growing on Mississippi roadways. This would determine the long-term outcome of plantings that occurred years earlier, give insight on species succession, and reveal what species are presently requiring mowing. This survey will be conducted during summer for one fiscal year and include both winter (end of season) and summer (early-mid season) species.

### Progress:

#### FY 2011:

The notice to proceed came in February 2011. Since that time, I have brought on a master of science student to conduct this research. The student conducted a thorough literature review on short statured species that showed promise for quick germination and establishment. A list of species that fit the above criteria was generated and seed located. Each species was tested in a germination chamber to determine whether they may be considered good options for this study. Once a list of species was generated we generated treatments consisting of single species or a mixture of several species. Plots along highway 25 were prepared and seed was planted in early June. Weekly measurements occurred

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from the time of planting until plot coverage reached 70%. Digital image analysis, volumetric water content, and visual ratings were all used to generate data on this study. A second study looking at the effect of various mulch materials on plant establishment commenced in July. The same measurements listed above were recorded weekly until 70% plot coverage occurred.

### **FY 2012:**

We continued to monitor the summer seeding experiment, planted in early June for species composition, plant height and soil moisture. We also continued to monitor a hydroseeding study looking at the effect of different hydromulch materials available for hydroseeding. This experiment was planted in early September but was monitored weekly at the beginning of this year and then monitored monthly after mid-October. Data was collected on germination, plant height and species composition. A fall experiment focusing on suitable cool season species was planted in late October. This experiment was monitored for germination, plant cover and soil moisture intensely for 30 days and then less frequently after 30 days. The second round of the growth chamber study to investigate which species germinate well at high temperatures for summer seeding. The second summer seeding experiment, was planted the third week of June. The first 30 days following rainfall this experiment will be monitored intensely for germination, species composition, plant height and soil moisture content. All experiments are or will be monitored monthly for species composition and plant height.

### **FY 2013:**

We continued to monitor the 2 summer seeding experiments, planted in early June of 2011 and 2012 for species composition, and plant height. We also continued to monitor 2 hydroseeding studies looking at the effect of different hydromulch materials available for hydroseeding. These experiments were planted in early September (2011) and late May (2013). Data was collected on germination, plant height and species composition. Two fall experiments focusing on suitable cool season species were planted in late October 2011 and 2012. These experiments were monitored for germination, plant cover and soil moisture intensely for 30 days and then less frequently after 30 days. These experiments have been our most successful and oil seed radish appears to be an excellent nurse crop and turf type tall fescue appears to be a viable low statured grass for roadside establishment. A hydromulching experiment for centipede grass was seeded in June 2012. An experiment to determine optimal seeding rates for oil seed radish when seeded in the summer with Bermuda grass was seeded in late July. All experiments are or will be monitored monthly for species composition and plant height.

### **Plans for FY 2014:**

We will continue to monitor species composition and plant height on all experiments. We hope to initiate a cool season species experiment on one or two sites in MS in September/Oct. to see if Turf type tall fescue is viable in other parts of MS. We will begin to put together the project report.

**Cost Estimate for FY 2014** \$33,509.17

# Mississippi Research Work Program 2014

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**LINE ITEM:** 22

**STATE STUDY NUMBER:** 240

**TOTAL STUDY BUDGET:** \$292,186.30

**TOTAL STUDY COST TO DATE:** \$239,660.83

**DATE STARTED:** 02/02/2011

**COMPLETION DATE:** 12/31/2013

## Evaluation of Fertility Practices During Roadside Establishment in MS to Minimize Nonpoint Source Pollutants

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Jac Varco

### Objective:

Turf on Mississippi roadsides is typically established with one large fertilizer application at the time of planting without soil test recommendations. There is great concern for runoff of sediment and nutrients from roadside turf sites. Nutrient and sediment losses from highway construction sites are inevitable due to the lack of vegetation and sloped land. Our objective is to provide guidelines for maximizing the efficiency of fertilizer use with rapid plant establishment and minimal runoff. Experiments will be conducted to compare the current single application rate with other methods that are based on soil test recommendations. Rain simulations will provide a consistent and precise data flow that will result in fertilization best management practices for road construction in Mississippi.

### Progress:

#### FY 2011:

The notice to proceed came in February 2011. Since that time, I have brought on a PhD student to conduct this research. The student conducted a thorough literature review on runoff, fertilizer sources, mulches, and species. The summer rainfall simulations began in July 2011 to examine fertilizer sources on time to establishment and fertilizer and sediment losses during rain events. The second study of this experiment began in September and examined the various mulch sources on fertilizer and sediment losses during roadside establishment.

#### FY 2012:

Field site preparation for the fall mulch study was conducted October 2011 at the Mississippi State north farm. During this period, the site was sprayed with glyphosate to kill existing vegetation and tilled to produce an acceptable seedbed. Stainless steel frames and plastic containers were installed in the soil to collect runoff from rain events during the study. Planting and fertilization took place 21 October 2011.

## Mississippi Research Work Program 2014

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During the study period of 60 days, five natural rain events occurred producing a total of 128 runoff samples. Furthermore, we conducted three simulated rain events producing a total of 672 samples. After collection, the samples were frozen until processing and analysis. Vegetative cover, soil volumetric water content, and weather data were also collected during the study period.

Runoff samples collected from the summer 2011 fertilizer study were processed and nutrient analysis took place concurrently with the fall mulch study. Nutrient analysis continued into spring 2012. The site selection for the summer 2012 fertilizer study took place in March. The site selected was in a similar location as the 2011 summer study, an area on highway 25 near Starkville, MS. The site's existing vegetation was removed and the soil tilled to produce an acceptable seedbed late April 2012. The stainless steel frames and plastic collection containers were installed May of 2012. Seeding and the first fertilizer application will take place 14 June 2012 depending on the weather. Rainfall simulations will take place 14, 28, and 56 days after seeding. A second fertilizer application will be applied 15 days after seeding. Samples from the simulated rain events and any runoff producing natural rain events will be collected and stored for later processing and analysis. The study will conclude 14 August 2012 and preparation for the 2012 fall mulch study will begin.

