

Mississippi
Department of Transportation
RESEARCH WORK PROGRAM
SPR-1(66), Part II
L560

For the Fiscal Period
October 1, 2012 to September 30, 2013



APPROVED

Aug 7 13
DATE

FOR THE DIVISION ADMINISTRATOR
FEDERAL HIGHWAY ADMINISTRATION

Prepared by the
Mississippi Department of Transportation
RESEARCH DIVISION

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In Cooperation with the
U.S. Department of Transportation
Federal Highway Administration

Mississippi Research Work Program 2013

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GENERAL COMMENTS ON RESEARCH WORK PROGRAM FOR FISCAL YEAR 2013

The SPR Part II research work program allocation for FY 2013 totals \$2,030,058.80 and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$125,507.21 for FY 2013, a TRB Correlation Service contribution of \$31,947.29, AASHTO Technical Services Program contributions totaling \$ 74,200.00, and pooled-fund studies totaling \$ 395,000.00 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. 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 2013. 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 2013. 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 2013 research work program. The pooled fund studies, the TRB Correlation Service and NCHRP as described herein are funded with 100% SPR Part II funds (no state match). The 40 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.

(Amended with spring study additions 6/18/2013)

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	Principal Investigator	Agency/Co
Existing State Studies & Internal Line Items										
1	Long-Term Pavement Performance (LTPP)	N/A	10/1/2012	9/30/2013	\$0.00	\$7,982.82	\$7,000.00	\$7,312.72	James C. Watkins	MDOT
2	Implementation of Research Projects	N/A	10/1/2012	9/30/2013	\$0.00	\$320,731.42	\$350,000.00	\$327,640.31	James C. Watkins	MDOT
3	Technology Transfer	N/A	10/1/2012	9/30/2013	\$0.00	\$103,657.54	\$110,000.00	\$122,982.72	James C. Watkins	MDOT
4	Pavement Management	N/A	10/1/2012	9/30/2013	\$0.00	\$269,059.97	\$325,000.00	\$291,397.48	Cindy Smith	MDOT
5	Skid Collection	N/A	10/1/2012	9/30/2013	\$0.00	\$109,369.95	\$60,000.00	\$95,315.19	Marta Charria	MDOT
6	Information and Data Collection Technology	N/A	10/1/2012	9/30/2013	\$0.00	\$103,215.43	\$110,000.00	\$109,870.33	Reginald Jenkins	MDOT
7	Performance Measures	N/A	10/1/2012	9/30/2013	\$0.00	\$55,938.73	\$75,000.00	\$60,468.12	Adam Aleithawe	MDOT
8	Research Contract Liaison	N/A	10/1/2012	9/30/2013	\$0.00	\$76,317.34	\$65,000.00	\$52,186.60	Robbie Vance	MDOT
9	Minor Research Studies	N/A	10/1/2012	9/30/2013	\$0.00	\$28,461.57	\$25,000.00	\$79,868.52	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	\$704,419.06	\$275,000.00	\$96,992.44	Chetana Rao	Applied Research Associates

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 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	\$0.00	\$30,837.25	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	\$67,566.74	\$76,000.00	\$0.00	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	\$1,000.00	\$0.00	Cindy Smith	MDOT

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 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	\$24,000.00	\$15,000.00	\$0.00	\$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	\$160,404.60	\$63,438.72	\$79,314.31	Isaac Howard	Mississippi State University
16	Open Graded Friction Course for HMA Pavements	207	10/1/2007	6/30/2013	\$135,000.00	\$131,618.26	\$3,381.74	\$16,112.17	Tom White	Mississippi State University

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 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	\$265,787.11	\$51,370.31	\$81,678.87	Isaac Howard	Mississippi State University
18	I55 Integrated Diversion Traffic Management Benefit Study	223	10/1/2009	12/31/2012	\$152,810.00	\$127,431.97	\$25,378.03	\$68,455.82	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	\$83,806.92	\$40,558.00	\$32,965.80	John Guyton	Mississippi State University

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	Principal Investigator	Agency/Co
20	Instrumentation & Computational Modeling for Evaluation of Bridge Substructures Across Waterways	229	10/1/2009	12/31/2012	\$150,000.00	\$22,717.15	\$127,282.86	\$18,399.92	Wei Zheng	Jackson State University
21	Optimizing Mississippi Aggregates for Concrete Bridge Decks	231	10/1/2009	10/31/2012	\$97,478.52	\$87,874.17	\$9,604.35	\$0.00	Robert Varner	Burns Cooley Dennis, Inc.
22	Evaluation of Short Statured Species for Rapid Establishment on Mississippi Roadsides	234	10/1/2010	6/30/2013	\$213,482.41	\$139,238.97	\$74,243.45	\$43,656.57	Barry Stewart	Mississippi State University
23	Triple-Bottom Line Assessment of Future Mississippi Intermodal Facility	235	10/1/2010	12/31/2012	\$140,875.00	\$60,050.96	\$80,824.04	\$13,965.63	Tulio Sulbaran	University of Southern Mississippi
24	Evaluation of Crushed Concrete Base Strength	238	10/1/2010	12/31/2012	\$81,607.61	\$0.00	\$81,567.61	\$0.00	L. Allen Cooley, Jr.	Burns Cooley Dennis, Inc.