### **FY 2013:**

The 2012 mulch study was planted mid-September and continued through the end of November. During the study period, runoff samples were collected from simulated rainfall 14, 28, and 56 days after seeding. Runoff samples were collected following natural rainfall 18 September and 1, 15, and 18 October. Vegetative cover, soil volumetric water content, and weather data were also collected. All runoff samples collected from 2011 and 2012 studies were processed and analyzed for total nitrogen in spring 2013. Sediment analysis was initiated following total nitrogen analysis.

### **Plans for FY 2014:**

All field sites will be maintained through December 2013. Sediment analysis of 2011 and 2012 runoff samples will be completed. Appropriate statistical procedures will be selected and used for the analysis of runoff and vegetative establishment data from all studies. A final report outlining results will be drafted and submitted to satisfy the conditions of the award.

**Cost Estimate for FY 2014** \$52,525.46

# Mississippi Research Work Program 2014

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**LINE ITEM:** 23

**STATE STUDY NUMBER:** 245

**TOTAL STUDY BUDGET:** \$90,501.91

**TOTAL STUDY COST TO DATE:** \$32,087.67

**DATE STARTED:** 06/01/2012

**COMPLETION DATE:** 12/31/2013

## Aggregate Absorption in HMA Mixtures

**RESEARCH AGENCY:**

Burns Cooley Dennis, Inc.

**PRINCIPAL INVESTIGATOR:**

Allen Cooley

### Objective:

Within the state of Mississippi, natural chert gravels are our source of native aggregates. The absorption characteristics of our gravels can range from relatively non-absorptive to very absorptive. Areas of our state that predominantly have high absorption aggregates routinely have HMA pavement layers that crack prematurely. Within this project, Burns Cooley Dennis will sample field projects in which aggregates of varying absorption characteristics are utilized. The research will involve conducting tests that will identify how much asphalt absorption takes place through the entire production and construction process.

### FY 2012:

No work was completed during FY 2012.

### FY 2013:

Sampled four field projects. Laboratory testing of the projects was initiated and continues.

### Plans for FY 2014:

Continued sampling and testing of field projects. Finalize research and submit final report

**Cost Estimate for FY 2014** \$58,414.24

## Mississippi Research Work Program 2014

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**LINE ITEM:** 24

**STATE STUDY NUMBER:** 246

**TOTAL STUDY BUDGET:** \$98,483.71

**TOTAL STUDY COST TO DATE:** \$27,531.70

**DATE STARTED:** 06/01/2012

**COMPLETION DATE:** 12/31/2013

### Development of Laboratory Mix Design Procedures for RAP Mixes

**RESEARCH AGENCY:**

Burns Cooley Dennis, Inc.

**PRINCIPAL INVESTIGATOR:**

Allen Cooley

**Objective:**

Within this project, Burns Cooley Dennis will sample field projects in which RAP is incorporated within the mixture. Laboratory testing will be conducted on these samples to determine the amount of blending that occurs between the RAP binder and virgin binder. Testing will also be conducted on laboratory prepared mixtures, using the same materials, to determine the proper methodology for incorporating RAP into mixtures during mix design.

**FY 2012:**

No work was completed during FY 2012.

**FY 2013:**

Two field projects were sampled and tested.

**Plans for FY 2014:**

Continued sampling and testing of field projects. Finalize research and submit final report

**Cost Estimate for FY 2014** \$70,952.02

# Mississippi Research Work Program 2014

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**LINE ITEM:** 25

**STATE STUDY NUMBER:** 247

**TOTAL STUDY BUDGET:** \$99,821.14

**TOTAL STUDY COST TO DATE:** \$76,281.12

**DATE STARTED:** 03/13/2012

**COMPLETION DATE:** 12/31/2014

## **Influence of Cementitious Materials on Shrinkage of Bridge Deck Concrete**

**RESEARCH AGENCY:**

Burns Cooley Dennis, Inc.

**PRINCIPAL INVESTIGATOR:**

Robert Varner

### **Objective:**

BCD proposes to test thirty concrete mixtures to determine the influence of source of portland cement and source fly ash on shrinkage and cracking of concrete bridge decks. Six sources of portland cement will be selected and used to develop six mixtures with 100 percent portland cement. Four sources of Class C and Class F fly ash will be selected and combined with one of the sources of portland cement to develop twenty-four mixtures using fly ash to replace portland cement. Replacement rates for fly ash will be 15%, 20%, and 25%.

### **FY 2012:**

BCD received NTP on March 31, 2012. BCD has collected samples of aggregate and has performed laboratory testing on the aggregates.

### **FY 2013:**

BCD finished all laboratory testing of concrete mixtures and continued shrinkage measurements. BCD will continue to evaluating data.

### **Plans for FY 2014:**

BCD will complete final report and provide MDOT with a draft final copy three months prior to completion date of December 31, 2014.

**Cost Estimate for FY 2014** \$29,076.02

# Mississippi Research Work Program 2014

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**LINE ITEM:** 26

**STATE STUDY NUMBER:** 250

**TOTAL STUDY BUDGET:** \$291,975.80

**TOTAL STUDY COST TO DATE:** \$81,841.13

**DATE STARTED:** 01/17/2012

**COMPLETION DATE:** 12/31/2015

## Full Depth Reclamation for High Traffic Applications

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Isaac Howard

### Objective:

The proposed study will characterize properties of FDR that are important to design, construction and performance in high traffic applications. Historically FDR has been more commonly used in lower traffic applications and a study of the nature proposed could not be identified with materials similar to those native to Mississippi. The proposed study is aimed at providing design, construction, and performance guidance for FDR layers in high traffic applications, which have different behavioral conditions than low traffic applications.