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(Amended with spring study additions 6/18/2013) Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	Principal Investigator	Agency/Co
25	Cement Influences on Gravel Aggregate Concrete Strength	239	10/1/2010	12/31/2012	\$99,973.99	\$94,594.02	\$5,379.97	\$0.00	Robert Varner	Burns Cooley Dennis, Inc.
26	Evaluation of Fertility Practices During Roadside Establishment in MS to Minimize Nonpoint Source Pollutants	240	10/1/2010	6/30/2013	\$292,186.29	\$103,660.45	\$171,272.00	\$50,933.21	Jac Varco	Mississippi State University
27	Aggregate Absorption in HMA Mixtures	245	10/1/2013	12/31/2013	\$90,503.46	\$9,675.00	\$64,500.00	\$9,675.00	Allen Cooley	Burns Cooley Dennis, Inc.
28	Development of Laboratory Mix Design Procedures for RAP Mixes	246	3/1/2012	12/31/2013	\$98,493.21	\$10,500.00	\$70,000.00	\$10,500.00	Allen Cooley	Burns Cooley Dennis, Inc.
29	Influence of Cementitious Materials on Shrinkage of Bridge Deck Concrete	247	3/1/2012	12/31/2014	\$99,843.50	\$4,500.00	\$30,000.00	\$4,500.00	Robert Varner	Burns Cooley Dennis, Inc.

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	Principal Investigator	Agency/Co
30	Full Depth Reclamation for High Traffic Applications	250	2/1/2012	12/31/2014	\$291,975.80	\$24,733.34	\$129,000.00	\$7,599.40	Isaac Howard	Mississippi State University
31	In-House Support to Full-Depth Reclamation for High-Traffic Applications	251	2/1/2012	12/31/2014	\$6,000.00	\$0.00	\$2,000.00	\$0.00	William Barstis	MDOT
32	Acceptable Vibrations on Green Concrete	252	2/1/2012	12/31/2013	\$79,907.78	\$2,663.95	\$17,579.71	\$2,663.95	Seamus Freyne	Mississippi State University
33	Driver Speed Limit Compliance in School Zones: Assessing the Impact of Sign Saturation	253	2/1/2012	12/31/2013	\$78,177.60	\$4,397.85	\$29,319.00	\$4,397.85	Lesley Strawderman	Mississippi State University
34	A Synthesis Study of Noncontact Nondestructive Evaluation of Top-down Cracking in Asphalt Pavements	255	2/1/2012	6/30/2013	\$71,500.00	\$26,142.41	\$36,286.07	\$7,620.00	Waheed Uddin	University of Mississippi

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(Amended with spring study additions 6/18/2013)Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	Principal Investigator	Agency/Co
					Total Technical Assistance		\$1,127,000.00	\$1,147,042.00		
					Total State Studies Excluding Tech Assistance		\$1,464,986.00	\$580,268.00		
					Total All Continuing 80/20		\$2,591,986.00	\$1,727,310.00		

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Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	PI	Agency/Co
New State Studies for FY2013										
35	Tenn-Tom Transports STEM Education	258	3/1/2013	9/30/2013	\$25,000.00	\$0.00	\$25,000.00	\$0.00	Agnes Zaiontz	Tennessee Tombigbee Waterway
36	Analyzing the Impact of Intermodal-Related Risk to the Design and Management of Biofuel Supply Chain	259	10/1/2013	12/31/2014	\$100,911.00	\$0.00	\$10,000.00	\$0.00	Sandra D. Eksioglu	Mississippi State University
37	Guidelines for PCC Inputs to AASHTOWARE Pavement ME Design	260	10/1/2013	12/31/2014	\$22,500.00	\$0.00	\$6,000.00	\$0.00	Chetana Rao	Rao Research and Consulting, LLC
38	Turbidity Monitoring and Equipment Evaluation at MDOT Construction Sites	261	10/1/2013	12/31/2014	\$125,000.00	\$0.00	\$5,000.00	\$0.00	Bobby Moseley	Thompson Engineering

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Mississippi FY2013 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	FY2013 Budget	FY2012 Expenditures	PI	Agency/Co
39	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	\$5,000.00	\$0.00	John Byrd	Mississippi State University
40	Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements	263	8/1/2012	12/31/2013	\$350,000.00	\$0.00	\$30,000.00	\$0.00	Allen Cooley	Burns Cooley Dennis, Inc.
41	In-House 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	\$5,000.00	\$0.00	Bill Barstis	MDOT
					Total New Studies		\$86,000.00			
					State Study Totals		\$2,677,986.00	\$1,727,310.00		

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100% Federally Funded FY2013 Studies		
Continuing Pooled Funds		
	FY2012	FY2013
Traffic Signal Systems Operation and Management	\$25,000.00	\$25,000.00
Accelerated Performance Testing on the 2012 NCAT Pavement Test Track	\$295,000.00	\$295,000.00
Improving the Quality of Pavement Profiler Measurement	\$15,000.00	\$15,000.00
Bridge Pier Scour Research	\$20,000.00	\$20,000.00
Southeast Transportation Research Consortium	\$5,000.00	\$5,000.00
Pavement Surface Properties Consortium: A Research Program	\$20,000.00	\$20,000.00
Transportation Library Connectivity and Development	\$15,000.00	\$15,000.00
Total Continuing Pooled Funds	\$395,000.00	\$395,000.00
Transportation Research Board Correlation Service	\$110,135.00	\$31,947.29
Mississippi Participation in NCHRP	\$523,590.00	\$121,803.52
AASHTO Technical Implementation Group (TIG)	\$0.00	\$6,000.00
AASHTO Load and Resistance Factor Design (LRFD)	\$0.00	\$10,000.00
AASHTO Technical Service Program to Develop AASHTO Materials Standards (DAMS)	\$0.00	\$5,000.00
AASHTO National Transportation Product Evaluation Program (NTPEP)	\$0.00	\$12,000.00
AASHTO Product Evaluation Listing (APEL)	\$0.00	\$1,200.00
AASHTO Transportation System Preservation Technical Service Program (TSP2)	\$0.00	\$20,000.00
AASHTO Cement and Concrete Reference Laboratory		

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(CCR)	\$0.00	\$6,666.67
AASHTO Accreditation Program (AAP)	\$0.00	\$6,666.67
AASHTO Materials Reference Library (AMRL)	\$0.00	\$6,666.66
TOTAL AASHTO TSP		\$74,200.00
TOTAL Pooled Funds Including AASHTO, NCHRP & TRB		\$622,951.00