### FY 2012:

Task 2 (material acquisition from Hwy 49) was completed during FY 2012. A modest amount of literature review was performed (Task 3), and work commenced on strength versus time specimens (Task 7). Testing of 9.5 mm and 19 mm asphalt began (Task 4), as did gradation variability testing (Task 5). Task 17 (permeability testing), made some progress as needed items were purchased and one field test was performed.

### FY 2013:

Progress was made on several tasks. The majority of the literature review (Task 3) was completed. Unless additional tests are warranted from analysis, Tasks 4 and 5 asphalt testing and gradation variability are complete. Task 6 and 7 (wheel tracking) is an area where more progress is needed. Specimen preparation questions have put this task on hold slightly relative to the original plan. Some preliminary wheel trackign efforts have been performed. Task 7 (strength versus time) has been initiated for some specimens, with additional testing planned for the upcoming FY. Tasks 8 through 11 (strength variability, traffic opening, durability, and elastic modulus) have been investigated to some extent, and they are envisioned for more detailed investigation in upcoming FY's. Task 17 (longitudinal joint measurement) is progressing as planned with two field tests and subsequent analysis per year.

## Mississippi Research Work Program 2014

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### **Plans for FY 2014:**

Most efforts in FY 2014 are planned within tasks 5 to 12 and task 17. Longitudinal joint testing (Task 17) is envisioned to continue as it has been. Wheel tracking (Task 6) should be well over half way complete by the end of FY 2014, as should gradation variability (Task 6). Strength versus time specimens should be made and largely tested by the end of FY 2014. Traffic opening and strength variability (tasks 8 and 9) should also be largely finished in terms of testing by the end of FY 2014. Tasks 10 and 11 (durability and elastic modulus) are envisioned to be worked on during the next FY, and their progress will depend on results in early stages of each effort. Some analysis (task 12) should commence during FY 2014.

**Cost Estimate for FY 2014** \$110,000.00

## Mississippi Research Work Program 2014

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**LINE ITEM:** 27

**STATE STUDY NUMBER:** 251

**TOTAL STUDY BUDGET:** \$6,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:** 01/17/2012

**COMPLETION DATE:** 12/31/2015

### **In-House Support to Full-Depth Reclamation for High-Traffic Applications**

**RESEARCH AGENCY:**

MDOT

**PRINCIPAL INVESTIGATOR:**

William Barstis

**Objective:**

This study will provide in-house support to the Full-Depth Reclamation for High-Traffic Applications. This item will fund traffic control and MDOT staff time for the study.

**FY 2013:**

Collected Falling Weight Deflectometer (FWD) data for PI of SS No. 250. Provided traffic control for FWD data collection.

**Plans for FY 2014:**

Collect FWD test data for PI of SS No. 250. Provide traffic control for FWD data collection. Provide construction and materials data.

**Cost Estimate for FY 2014** \$6,000.00

## Mississippi Research Work Program 2014

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**LINE ITEM:** 28

**STATE STUDY NUMBER:** 252

**TOTAL STUDY BUDGET:** \$79,907.61

**TOTAL STUDY COST TO DATE:** \$71,373.32

**DATE STARTED:** 03/02/2012

**COMPLETION DATE:** 12/31/2013

### Acceptable Vibrations on Green Concrete

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Seamus Freyne

**Objective:**

MDOT Specifications require concrete in pile shafts to reach compressive strength of 2,500 psi before additional piles are made within a radius of 30 feet, and the typical delay of 48 to 72 hours adds cost to a project that is passed on to the state. This study will determine the maximum vibrations green concrete can handle without detriment to ultimate performance.

**FY 2012:**

Task C1, Literature Search, Task C2, Commodities Purchase, and Task C3, Field Observations, should be 100% complete as FY 2012 concludes. Task C4, Experimental Work, should be 80% complete. Task C6, Project Management, should also be 80% complete. Task C7, Final Report, should be 60% complete.

**FY 2013:**

All tasks are now complete except Task C7, Final Report, which is 90% complete.

**Plans for FY 2014:**

Efforts will be made to finish this study before FY 2014

# Mississippi Research Work Program 2014

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**Cost Estimate for FY 2014** \$3,413.71

# Mississippi Research Work Program 2014

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**LINE ITEM:** 29

**STATE STUDY NUMBER:** 253

**TOTAL STUDY BUDGET:** \$78,177.60

**TOTAL STUDY COST TO DATE:** \$77,863.46

**DATE STARTED:** 03/02/2012

**COMPLETION DATE:** 12/31/2013

## **Driver Speed Limit Compliance in School Zones: Assessing the Impact of Sign Saturation**

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Lesley Strawderman

### **Objective:**

School zones and their corresponding speed reduction signs are placed on roadways with an admirable intention: to slow driver speeds thereby improving safety in the area. However, the presence of too many signs may cause oversaturation amongst drivers, leading many of them to ignore the school zones while driving. The objective of this project is to evaluate the impact of sign saturation on driver behavior. This will be accomplished by studying driver behavior in school zones with varying sign placement and density. Changes in driver's speed will be the main focus of data collection. The results would provide MDOT with empirically based guidelines on the effectiveness of introducing new school zones in Mississippi. MDOT decision makers would be able to improve the effectiveness of existing school zones by avoiding oversaturation of similar signs on the roadway.

### **FY 2012:**

Completed tasks 1a and 1b, in which sign inventory and accident data from MDOT was analyzed. Over 2,000 signs were evaluated from the sign database, density measures were created and implemented, and MDOT district 1 was compared to the rest of the state for validity. Sign data was also validated. Completed task 2, where representative school zones were selected along with MDOT personnel for data collection. Completed task 3, data collection, by collecting driver speed data in the selected school zones.

### **FY 2013:**

Completed task 4, data analysis. Speed data was extracted from traffic equipment to determine the impact of school zone sign saturation on driver speed. Based on the results, completed task 5, develop guidelines. Submitted the final project report (task 6) to MDOT project champion.

### **Plans for FY 2014:**

## Mississippi Research Work Program 2014

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No additional work will be conducted in FY 2014.

**Cost Estimate for FY 2014** \$125.56

## Mississippi Research Work Program 2014

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**LINE ITEM:** 30

**STATE STUDY NUMBER:** 255

**TOTAL STUDY BUDGET:** \$71,500.00

**TOTAL STUDY COST TO DATE:** \$37,077.85

**DATE STARTED:** 06/18/2012

**COMPLETION DATE:** 12/31/2013

### **A Synthesis Study of Noncontact Nondestructive Evaluation of Top-down Cracking in Asphalt Pavements**

**RESEARCH AGENCY:**

University of Mississippi

**PRINCIPAL INVESTIGATOR:**

Waheed Uddin

**Objective:**

Top-down cracking in asphalt pavement has been reported in many states and European countries. Its mechanism and nondestructive evaluation methods are being investigated but a thorough review is needed to identify any noncontact evaluation technology that can expedite field surveys of top-down cracking without depending on cores. This proposed study will undertake intensive literature review and personal contacts worldwide in an effort to identify top-down cracking evaluation technologies that can be applied at highway speed. If a candidate technology is found then a pilot field study will be recommended in a follow up phase of the study. If no such noncontact evaluation technology is found for implementation at highway speed then a research needs statement will be prepared in the NCHRP format and recommended to pursue a national study to develop such technology. The potential value of the end result products and/or services to the Department will result in correctly identifying top-down cracking distress at expedited speed, using the data to correctly design MR&R strategies, and calibrating the MEPDG models for Mississippi. The savings will be in millions of dollars annually considering cost avoidance of coring and implementing better performing pavement maintenance and rehabilitation strategies. The study will be completed in one year.

**FY 2012:**

An extensive literature review is being conducted on top-down cracking evaluation studies, as well as email/telephone contacts will be made to explore any current research studies on noncontact evaluation technologies.

**FY 2013:**

An extensive worldwide literature review has been conducted on top-down cracking evaluation studies in asphalt pavements, as well as email/telephone contacts were made to review past and current research studies on noncontact nondestructive evaluation technologies. A PhD student was hired in Fall

## Mississippi Research Work Program 2014

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2012 and a new PhD graduate student continued literature research effort and preparation of summaries of relevant papers and reports. PI is an invited member on European COST Action TU1208 study of the use of ground penetrating radar (GPR) headed by Roma Tre University, Italy. PI also visited a pavement evaluation equipment manufacturer in Florida in March 2013 (at no cost to the study) to discuss possible use of any available noncontact equipment technology at highway speed. The discussion confirmed that a vehicle mounted moving GPR designed for rail track evaluation may be a good nondestructive test candidate. Furthermore, a recent nondestructive equipment study under SHRP-2 conducted at Auburn university test track was also reviewed and a participating equipment manufacturer was contacted. A draft tech memo is in progress as of July that will be forwarded to the MDOT research division by the end of August for their review.

### **Plans for FY2014**

After review of the draft tech memo by the MDOT research division, the PI will present findings and recommendations to the MDOT research division in October 2013. Based on the MDOT feedback, the tech memo will be finalized and the final study products will be submitted to the MDOT by the end of December 2013.

**Cost Estimate for FY 2014** \$34,422.15

# Mississippi Research Work Program 2014

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**LINE ITEM:** 31

**STATE STUDY NUMBER:** 259

**TOTAL STUDY BUDGET:** \$99,642.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2014

## Analyzing the Impact of Intermodal-Related Risk to the Design and Management of Biofuel Supply Chain

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Sandra D. Eksioglu

### Objective:

The objective of this proposal is to design decision-support tools for identifying biorefinery locations that ensure a cost-efficient and reliable supply chain. We will build mathematical models which take into consideration the benefits (such as, accessibility to different modes of transportation), as well as, the risk associated with locating a refinery near an intermodal facility. The goal is to design biofuel supply chains that not only perform well under normal conditions but also maximally hedge against losses of not having access to cost-efficient transportation modes because of disruptions at intermodal facilities.

The outcomes of this project are on-line with the mission of the Intermodal Planning Division of MDOT to promote and support intermodal transportation by providing technical assistance which aims to improve and increase the usability of existing intermodal facilities. Through our experiments we will identify under what conditions locating a biofuel plant near an intermodal facility is advisable; and what are the benefits/costs of such a decision. These results can be used to encourage biofuel plants to use intermodal facilities/transportation and make their investments accordingly.

The biofuels industry seems to have a bright future in Mississippi due to the abundance amount of biomass in the form of agricultural residues, forest products, and forest residues. Other factors, such as, low wages, non-unionized labor, and incentive packages offered by the state, impact a company's decision to locate in Mississippi. These tools can be used to help biofuel plant make better facility locations decisions; which in turn will contribute to their success.

### Plans for FY 2014:

Waiting on notice to proceed.

**Cost Estimate for FY 2014** \$74,731.50



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**LINE ITEM:** 32

**STATE STUDY NUMBER:** 260

**TOTAL STUDY BUDGET:** \$22,500.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2014

## Guidelines for PCC Inputs to AASHTOWARE Pavement ME Design

**RESEARCH AGENCY:**

Rao Research and Consulting, LLC

**PRINCIPAL INVESTIGATOR:**

Chetana Rao

### Objective:

This proposal is submitted for MDOT to consider developing a formal report on PCC materials data necessary for AASHTOWare PAVEMENT ME Design. A detailed problem statement highlighting the project objective, and a work plan to accomplish the objectives are presented in this proposal.

Under SS 177, MDOT conducted a comprehensive test program to determine ME pavement design PCC material inputs for mix designs covering a wide range of materials available in Mississippi. Results from this project are expected to be used in the materials library that MDOT plans to develop to support MEPDG implementation. The results contain test data for 20 mixes and include results for the following properties determined from the listed test procedures:

- Modulus of Rupture or Flexural Strength – ASTM C 78
- Compressive Strength – ASTM C 39
- Modulus of Elasticity – ASTM C 469
- Tensile Strength – ASTM C 469
- CTE – AASHTO TP-60
- Concrete Shrinkage – ASTM C 157
- Unit Weight – ASTM C 138
- Poisson's Ratio – ASTM C 469

These results have not been formally published by MDOT so far. It will be immensely useful to summarize these data in a report so it can be used in the future implementation of the ME Design procedure.