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

	Budget Program FY12	Previous FY Expenditures	Total Expended to Date	Total Study Budget
Implement the 2002 Design Guide for MDOT (Phase II)	\$0.00	\$0.00	\$502,297.00	\$500,000.00
PI: Chetana Rao				

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 2013

Salaries (Regular Employees)	\$4,900.00
Employee Benefit	\$1,372.00
Materials, Supplies, and Services	\$728.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
 Total	 \$7,000.00

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LINE ITEM 2

Implementation of Research Projects

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 2013

Salaries (Regular Employees)	\$265,000.00
Employee Benefit	\$74,200.00
Materials, Supplies, and Services	\$3,600.00
Travel and Sustenance	\$7,200.00
Conference Registrations	<u>\$0.00</u>
Total	\$350,000.00

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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 2013

Salaries (Regular Employees)	\$44,000.00
Employee Benefit	\$12,320.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$53,680.00
Conference Registrations	<u>\$0.00</u>
Total	\$110,000.00

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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 2013

Salaries (Regular Employees)	\$253,066.00
Employee Benefit	\$70,858.48
Materials, Supplies, and Services	\$537.76
Travel and Sustenance	\$537.76
Conference Registrations	<u>\$0.00</u>
Total	\$325,000.00

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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 2013

Salaries (Regular Employees)	\$42,000.00
Employee Benefit	\$11,760.00
Materials, Supplies, and Services	\$5,000.00
Travel and Sustenance	\$1,240.00
Conference Registrations	<u>\$0.00</u>
Total	\$60,000.00

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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 2013

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

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LINE ITEM 7

Performance Measures

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.

Cost Estimate for FY 2013

Salaries (Regular Employees)	\$51,000.00
Employee Benefit	\$14,000.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
 Total	 \$65,000.00

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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 2013

Salaries (Regular Employees)	\$46,800.00
Employee Benefit	\$18,200.00
Materials, Supplies, and Services	\$0.00
Travel and Sustenance	\$0.00
Conference Registrations	<u>\$0.00</u>
Total	\$65,000.00

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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 2013

Salaries (Regular Employees)	\$49,776.00
Employee Benefit	\$13,937.28
Materials, Supplies, and Services	\$2,286.72
Travel and Sustenance	\$9,000.00
Conference Registrations	<u>\$0.00</u>
Total	\$75,000.00

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LINE ITEM: 10

STATE STUDY NUMBER: 170

TOTAL STUDY BUDGET: \$1,237,838.26

TOTAL STUDY COST TO DATE: \$704,419.06

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:

Chetana Rao

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.

Plans for FY 2013:

Review Input Files for DARWin M-E; Review Field Data of non-LTPP sections; Review & Customize NCAT's Climate Files for Project Analysis; Creating Input Libraries for DARWin M-E; CIPR & Stabilized Base Consulting; Determine Effect of Truck Overloads; MS-ATLAS File & DARWin-ME Compatibility; Calibration and validation of performance models; Recommend levels needed for design input; Evaluate design results using locally calibrated models; Develop training materials and conduct training; Customize software; Final Report.

ARA will also request an extension of project completion date to Dec 2013 to allow time for MDOT to provide data essential for calibration.

Cost Estimate for FY 2013 \$275,000.00

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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.

Plans for 2013:

We are charging to the Implementation line item now.

Cost Estimate for FY 2013 \$0.00

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LINE ITEM: 12

STATE STUDY NUMBER: 184

TOTAL STUDY BUDGET: \$218,224.00

TOTAL STUDY COST TO DATE: \$67,566.74

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.

Plans for FY 2013:

The fifth 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 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 five 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 2013 \$76,000.00

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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.

Plans for FY 2013:

Data will be collected and submitted to JSU.

Cost Estimate for FY 2013 \$1,000.00

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LINE ITEM: 14

STATE STUDY NUMBER: 186

TOTAL STUDY BUDGET: \$24,000.00

TOTAL STUDY COST TO DATE: \$15,000.00

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:

No work performed during FY 09.

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FY 2010:

No work was done in FY10.

FY 2011:

No work was done in FY11.

FY 2012:

No work was done in FY2012.

Plans for FY 2013:

No work is planned for FY2013.

Cost Estimate for FY 2013 \$0.00

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LINE ITEM: 15

STATE STUDY NUMBER: 206

TOTAL STUDY BUDGET: \$239,703.00

TOTAL STUDY COST TO DATE: \$160,404.60

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.

Plans for 2013:

Plans for FY 2013 are to complete all testing for the project, complete all field testing, and complete the literature review. By the end of FY 2013 the plan is to only have the project nearly complete, with some report writing and specification guidance efforts possibly left to complete.

Cost Estimate for FY 2013 \$63,438.72

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LINE ITEM: 16

STATE STUDY NUMBER: 207

TOTAL STUDY BUDGET: \$135,000.00

TOTAL STUDY COST TO DATE: \$131,618.26

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.

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

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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.

Plans for FY 2013:

Plans for FY 2013 are to finish presentation of data and prepare the final draft report.

Cost Estimate for FY 2013 \$3,381.74

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LINE ITEM: 17

STATE STUDY NUMBER: 211

TOTAL STUDY BUDGET: \$330,000.00

TOTAL STUDY COST TO DATE: \$265,787.11

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.

Plans for 2013:

A few hundred additional Bending Beam Rheometer tests are planned (laboratory and field aged emulsion), alongside continued LTP test section monitoring and laboratory LTP testing. Thereafter, the majority of the SS 211 testing should be complete. A key focus in FY 2013 will be data analysis and report writing once the additional BBR and LTP testing is complete.