For the measurement of CTE AASHTO has revised the TP-60 test procedure to the T336 procedure which results in more accurate CTE values. The T336 procedure corrects the assumption made for the CTE of the calibration specimen in the TP 60 procedure. The SS 177 CTE values are being corrected under the SS 170 study, which is producing a stand-alone document on the CTE corrections. The report developed in the proposed study will include the corrected CTE values.

## Mississippi Research Work Program 2014

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Additionally, the availability of such a comprehensive and complete set of materials database also provides a great opportunity to develop level 2 correlations for use in MEPDG.

**Plans for FY 2014:**

Waiting on notice to proceed.

**Cost Estimate for FY 2014** \$18,000.00

## Mississippi Research Work Program 2014

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**LINE ITEM:** 33

**STATE STUDY NUMBER:** 261

**TOTAL STUDY BUDGET:** \$125,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2014

### **Turbidity Monitoring and Equipment Evaluation at MDOT Construction Sites**

**RESEARCH AGENCY:**

Thompson Engineering

**PRINCIPAL INVESTIGATOR:**

Bobby Moseley

**Objective:**

MDOT has collected some initial data on turbidity levels in receiving streams due to run-off from construction projects. However, the results of the initial study (State Study 225) identified other areas where additional data is needed. The goal of this research project is to expand the current limited baseline turbidity conditions at select construction sites and to evaluate differing turbidity monitoring equipment under differing site conditions. Data, following initial site selection and site visits with MDOT, will be collected using MDEQ and EPA protocols as guidance.

**FY 2013:**

No work has been performed. Contract not issued.

**Plans for FY 2014:**

Kick Off Meeting, SAP Development, and Field Work

**Cost Estimate for FY 2014** \$100,000.00

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**LINE ITEM:** 34

**STATE STUDY NUMBER:** 262

**TOTAL STUDY BUDGET:** \$77,748.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2015

### Evaluation of the WatchDog Weather Station to Reduce Drift from MDOT Spray Trucks

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

John Byrd

**Objective:**

Weather conditions that cause right of way herbicide drift onto sensitive adjacent crops can be avoided if wind speed and direction relative to the spray truck can be accurately monitored during applications.

**FY 2013:**

Developed proposal.

**Plans for FY 2014:**

Purchase equipment, conduct stationary and mobile testing, summarize data, develop recommendations to MDOT to purchase or not purchase, train spray truck operators if equipment is acceptable to MDOT personnel, prepare quarterly and final reports.

**Cost Estimate for FY 2014** \$49,696.00

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**LINE ITEM:** 35

**STATE STUDY NUMBER:** 263

**TOTAL STUDY BUDGET:** \$350,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2014

### Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements

**RESEARCH AGENCY:**

Burns Cooley Dennis, Inc.

**PRINCIPAL INVESTIGATOR:**

Allen Cooley

#### Objective:

The Mechanistic-Empirical Pavement Design Guide (MEPDG) method for designing pavement structures utilizes mechanistic materials properties combined with other inputs to predict pavement performance using user inputs. Pavement performance models are used for this prediction of pavement performance. The pavement performance models are based upon national predictive models that are likely not applicable to Mississippi. This research project is designed to provide the required information for the calibration of these performance models for Mississippi materials and conditions. A number of test pavement sections will be visited, evaluated, sampled, and tested. Following these activities site reports will be prepared for each individual site that provides the information required for this calibration of the pavement performance models to local conditions.

#### FY 2013:

Collected Falling Weight Deflectometer (FWD) data for PI of SS No. 250. Provided traffic control for FWD data collection.

#### Plans for FY 2014:

Collect FWD test data for PI of SS No. 250. Provide traffic control for FWD data collection. Provide construction and materials data.

**Cost Estimate for FY 2014** \$250,000.00

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**LINE ITEM:** 36

**STATE STUDY NUMBER:** 264

**TOTAL STUDY BUDGET:** \$50,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:**

**COMPLETION DATE:** 12/31/2014

### **District Traffic Control support to Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements**

**RESEARCH AGENCY:**

MDOT

**PRINCIPAL INVESTIGATOR:**

Bill Barstis

**Objective:**

District traffic control personnel and equipment are required to provide lane closures for the conduct of field sampling/testing operations related to the conduct of State Study No. 263. District charges for this task will be funded by this support study.

**Plans for FY 2014:**

Waiting on notice to proceed.

**Cost Estimate for FY 2014** \$40,000.00

# Mississippi Research Work Program 2014

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## New State Studies for FY2014

**LINE ITEM:** 37

**STATE STUDY NUMBER:** 265

**TOTAL STUDY BUDGET:** \$50,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:** 10/01/2013

**COMPLETION DATE:** 12/31/2014

## Research Division Support to Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements

**RESEARCH AGENCY:**

MDOT

**PRINCIPAL INVESTIGATOR:**

Bill Barstis

### Objective:

The Research Division in-house support to State Study (SS) 263 will provide falling weight deflectometer (FWD) field testing and FWD data analysis to characterize in-situ moduli of pavement layers at each project site used for local calibration of MEPDG performance models. Extensive coordination between principal investigator of SS No. 263 and MDOT District traffic control personnel will be performed via this support study as well as review of site reports generated as a deliverable of SS 263.

**Cost Estimate for FY 2014** \$40,000.00

## Mississippi Research Work Program 2014

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**LINE ITEM:** 38

**STATE STUDY NUMBER:** 266

**TOTAL STUDY BUDGET:** \$150,000.00

**TOTAL STUDY COST TO DATE:** \$0.00

**DATE STARTED:** 03/01/2014

**COMPLETION DATE:** 12/31/2016

### **Field Aging Effects on Asphalt Mixed at Different Temperatures and Hauled Different Distances**

**RESEARCH AGENCY:**

Mississippi State University

**PRINCIPAL INVESTIGATOR:**

Isaac L. Howard

**Objective:**

With all the options available to produce and place asphalt pavement in present day, a study into the field aging of these materials needs to be performed. Field aging has always been one of the biggest uncertainties in asphalt pavement performance, and with the widespread use of warm mix technologies, there are more aging questions than ever. This study is very timely, and if performed now can be conducted for less cost by leveraging the investment of a previous study.

**Cost Estimate for FY 2014** \$32,142.86

### 100% Federally Funded Studies (NCHRP, TRB, AASHTO, SHRP2, and Pooled Funds)

#### SHRP2

Congress authorized the second [Strategic Highway Research Program \(SHRP 2\)](#) in 2005 to investigate the underlying causes of highway crashes and congestion in a short-term program of focused research. To carry out that investigation, SHRP 2 targets goals in four interrelated focus areas:

- ▶ Safety: Significantly improve highway safety by understanding driving behavior in a study of unprecedented scale.
- ▶ Renewal: Develop design and construction methods that cause minimal disruption and produce long-lived facilities to renew the aging highway infrastructure.
- ▶ Reliability: Reduce congestion and improve travel time reliability through incident management, response, and mitigation.
- ▶ Capacity: Integrate mobility, economic, environmental, and community needs into the planning and design of new transportation capacity.

SHRP 2 is being conducted under a memorandum of understanding among the American Association of State Highway and Transportation Officials, the Federal Highway Administration, and the National Research Council. The multiyear program (five years of funding, nine years to complete) began work in March 2006. SHRP 2 is guided by an oversight committee and four technical coordinating committees, one in each of the four focus areas. More targeted task groups provide assistance in areas requiring specific technical expertise, including preparation of requests for proposals and review of proposals.

**Cost Estimate for 2014 SPR Part II Funds: \$92,456.97**

## Mississippi Research Work Program 2014

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### Mississippi Participation in NCHRP

The Mississippi Department of Transportation contributes to the National Cooperative Highway Research Program (NCHRP). NCHRP is a special-purpose program administered by the Transportation Research Board (TRB) under a three-way agreement among the National Academy of Sciences, AASHTO, and the FHWA. Funding is provided by state highway and transportation agencies at a rate of 5.5% of the agencies' SPR (both Part I & II) funds. Funds for this participation are 100% Federal and thus contain no state match. These pooled funds are used to fund research aimed at solving national or regional problems and can only be spent on problems approved by at least two-thirds of the states. Formal solicitations are made from the states, AASHTO committees, TRB committees and FHWA to develop problem statements. MDOT's annual contribution is paid from SPR Part II funds.

**Cost Estimate for 2014 SPR Part II Funds: \$121,803.52**

## Mississippi Research Work Program 2014

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### Transportation Research Board Correlation Service

This service provides for subscription to a "Research Correlation Service" from the Transportation Research Board, a service established and operated in accordance with the recommendation of the Executive Committee of AASHTO. The activities supported by this subscription include the collection of available information concerning past, current and proposed research related to transportation from all sources including federal, state and other government agencies, colleges and universities, research and planning organizations, transport operators and industry, as well as the TRB Annual Meeting and conference programs; the study and correlation of this information through the work of the committees of the Board and dissemination of the useful findings of research and other information by all feasible means including the several TRB publication series, the output of the Transportation Information Services, and through personal contacts during scheduled field visits by the TRB professional staff. The FY 2010 TRB Correlation Service is funded for \$110,136, which corresponds to the current annual subscription cost for Mississippi. Funding for the TRB Correlation Service is paid using SP&R Part II funds.

**Cost Estimate for 2014 SPR Part II Funds: \$31,947.29**

## **POOLED FUND STUDIES**

### **Improving the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis**

Host Agency: Federal Highway Administration

Improve the Quality of Pavement Surface Distress and Transverse Profile Data Collection and Analysis by assembling SHAs, the FHWA, and industry representatives to:

- Identify data collection integrity and quality issues
- Identify data analysis needs
- Suggest approaches to addressing identified issues and needs

Based on this information, the SHAs and the FHWA will:

- Initiate and monitor projects intended to address identified issues and needs
- Disseminate results
- Assist in solution deployment

FY 2014- \$15,000

# Mississippi Research Work Program 2014

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## Southeast Transportation Research Consortium

Host Agency: Louisiana Department of Transportation & Development

The RAC Region II is developing a collaborative research program through the Transportation Pooled Fund (TPF) Program. The research program is called the Southeast Transportation Consortium and is intended to encourage coordination among member states and provide resources and management of collaborative studies. The consortium intends to address high priority transportation research topics of common interest to the RAC II Region states and for which expertise exists within the region.

FY2009-\$5,000

FY2010 - \$5,000

FY2011 - \$5,000

FY2012- \$5,000

FY2013 - \$5,000

FY 2014 - \$5,000

# Mississippi Research Work Program 2014

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## Accelerated Performance Testing on the 2012 NCAT Pavement Test Track

Host Agency: Alabama Department of Transportation

1. Constructing 200 ft test sections on the existing 1.7-mile NCAT test oval that are representative of in-service roadways;
2. Applying accelerated performance truck traffic in the 2 years following construction;
3. Assessing/comparing the functional & structural field performance of trafficked sections on a regular basis via surface & subsurface measures;
4. Validating/calibrating new & existing mechanistic-empirical (M-E) approaches to pavement analysis & design using pavement surface condition, pavement load response, precise traffic & environmental logging, & cumulative damage;
5. Determining the life cycle cost of various pavement preservation alternatives in a highly controlled experiment that will provide state Departments of Transportation (DOTs) with the financial foundation to begin to build a decision tree for their own maintenance program;
6. Correlating field results with laboratory data for both mechanistic & preservation applications; and
7. Answering practical questions posed by research sponsors through formal (i.e., reports & technical papers) & informal (e.g., one-on-one responses to sponsor inquiries) technology transfer.