Cost Estimate for FY 2013 \$51,370.31

Mississippi Research Work Program 2013

LINE ITEM: 18

STATE STUDY NUMBER: 223

TOTAL STUDY BUDGET: \$152,810.00

TOTAL STUDY COST TO DATE: \$127,431.97

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 conducted to get some feedback. A project progress meeting with the traffic engineering division was held 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 studied 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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Plans for FY 2013:

In Federal FY2013, a I-55 diversion case study will be developed under different scenarios. In addition, the research team will continue to work with Temple to set up the expert system in ACTRA. Specific plans for FY2013 based on tasks are listed below. **Task 4: An Expert System Approach.** Hardware-in-the-loop simulation will be conducted to test the IDTMS system performance using real signal controllers. Several signal timing plans will be developed to accommodate different diversion volumes. A rule based expert system algorithm will be developed to decide which traffic signal timing plan will be implemented. **Task 5 an Optimization Approach - Subtask 5.2: Algorithm Selection and Development.** The research team will continuously improve the proposed dynamic algorithm efficiency. The search criteria will be proved to produce the optimal solution. **Subtask 5.3: Solution and System Integration –** The research team will continue to code the proposed models and algorithms into the CORSIM simulation. Furthermore, a NTCIP interface will be provided for future integration to the MDOT compliant system. **Task 6: Benefit Studies.** The research team will conduct a case study for I-55 diversion traffic management in the Northern Jackson area. Different scenarios under different traffic volumes and diversion control strategies will be developed in the CORSIM simulation. The effectiveness of the diversion model and the traffic signal optimization model will be validated. Measure of effectiveness, such as travel time, delay, will be collected and summarized. The benefits of the proposed IDTMS system will be demonstrated by analyzing the results from the simulation. **Task 7: Final Report –** A final report summarizing all the work from Task 1 to Task 6 will be developed by the end of the project.

Cost Estimate for FY 2013 \$25,378.03

Mississippi Research Work Program 2013

LINE ITEM: 19

STATE STUDY NUMBER: 228

TOTAL STUDY BUDGET: \$135,044.00

TOTAL STUDY COST TO DATE: \$83,806.92

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.

Plans for FY2013:

Periodic spotlight counts will continue until Dec 2012 and selected vegetation plots will be monitored to follow up on interesting observations worthy of mention but where the sample size will prevent statistically significant data. We will report these observations as case studies. Public opinion surveys will be completed. Data analysis will be completed and the results of the analysis will be converted into recommendations. Edward will complete his Masters Thesis. Presentations of the final results will be delivered at various conferences and published in several formats and venues. Final reports including statistical analyses and recommendations will be delivered to MDOT. Two Extension publications on the identification of native and non-native grasses are in the works.

Cost Estimate for FY 2013 \$40,558.00

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LINE ITEM: 20

STATE STUDY NUMBER: 229

TOTAL STUDY BUDGET: \$150,000.00

TOTAL STUDY COST TO DATE: \$22,717.15

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 monitoring, "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.

Plans for FY 2013:

The selected TDR sensor and wireless data acquisition system will be purchased and assembled at the lab. They will be tested and calibrated by comparing the sensor measurement and manual measurement and transmitting measurement data wirelessly to the desktop computer at the MDOT office. The research staff will be recruited to carry out the lab work. The TAC will be invited to examine the pilot lab test and make suggestions. The research team will also continue efforts to improve efficiency of a computational framework for assessing the scoured bridges, and will make effort for disseminating the project finding to all interested parties to facilitate transferring of structural health monitoring technology into practice.

Cost Estimate for FY 2013 \$127,282.86

Mississippi Research Work Program 2013

LINE ITEM: 21

STATE STUDY NUMBER: 231

TOTAL STUDY BUDGET: \$97,478.52

TOTAL STUDY COST TO DATE: \$87,874.17

DATE STARTED: 05/07/2010

COMPLETION DATE: 12/31/2012

Optimizing Mississippi Aggregates for Concrete Bridge Decks

RESEARCH AGENCY:

Burns Cooley Dennis, Inc.

PRINCIPAL INVESTIGATOR:

Robert Varner

Objective:

A class BD concrete has been recently added to MDOT's classes of concrete in an effort to reduce the amount of shrinkage cracks in bridge decks. A primary focus of the BD class concrete is to optimize aggregate gradations to reduce voids in the concrete mixture matrix and reduce cement paste that is required to fill the voids. Limits have been included in the BD class concrete based on combined gradations. These limits will require possible blending of aggregates, crushing, and modifications to ready mix concrete plants. Little or no data has been generated using Mississippi aggregates that confirm that gradation limits included in the BD class concrete specifications provide concrete mixtures that exhibit less shrinkage and cracking. Burns Cooley Dennis, Inc., will work with the department to identify one sand and gravel source of local aggregates for this research project. The aggregates will be processed and stockpiles will be create for the 1", ¾", 1/2", 3/8", No. 4, No. 8, No. 16, No. 30, No. 50, and No. 100 sizes. These stockpiles will then be used to meet combined gradation requirements listed in the BD class concrete specification. Concrete mixtures will be developed to follow the contour of the middle and upper and lower limits of the combined aggregate gradation. An additional forty-two concrete mixtures will be developed to evaluate extending the limits of the BD gradation and to determine the impact on shrinkage and strength. Unit weight and voids will also be determined for each combination of aggregates used in the mixtures. Data collected from these forty-five mixtures will be used to develop combined gradation limits for Mississippi aggregates. Each mixture will be tested for slump, temperature, air, unit weight, strength, and shrinkage (ASTM C 157).

Progress:

FY 2010:

Work accomplished during this period includes obtaining materials to be used in this research, performing laboratory testing on aggregates, processing aggregates into individual size fractions, and conducting 30 concrete laboratory mixes. BCD developed spreadsheets to manage and share data.

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FY 2011:

Shrinkage measurements were made and excel files updated. Data updates were provided to TAC members. BCD also provided an update to TAC members in a meeting held on December 2, 2010.

FY 2012:

BCD requested a no cost to MDOT extension. The completion date was June 30, 2012. The completion date has been moved to December 31, 2012.