FY 2012- \$295,000

FY 2013- \$295,000

FY 2014- \$295,000

### **AASHTO Technical Implementation Group (TIG)**

Host Agency: AASHTO

TIG was established to identify and champion the implementation of a select few “ready to use” technologies, products, or processes that were likely to yield benefits to the users. TIG scans the horizon for outstanding advancements in transportation technology and invests time and money to accelerate their adoption by agencies nationwide. TIG is associated with the AASHTO Standing Committee on Highways, Research Advisory Committee.

Each year, TIG selects 3-4 highly valuable, but largely unrecognized procedures, processes, software, devices, or other innovations that have been adopted by at least one agency, are market-ready, and are available for use by other interested agencies. TIG’s objective is to share information with AASHTO member agencies, local agencies, and their industry partners to improve the nation’s transportation system.

Cost is \$6,000 per year.

### **AASHTO Equipment Management Technical Services Program (EMTSP)**

Host Agency: AASHTO

The AASHTO Equipment Management Technical Services Program (EMSTP) was formerly called AETO and can be found at [www.emtsp.org](http://www.emtsp.org). It is associated with the AASHTO Subcommittee on Maintenance and was established in 2008.

Equipment fleets comprise a significant asset investment and are a large portion of all public works agencies' budgets and expenses. The effectiveness of such equipment fleet operations affects the public agencies' ability to adequately perform normal activities and successfully respond to emergency events. In addition, the rate of advancement of technology associated with roadway construction and maintenance equipment is so rapid that it is nearly impossible for individual public agencies to stay abreast of the latest technologies, evaluate these technologies, and implement the most cost-effective technologies to gain the advantages that they could provide.

The AASHTO Equipment Management Technical Services Program (EMSTP) will keep current data pertaining to new types of equipment along with all advancing innovation and technology directly related to equipment fleet. This technical service program will also help advance asset management principles in the management of these fleets. This information will disseminated throughout the state DOTs to reduce costs of maintenance operations.

Cost is \$3,000 per year.

### **AASHTO Load and Resistance Factor Design (LRFD)**

Host Agency: AASHTO

Load and Resistance Factor Design (LRFD) Bridges and Structures Specification Maintenance (LRFD) is associated with the AASHTO Subcommittee on Bridges and Structures. On April 21, 2002, the AASHTO Board of Directors approved policy resolution PR-4-02 endorsing the project, "Long-Term Maintenance of Load and Resistance Factor Design (LRFD) Specifications." In order to continue funding for these purposes, a Transportation Pooled Fund, TPF-5(068) was set up with the Iowa DOT, and states were able to contribute to the fund. This pooled fund has been successfully in place since 2003. The AASHTO Highway Subcommittee on Bridges and Structures unanimously approved the need for continuing to fund this program at their annual meeting in May of 2006. The pooled fund program through Iowa DOT was extended until Fiscal Year 2010, at which point it was closed out. Because the LRFD specifications still need further research and development to maintain quality documents, AASHTO has determined the necessity of keeping this program in place and has now taken over the program as an AASHTO Technical Service Program. In December of 2009 FHWA determined that this program met the criteria for use of 100% State Planning and Research (SP&R) funds. This program continues to support the maintenance and updating of all the LRFD Design specifications.

Cost is \$10,000 per year.

## Mississippi Research Work Program 2014

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### **AASHTO Technical Service Program to Develop AASHTO Materials Standards (DAMS)**

Host Agency: AASHTO

Technical Service Program to Develop AASHTO Materials Standards (DAMS) is associated with the AASHTO Subcommittee on Materials. The primary function of this AASHTO Technical Service Program is to support the participation of member departments at the Subcommittee on Materials annual meeting, which is convened for the discussion of outstanding ballot items, development of new standards, and revisions and updates to current standards. A secondary role may include the financial support for the involvement of professional writers in the development of new specifications or major revisions of current specifications. AASHTO Member Departments will be asked to sponsor this Technical Service Program by contributing a voluntary assessment of \$5,000 per sponsor annually to fund the establishment and ongoing activities of the program.

Cost is \$5,000 per year.

## Mississippi Research Work Program 2014

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### **AASHTO National Transportation Product Evaluation Program (NTPEP)**

Host Agency: AASHTO

National Transportation Product Evaluation Program (NTPEP) is associated with the AASHTO Subcommittee on Materials and can be found at [www.ntpep.org](http://www.ntpep.org). NTPEP was established by the AASHTO Board of Directors in 1994 to cooperatively test manufactured transportation products that are of common interest to all member departments and share the results from these laboratory and field evaluations. NTPEP is able to provide coordinated evaluations on various products and materials in the areas of traffic, safety, construction, and maintenance. The program is evaluated every four years for financial viability, its effectiveness, the funding mechanisms to support it, and the need for its continuance. NTPEP is run through a joint funding concept between participating industry and AASHTO members, with revenue from industry being used primarily for the testing of and reporting on their products, and with voluntary member dues used primarily for support services to administer NTPEP.

Cost is \$7,500 per year.

### **AASHTO Product Evaluation Listing (APEL)**

Host Agency: AASHTO

AASHTO Product Evaluation Listing (APEL) is associated with the AASHTO Subcommittee on Materials and can be found at [apel.transportation.org](http://apel.transportation.org). APEL is a web-based technical service program that serves as a clearinghouse for state-level evaluation and testing of new and/or proprietary engineered transportation products. This program offers a substantial cost benefit to member departments, as well as to manufacturers of transportation products. The program allows manufacturers to submit products online for evaluation to multiple agencies. For the member departments, the program allows agencies to customize and automate the work flow process for new product evaluations. The program also shares individual member departments' products evaluations for the benefit of AASHTO, which lowers the evaluation costs. The APEL Council under the Subcommittee on Materials is charged with program guidance and development.