Plans for FY 2013:

BCD will complete final report and provide MDOT with a draft final copy three months prior to completion date of December 31, 2012.

Cost Estimate for FY 2013 \$9,604.35

Mississippi Research Work Program 2013

LINE ITEM: 22

STATE STUDY NUMBER: 234

TOTAL STUDY BUDGET: \$213,482.41

TOTAL STUDY COST TO DATE: \$139,238.97

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.

Plans for FY 2013:

We will continue to monitor species composition and plant height on all experiments. We will initiate another hydroseeding study similar to the one planted last September. We will initiate another fall planting study concentrating on cool season species. We will begin to put together the project report.

Cost Estimate for FY 2013 \$74,243.45

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LINE ITEM: 23

STATE STUDY NUMBER: 235

TOTAL STUDY BUDGET: \$140,875.00

TOTAL STUDY COST TO DATE: \$60,050.96

DATE STARTED: 02/22/2011

COMPLETION DATE: 06/30/2013

Triple-Bottom Line Assessment of Future Mississippi Intermodal Facility

RESEARCH AGENCY:

University of Southern Mississippi

PRINCIPAL INVESTIGATOR:

Tulio Sulbaran

Objective:

A proposed intermodal facility in south Mississippi is still in the concept stage. It is the perfect time for the stakeholders to have a thorough study of these kinds of facilities. This triple-bottom line assessment of comparable facilities will provide the base information needed by the citizens, governments, and businesses involved with the realization of the south Mississippi intermodal complex to make better informed decisions. The stakeholders can learn from the mistakes and successes of other intermodal transportation endeavors. Processes and organizations can be established that will allow the region to develop a world-class inland port intermodal facility that improves the competitiveness of the businesses involved, protects the environment and quality-of-life of south Mississippi, and creates equitable and sustainable economic development.

Too often regions who have or attempted to establish intermodal facilities have made the same mistakes and the results are often citizen outrage and failure to achieve all three triple-bottom line outcomes. The Port of the Future in Gulfport is an exciting opportunity for the Gulf Coast. The Mississippi State Port Authority (MSPA) and stakeholders on the coast have come together to start making this vision come true. This study will help give the inland regions in proximity to Gulfport the knowledge to leverage the opportunity created by the Port of the Future to benefit the profits, planet, and people that is south Mississippi.

Progress:

FY 2011:

Secure executed contract; Began Literature Review; Began to Identify Benchmark facilities; Substantially completed literature review; Substantially completed list of benchmark facility; Initiated data Collection Instrument; Continued the collection of information regarding the benchmark facilities information; Held progress meeting.

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FY 2012:

During this period research team successfully completed the following major activities 1- Initiated the Data Collection; 2- Prepared Preliminary Findings Report 3- Presented Chapter 3 first draft, 4 – Presented Chapter 4 first draft; 5- Held progress meeting; 6- Collect additional secondary data; 7- Processed collected data; 8-Prepared draft initial Results; 9- Initiated identifying stakeholders for roundtables; 10-Began preparation ; 11- Worked with MDOT to send letter requesting response to Survey; 12- Send Survey Link Again; 13-Continued working on data Analysis and Results; 14-Met with MDA project leaders; 15- Coordinate dproject efforts with MDA project; and 16-Held Teleconferece Discussion with MDOT to host roundtables; and 17-Held Progress Meeting

Plans for FY 2013:

The following are the team planned activities for the upcoming quarter 1- Analyze Data; 2-Continue working on Final Report; 3- Coordinating Findings with MDA project leaders; 4- Coordinate project efforts with MDA project; 7- Hold two Round Table; and 8-Hold Progress Meetings

Cost Estimate for FY 2013 \$80,824.04

Mississippi Research Work Program 2013

LINE ITEM: 24

STATE STUDY NUMBER: 238

TOTAL STUDY BUDGET: \$81,607.61

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 02/25/2011

COMPLETION DATE: 12/31/2012

Evaluation of Crushed Concrete Base Strength

RESEARCH AGENCY:

Burns Cooley Dennis, Inc.

PRINCIPAL INVESTIGATOR:

L. Allen Cooley, Jr.

Objective:

BCD will work with MDOT to identify four sources, with the three base grading (¾ down, No. 610, and 825B) for laboratory testing. Gradations and Atterberg limits of the base samples will be performed in accordance to MT-22 and AASHTO T89/90. The moisture-density relationship of the base materials will then be performed in accordance with MT-8 and AASHTO T180. Following the determination of the moisture-density relationship of the base materials, three-point CBR (AASHTO T193) tests at varying efforts covering the range of MDOT's field density requirements (standard effort) for base materials and ranging from about 90 to 100 percent modified compaction effort. Additionally, resilient modulus (NCHRP1-28) tests will be conducted at target densities meeting the MDOT minimum field density (standard effort) requirements and at 100 percent of modified effort compaction. Additionally, LA abrasion (AASHTO T96), Micro Deval (AASHTO T327), and fine aggregate angularity (AASHTO T304) tests will be performed to investigate possible indicators of high and/or low strength base materials. Upon completion of these laboratory tests, 2 additional resilient modulus test will be performed on the 610 crushed limestone base at two additional compactive efforts to obtain resilient modulus versus compaction for densities ranging from 95 to 100 percent of MDOT standard effort. Also, one crushed concrete base material will also be selected for testing at two additional compactive efforts to obtain resilient modulus versus compaction for densities ranging from 95 to 100 percent of MDOT standard effort. The crushed concrete sample selected will be the sample that is found to meet current MDOT criteria, and be nearest to the lower quality limits that are currently required by MDOT and/or the quality indicator(s) that are found in this study. Following these strength tests and aggregate properties tests, the data will be compared and summarized into a final report for MDOT.

Progress:

Mississippi Research Work Program 2013

FY 2011:

All ten base materials were obtained. These materials included seven crushed concrete base materials and three limestone base materials. Testing was initiated on all ten materials.

FY 2012:

Laboratory testing will be initiated and completed. Following completion of the laboratory work, a final report will be provided.

Plans for FY 2013:

A final report will be provided.

Cost Estimate for FY 2013 \$81,567.61

Mississippi Research Work Program 2013

LINE ITEM: 25

STATE STUDY NUMBER: 239

TOTAL STUDY BUDGET: \$99,973.99

TOTAL STUDY COST TO DATE: \$94,594.02

DATE STARTED: 03/02/2011

COMPLETION DATE: 06/30/2013

Cement Influences on Gravel Aggregate Concrete Strength

RESEARCH AGENCY:

Burns Cooley Dennis, Inc.

PRINCIPAL INVESTIGATOR:

Robert Varner

Objective:

BCD will work with MDOT to identify gravel, limestone and cementitious material sources for use in this study. BCD will secure samples of cementitious materials and aggregates and perform specific gravity test and sieve analyses on the aggregate samples. BCD will develop 84 MDOT Class AA concrete mixes and develop spreadsheets for data processing and calculations. BCD will conduct laboratory mixing and testing of concrete which will include slump, unit weight, temperature, and compressive strength. BCD will also conduct compressive strength test on mortar cubes for each cement sample. BCD will provide a final report detailing the concrete mixtures, materials and the test results. Low strength mixes will be documented along with associated cementitious material characteristics.

Progress:

FY 2011:

BCD completed all laboratory testing of 84 concrete mixtures and 21 mortar cubes mixtures needed for this study.

FY 2012:

BCD summarized data and began work on the final report.

Plans for FY 2013:

BCD will complete final report and provide MDOT with a draft final copy three months prior to completion date of December 31, 2012.

Cost Estimate for FY 2013 \$5,379.97

Mississippi Research Work Program 2013

LINE ITEM: 26

STATE STUDY NUMBER: 240

TOTAL STUDY BUDGET: \$292,186.29

TOTAL STUDY COST TO DATE: \$103,660.45

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

Mississippi Research Work Program 2013

to collect runoff from rain events during the study. Planting and fertilization took place 21 October 2011. 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.

Plans for FY 2013:

The 2012 fall mulch study will be planted mid-September and continue until mid-November. During this time we will conduct rainfall simulations 14, 28, and 56 days after seeding. Vegetative cover, soil volumetric water content, and weather data will also be collected. The 2011 field sites will continue to be maintained and a species evaluation will be conducted using the line intersect method. Processing and analysis for the remainder of the 2011 and all of the 2012 runoff samples will take place. Furthermore, statistical analyses for sediment, nutrients, soil volumetric water content, and vegetative coverage will be conducted. The results will be used to write final reports for the studies conducted over the two and a half year project.

Cost Estimate for FY 2013 \$171,272.00

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LINE ITEM: 27

STATE STUDY NUMBER: 245

TOTAL STUDY BUDGET: \$90,503.46

TOTAL STUDY COST TO DATE: \$9,675.00

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.

Plans for FY 2013:

It is expected that this study will be initiated in FY 2013. Field testing of HMA mixture as well as laboratory testing of HMA mixture will be conducted.

Cost Estimate for FY 2013 \$64,500.00

Mississippi Research Work Program 2013

LINE ITEM: 28

STATE STUDY NUMBER: 246

TOTAL STUDY BUDGET: \$98,493.21

TOTAL STUDY COST TO DATE: \$10,500.00

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.

Plans for FY 2013:

It is expected that this study will be initiated in FY 2013. Field testing of HMA mixture as well as laboratory testing of HMA mixture will be conducted.

Cost Estimate for FY 2013 \$70,000.00

Mississippi Research Work Program 2013

LINE ITEM: 29

STATE STUDY NUMBER: 247

TOTAL STUDY BUDGET: \$99,843.50

TOTAL STUDY COST TO DATE: \$4,500.00

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.

Plans for FY 2013:

BCD will conduct laboratory testing of concrete mixtures and begin shrinkage testing.

Cost Estimate for FY 2013 \$30,000.00

Mississippi Research Work Program 2013

LINE ITEM: 30

STATE STUDY NUMBER: 250

TOTAL STUDY BUDGET: \$291,975.80

TOTAL STUDY COST TO DATE: \$24,733.34

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.

Plans for FY 2013:

During FY 2013 it is planned to perform the majority of the rest of the literature review (Task 3). Task 4 (asphalt testing) and Task 5 (gradation variability) is also planned to be completed during FY 2013. Some wheel tracking of in place recycled materials (Task 6) is envisioned during FY 2013, and strength versus time testing should be mostly complete in FY 2013 depending on how long testing is performed (test results will dictate test durations). Strength variability (Task 8) and traffic opening (Task 9) are envisioned to be worked on during FY 2013. Durability investigation (e.g. Cantabaro and BBR) will be partially completed in FY 2013, along with some of the needed efforts to measure elastic modulus (Task 11).

Cost Estimate for FY 2013 \$129,000.00

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LINE ITEM: 31

STATE STUDY NUMBER: 251

TOTAL STUDY BUDGET: \$6,000.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 01/17/2012

COMPLETION DATE: 12/31/2014

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.

Cost Estimate for FY 2013 \$2,000.00

Mississippi Research Work Program 2013

LINE ITEM: 32

STATE STUDY NUMBER: 252

TOTAL STUDY BUDGET: \$79,907.78

TOTAL STUDY COST TO DATE: \$2,663.95

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.

Plans for FY 2013:

Efforts will be made in the five months ahead to complete all unfinished tasks.

Cost Estimate for FY 2013 \$17,579.71

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LINE ITEM: 33

STATE STUDY NUMBER: 253

TOTAL STUDY BUDGET: \$78,177.60

TOTAL STUDY COST TO DATE: \$4,397.85

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.

Plans for FY 2013:

Complete task 4, data analysis. Speed data will be extracted from traffic equipment to determine the impact of school zone sign saturation on driver speed. Based on the results, task 5, develop guidelines, will be completed. Task 6, final report, will complete the project.