Cost is \$1,200 per year.

### **AASHTO Transportation System Preservation Technical Service Program (TSP2)**

Host Agency: AASHTO

Transportation System Preservation Technical Service Program (TSP2) is associated with the AASHTO Subcommittee on Maintenance. Its website is [www.tsp2.org](http://www.tsp2.org). It supports the research, technical, and program needs of the member states in their development and implementation of their own preservation programs for both pavement and bridges. AASHTO, in collaboration with the National Center for Pavement Preservation, has successfully implemented this technical service program to assist states with their pavement preservation efforts, including the establishment of regional pavement preservation partnerships.

An Oversight Panel guides the implementation and operation of the TSP2 program, including representation from the AASHTO Subcommittees on Bridges and Structures, Maintenance, Materials, and Asset Management, and Design's Joint Technical Committee on Pavements, as well as members from each of the AASHTO regions.

TSP2 has proven to be a successful program for pavement preservation and, with its recent expansion, bridges will be incorporated into the program. In this increasingly tight economy, participation in this program will help state DOTs preserve not only their pavements but their bridges as well.

Cost is \$20,000 per year.

## Mississippi Research Work Program 2014

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### AASHTO Materials Reference Library (AMRL)

Host Agency: AASHTO

The primary vision of the AASHTO Materials Reference Laboratory (AMRL) is to be the center for promoting quality and achievement of excellence in construction materials testing (CMT). We do this by providing services and tools through our three major programs: the Laboratory Assessment Program (LAP), the Proficiency Sample Program (PSP), and the AASHTO Accreditation Program (AAP). Through these activities, we evaluate testing competency, promote continual improvement, and instill confidence in the laboratories and specifiers that use our programs.

AMRL is part of the Engineering and Technical Services division of AASHTO (American Association of State Highway and Transportation Officials), an international leader in setting technical standards for all phases of highway system development. AASHTO represents all fifty states, Washington D.C. and Puerto Rico and serves as a liaison between the state departments of transportation and the federal government. AASHTO is the voice for transportation and strives to educate the public and key decision makers about the critical role that transportation plays in securing a good quality of life and a sound economy for our nation.

Cost is \$6,666.66 per year.

### AASHTO Cement and Concrete Reference Laboratory (CCR)

Host Agency: AASHTO

In the early part of the 20th century, various organizations, including the National Institute of Standards and Technology (formerly the National Bureau of Standards), the U.S. Army Corps of Engineers, the American Society of Civil Engineers, ASTM Committee C-1 on Cement, and the Portland Cement Association, began efforts to standardize the specifications and methods for testing portland cement. This eventually led to the establishment of the Cement Reference Laboratory (CRL) in 1929 at NIST with ASTM Committee C-1 as its sponsor. Inspection of laboratories was designated as the primary CRL activity. Until 1947, laboratory inspections were limited to laboratories performing physical tests on hydraulic cements. The inspection activity was gradually expanded to include concrete testing and ASTM Committee C-9 on Concrete and Concrete Aggregates became a joint sponsor in 1958. The name Cement and Concrete Reference Laboratory (CCRL) was adopted in 1960. The CCRL Laboratory Inspection Program has expanded in scope over the years to include cement, concrete, aggregate, steel reinforcing bars, pozzolan, and masonry materials (mortar and solid units). Over 1100 laboratories in the United States, Canada and Mexico currently receive inspections.

The second major CCRL activity is the distribution of proficiency samples for interlaboratory testing. The first portland cement sample was distributed in 1936. Samples have been added over the years with the current program including portland cement, blended cement, masonry cement, portland cement concrete, pozzolan, and masonry materials (mortar and solid units). Participation levels varies from 46 laboratories in the masonry mortar program to 1106 in the portland cement concrete program.

Cost is \$6,666.67 per year.

### AASHTO Accreditation Program (AAP)

Host Agency: AASHTO

The AASHTO Accreditation Program (AAP) was established in 1988 as a means of formally recognizing the competence of testing laboratories to perform specific tests on construction materials. AAP is a voluntary program that is available to all testing laboratories including government, commercial, university, and research facilities. There are nearly 1,500 individual laboratories that are currently accredited through AAP, making it the largest accrediting body of construction materials testing laboratories. AAP utilizes laboratory assessment and proficiency sample services provided by the AASHTO Materials Reference Laboratory (AMRL) and the Cement and Concrete Reference Laboratory (CCRL). AMRL provides administrative coordination and technical support for AAP.

Cost is \$6,666.67 per year.

## Mississippi Research Work Program 2014

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### AASHTO Safe, Reliable, and Secure Transportation Operations (SAFETY)

Host Agency: AASHTO

AASHTO member departments coordinate and cooperate with other public safety agencies and highway safety partners to develop and implement programs for improving safety on all public roads. The Highway Safety Policy and Management technical service program will support member departments' and AASHTO's highway safety efforts. This program began as the Safe, Reliable, and Secure Transportation Operations program and is being modified to reflect its focus on highway safety.

To work toward the goal of reducing highway fatalities by half in two decades, and reflecting the partnerships state DOTs have, AASHTO participates in the State Highway Safety Alliance to coordinate positions on transportation funding; the Toward Zero Deaths national steering committee to promote AASHTO's perspectives on developing and implementing a national strategy on highway safety, and in efforts with individual safety partners representing the multidisciplinary approach to highway safety. This program supports the role of the AASHTO Program Manager for Safety in these activities and others, such as Highway Safety Manual development and implementation and update of the AASHTO Strategic Highway Safety Plan. It also supports staff efforts to revise and implement safety-related publications, and to coordinate AASHTO input into publications of other organizations.

The program supports two AASHTO committees: Standing Committee on Highway Traffic Safety's and the SCOHTS Subcommittee on Safety Management. [Note: This program was established in October 2008 as the Safe, Reliable, and Secure Transportation Operations program]

Cost is \$10,000 per year