Cost Estimate for FY 2013 \$29,319.00

Mississippi Research Work Program 2013

LINE ITEM: 34

STATE STUDY NUMBER: 255

TOTAL STUDY BUDGET: \$71,500.00

TOTAL STUDY COST TO DATE: \$26,142.41

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.

Plans for FY 2013:

A synthesis of findings will be prepared and a follow up phase will be recommended for a pilot study in Mississippi with candidate technologies. If a viable noncontact highway speed

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technology is not found then a problem statement for research need will be prepared and submitted for a national study through NCHRP.

Cost Estimate for FY 2013 \$36,286.07

New State Studies for FY2013

LINE ITEM: 35

STATE STUDY NUMBER: 258

TOTAL STUDY BUDGET: \$25,000.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 03/01/2012

COMPLETION DATE: 09/30/2013

Tenn-Tom Transports STEM Education

RESEARCH AGENCY:

Tennessee Tombigbee Waterway

PRINCIPAL INVESTIGATOR:

Agnes Zaiontz

Objective:

The Tennessee-Tombigbee Waterway (Tenn-Tom) provides schools throughout the state the unique opportunity to broaden traditional models of learning for students. The waterway will provide real world experiences that will enrich education as students learn about one of the world's engineering marvels. Originally conceived by French explorers over 250 years ago, the Tennessee-Tombigbee Waterway is one of the Nation's largest, most costly, and complex public works projects which can serve as critical resource in teaching students about intermodal transportation and economic development in the state.

A \$160,000 Enhancement Project will jumpstart learning by providing the opportunity for students to learn about the waterway through interactive exhibits in an Intermodal Learning Center at the Tenn-Tom Waterway office in Columbus. A simulator or pilot house will allow students and other visitors to actually navigate the tug through locks, bridge crossings and along the banks of the waterway. A proposed lock model for students and visitors will include an interactive module depicting a lock opening/closing as well as maneuvering the tug into and out of the lock.

In addition, the proposed installation of cameras at all locks and selected ports, marinas and industries along the waterway will allow students to monitor the traffic along the waterway from their classroom and learn the methods of transporting goods from an industry by rail or

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truck to the port and onto barges. The student could use the data to compare the number and cost per ton of transporting on truck, rail or by water. They could also compare time to cost savings.

Request for Research Funds for Curriculum Development:

The Tennessee Tombigbee Waterway is requesting Research Funds totaling \$25,000 to develop a STEM curriculum which teaches students about intermodal transportation as well as the Waterway. The proposed curriculum would be aligned with Core Standards of Learning as well as National Math and Science Learning Standards.

Practicing math and science teachers will work with waterway personnel to develop the curriculum activities. The hands-on curriculum will be designed in lesson plan format and technology resources will also be included to enhance the lessons.

The curriculum will be available to any school in the state upon request. Teachers in the surrounding counties will be invited to attend a two-day training on the curriculum as soon as it is completed. CEU credit will be available for teachers who participate in the training.

Teachers will begin working with waterway personnel in August, 2012. Curriculum development will begin in September, 2012 and will be completed by March, 2013. Training for teachers will take place in June, 2013. The curriculum will be available for schools in June, 2013.

The Tenn-Tom Waterway will maintain the curriculum and update it annually. It will be available through the Intermodal Learning Center.

The contact for this project is Agnes Zaiantz, Business Manager, Tennessee Tombigbee Waterway. azaiontz@tenntom.org. 662-328-3268

Cost Estimate for FY 2013 \$25,000.00

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LINE ITEM: 36

STATE STUDY NUMBER: 259

TOTAL STUDY BUDGET: \$100,911.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 10/01/2013

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.

Cost Estimate for FY 2013 \$10,000.00

Mississippi Research Work Program 2013

LINE ITEM: 37

STATE STUDY NUMBER: 260

TOTAL STUDY BUDGET: \$22,500.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 10/01/2013

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.

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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.

Cost Estimate for FY 2013 \$6,000.00

Mississippi Research Work Program 2013

LINE ITEM: 38

STATE STUDY NUMBER: 261

TOTAL STUDY BUDGET: 125,000.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 10/01/2013

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 effects of construction on turbidity levels in receiving streams due to run-off from construction projects, and the EPA may soon be promulgating a Final Rule establishing numeric turbidity limitations. However, the results of the initial study (State Study 225) identified other areas where additional data is needed. Specifically, these areas include the turbidity of stormwater at site discharge points prior to mixing with the receiving stream and the need to identify more reliable and more site specific equipment for differing site conditions. 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. The water quality monitoring program will be primarily focused on gathering turbidity data. Data, following initial site selection and site visits with MDOT, will be collected using MDEQ and EPA protocols as guidance. Because of the complex factors which affect turbidity, this may be only one phase of a multiphase project.

Cost Estimate for FY 2013 \$5,000.00

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LINE ITEM: 39

STATE STUDY NUMBER: 262

TOTAL STUDY BUDGET: \$77,748.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 10/01/2013

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.

Cost Estimate for FY 2013 \$5,000.00

Mississippi Research Work Program 2013

LINE ITEM: 40

STATE STUDY NUMBER: 263

TOTAL STUDY BUDGET: \$350,000.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 08/01/2012

COMPLETION DATE: 12/31/2013

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:

This study will collect and analyze data for new and rehabilitated pavements to continue to calibrate the Mechanistic-Empirical Design Guide for Mississippi.

Cost Estimate for FY 2013 \$30,000.00

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LINE ITEM: 41

STATE STUDY NUMBER: 264

TOTAL STUDY BUDGET: \$50,000.00

TOTAL STUDY COST TO DATE: \$0.00

DATE STARTED: 10/01/2013

COMPLETION DATE: 12/31/2014

In-House support to Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements

RESEARCH AGENCY:

MDOT

PRINCIPAL INVESTIGATOR:

Bill Barstis

Objective:

This study will provide in-house support to State Study 242, Collection and Evaluation of Core Data for the MEPDG for Overlaid and New Pavements. The money budgeted will pay for traffic control, as well as Research Division personnel expenses of falling weight deflectometer (FWD) testing and data analysis.

Cost Estimate for FY 2013 \$5,000.00

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

NCHRP/TRB

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 2013 SPR Part II Funds: \$121,803.52

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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 2013 SPR Part II Funds: \$31,947.29

POOLED FUND STUDIES

Transportation Library Connectivity and Development

Host Agency: Missouri Department of Transportation

Accessible, reliable, and timely information is central to quality performance for all transportation agencies and stakeholders. Yet, a vast amount of transportation-related information is neither collected nor made available for use by others. This project will focus on making the transfer of information an integral part of transportation library and information services. Under the guidance of a full-time staff person contracted for the project, and with the support of a comprehensive marketing plan and materials, pooled fund participants will work to implement a national transportation technology transfer program for information and knowledge management. Guidance will be provided for cataloguing documents into the Online Computer Library Center and converting them to online format and network development. The total project budget is approximately \$1,000,000.

MDOT originally funded participation in this project in the FY 2008 Research Work Program with a onetime payment of \$15,000. Subsequent to this initial payment, the project study performed some additional work directly for MDOT in its efforts to improve and enhance library services; therefore, MDOT provided an additional \$15,000 during FY 2009. This additional work continued into FY 2010.

The pooled fund was assumed by Missouri DOT in FY11.

FY2008 - \$15,000 FY2009 - \$15,000 FY2010 - \$15,000

FY2011 - \$15,000 FY 2012 - \$15,000 FY 2013 - \$15,000 FY 2014 - \$15,000

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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

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Bridge Pier Scour Research

Host Agency: Federal Highway Administration

This research study focuses on advancing the knowledge of current practices for determining design scour depth of bridges. Using a combination of data obtained from historical scour research literature, laboratory experiments, field-testing, data collection and data evaluation, research will be completed and the issues associated with bridge scour practices and the lack of knowledge about such will be consequently addressed.

FY 2011 - \$20,000 FY 2012 - \$20,000 FY 2013 - \$20,000 FY 2014 - \$20,000

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Improving the Quality of Pavement Profiler Measurement

Host Agency: Federal Highway Administration

This research study focuses on providing agencies with information and firsthand experience to address issues and concerns related to profiler operation, equipment, and procedures. There is an increasing need for Department of Transportation to purchase and upgrade profiling equipment to provide network-level and project specific smoothness information. This includes profilers operated at close to posted speed limits that are most often used to determine ride quality on a network-level. The project objectives include:

- Deliver sample procurement specifications, maintenance guidelines, and profile analysis software.
- Establish criteria for verification centers and assist with the development of these locations.
- Develop and deploy a traceable verification center.
- Provide technical review of software that locates surface imperfections that require corrective repair during construction can relate the bumps to the highway users and procure for general distribution. MDOT contributed to this pooled fund from 2003-2006.

FY2003 - \$30,000 FY2004 - \$30,000 FY2005 - \$30,000 FY2006 - \$30,000

FY2011 - \$15,000 FY2012 - \$15,000 FY2013 - \$15,000 FY2014 - \$15,000

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Traffic Signal Systems Operation and Management

Host Agency: Indiana Department of Transportation

Signalized arterial represent a substantial component of the highway transportation network in the United States. The National Transportation Operations Coalition (NTOC) in their 2007 Traffic Signal Report Card noted that nationally 5 to 10 percent of all traffic delay is caused by improper traffic signal timings along major roadways. In 2007, the National Report Card for overall traffic signal systems operations was a D. The situation is not expected to improve as travel demand is forecast to grow significantly faster than network capacity. The increase in national attention on sustainable and livable communities necessitate a concentrated effort be placed upon improved management and operation of our nations traffic signal system inventory.

The Transportation Management Center (TMC) Pooled fund study (SPR-2(207)) initiated in 2000, has been very successful at generating consensus on best management practices for traffic management centers oriented mainly towards freeway operations. It is desirable to develop a similar pooled fund study oriented toward traffic signal operations and management that would complement SPR-2(207) and engage a broad cross section of agencies on the leading edge of active traffic signal management.

Develop a network of transportation agencies to:

1. Develop consensus on operational standards of performance,
2. Define a central management model that can leverage commercial wireless IP offerings that can be competitively outsourced, and
3. Management principles for using a central system to identify when and where resources are most needed to maximize return on investment.

The level of participation and associated funding commitments will allow for additional opportunities over time or in parallel to explore additional traffic signal initiatives beyond those described herein. For example, the evaluation of adaptive control field deployments and associated systems engineering guidance documents under development by FHWA.

FY 2012 - \$25,000 FY 2013 - \$25,000 FY 2014 - \$25,000

Mississippi Research Work Program 2013

Pavement Surface Properties Consortium: A Research Program

Host Agency: Virginia Department of Transportation

The objective of this pooled fund is to establish a research program focused on enhancing the level of service provided by the roadway transportation system through optimized pavement surface texture characteristics. The initial focus of the program will be the application of inertial and laser-based equipment for measuring these properties. Other questions and issues will be identified in cooperation with the pool fund participants. An interactive project solicitation process will be used to request feedback from all participants. **Note: We previously participated in this pooled fund from 2007 to 2010 and paid \$20,000 each of those four years and have since rejoined it for four more years at \$20,000 each.**

FY2007-\$20,000	FY2008-\$20,000	FY2009-\$20,000	FY2010-\$20,000
FY2012-\$20,000	FY2013-\$20,000	FY2014-\$20,000	FY2015-\$20,000

Mississippi Research Work Program 2013

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

Mississippi Research Work Program 2013

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 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 2013

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.

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. 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. 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. 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 2013

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.