

MISSISSIPPI SPR-1(45), PART II

GENERAL COMMENTS ON RESEARCH WORK PROGRAM  
FOR FISCAL YEAR 2005

The SPR (Part II) research work program allocation for FY 2005 totals \$1,703,423 (estimated) and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$374,753 for FY 2005, a TRB Correlation Service contribution of \$93,455 and pooled-fund studies totaling \$360,000 as detailed in the program tabulation and narrative included in this document. The NCHRP funding is 5.5% of the total SPR allocation (Parts I and II). 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 2005. 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 2005. 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 2005 research work program.

The pooled fund studies, TRB Correlation Service and NCHRP are funded with 100% SPR Part II funds (no state match). The twenty-two line items in the tabulation mentioned above includes only those items for which there is a state match in the funding.

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.

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LINE ITEM 1

Long-Term Pavement Performance

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 conducted in FY 2004 included:

- support for field data collection

Activities planned for FY 2005 include:

- maintaining pavement marking for existing LTPP sites
- support for all LTPP activities

**Cost Estimate for FY 2005**

Salaries (Regular Employees)	\$1,500
Employee Benefit	\$420
Materials, Supplies, and Services	\$380
Travel and Sustenance	<u>\$200</u>
Total	\$2,500

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LINE ITEM 2

Implementation of Research Projects

This line item funds Research Division activities relating to implementation of research studies.

Implementation Activities consist of field and office activities that apply research results to the solution of operational problems in the transportation area. Examples of these activities are:

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

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

**Cost Estimate for FY 2005**

Salaries (Regular Employees)	\$185,600
Employee Benefits	\$50,400
Materials, Supplies, and Services	\$19,000
Travel and Sustenance	<u>\$20,000</u>
 Total	 \$275,000

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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.

There are many similarities between items falling under the categories **Technology Transfer** and **Implementation** of this work program. For the purposes of this work program, a distinction will be made that **Implementation** will be concerned with actively putting research results into practice while **Technology Transfer** will refer to efforts to disseminate information. Examples of technology transfer are:

- 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)
- maintaining Research Division intranet website and support for research related postings on MDOT's "GoMDOT" webpage.

NOTE: The SPR WORK PROGRAM-PART I (Planning), Technology Transfer, provides direct support to the Center for Technology Transfer (T<sup>2</sup>) at Jackson State University, and those activities and funds are not included in the above line item, Technology Transfer.

**Cost Estimate for FY 2005**

Salaries (Regular Employees)	\$36,375
Employee Benefits	\$10,185
Materials, Supplies, and Services	\$1,440
Travel and Sustenance	<u>\$12,000</u>
Total	\$60,000

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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.

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 2005**

Salaries (Regular Employees)	\$198,400
Employee Benefits	\$63,000
Materials, Supplies, and Services	\$13,600
Travel and Sustenance	<u>\$25,000</u>
Total	\$300,000

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LINE ITEM NO. 5	STATE STUDY NO. 133
TOTAL STUDY BUDGET: \$97,276	TOTAL STUDY COST TO DATE: \$46,856
DATE STARTED: 10/01/99	COMPLETION DATE: 09/30/05
STUDY TITLE:	Soil Stabilization Field Trial
RESEARCH AGENCY:	University of Mississippi (This study will be conducted jointly with the Portland Cement Association sharing costs)
PRINCIPAL INVESTIGATOR:	K.P. George

**Objective:**

A field trial is proposed to investigate the effectiveness of fly ash or other methods such as pre-cutting the base at regular intervals or pre-cracking in mitigating the shrinkage-cracking problem in soil-cement. The Department has been using lime-fly ash (LFA) for stabilization of bases, and this field study will compare the performance of cement sections with LFA included in the program.

The research study is proposed to have a field trial incorporating one section of cement, another of reduced cement and fly-ash, a third section with pre-cut cement layer, a fourth section with induced pre-cracking, a fifth section incorporating lime and fly-ash, and the last section with ground granulated blast furnace slag as an additive.

**Progress:**

A literature review has been performed to review any previous research that would relate to the study. A project was identified for the test sections on MS 302 in Marshall County. Samples of the select material from this project location obtained and laboratory tests performed. Mix designs for each test section were composed based on these laboratory test results.

Six test sections were constructed and samples molded from the field-mixed material for strength testing at 7, 14, 28 and 90 days. Moisture/density testing of the in-place material was performed at the time of construction. Geogauge, FWD (performed by MDOT) and Clegg hammer testing was performed, and crack surveys obtained, over a 28-day monitoring period prior to placement of the asphalt base course. Twenty eight-day field cores were also collected and tested for unconfined compressive strength. Backcalculations of pavement layer moduli from FWD deflection basins were performed and these results compared to Geogauge results. An interim report was published by the principal investigator.

First-year field monitoring, including deflection tests employing FWD, retrieving 4-inch diameter cores and a detailed crack survey was conducted. The MODULUS 5.1

**Progress Continued:**

computer program was used to analyze the FWD deflection data. Core samples were tested for UCS.

Interim Report III was submitted to MDOT.

Fourth-year crack surveys were completed.

The test sections were periodically inspected for surface cracks during FY 2004.

**Plans for FY 2005:**

Fifth-year field tests including FWD tests, extraction of cores and performance of a crack survey are planned for October-November of 2004 for each of the test sections. FWD data will be employed to backcalculate the modulus of layers, especially the stabilized base. Compressive strength of each stabilized base will be determined by testing cylindrical cores. Surface cracks, if any, will also be a factor in assessing the overall suitability of the stabilized bases.

Once the data analysis is completed, those results will be compared with the earlier findings making final conclusions as to the suitability of each stabilized material. A final report will be prepared including the results of the last phase of tests and final conclusions.

**Cost Estimate for FY 2005 \$19,000**

The PCA and the University of Mississippi are providing funds that are not reflected in this Work Program to supplement this effort.

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LINE ITEM NO. 6	STATE STUDY NO: 138
TOTAL STUDY BUDGET: \$75,000	TOTAL STUDY COST TO DATE: \$16,834
DATE STARTED: 10/01/99	COMPLETION DATE: 03/31/06
STUDY TITLE:	In-House Support to State Study No. 133
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

**Objective:**

This study will be conducted to support State Study No. 133 "Soil Stabilization Field Trial" which is a proposed contract with the Department of Civil Engineering at the University of Mississippi. The field site location, layout, and sampling to support the contract study will be conducted by this in-house study.

**Progress:**

Federal Aid Project No. NH-0021-01(104)PH2 was selected as the project for the current study test sections. The project site is located on MS 302 between the Desoto/Marshall County line and US 72 in Marshall County. Meetings were conducted with the principal investigator of State Study No. 133, the Contractor/Subcontractors and MDOT personnel to ensure that the objectives of State Study No. 133 and the field methodologies utilized to meet these objectives were understood by all parties involved in the study. Samples of the select material from the project were obtained and submitted to the University of Mississippi for the required laboratory testing.

The construction of the various test sections was coordinated by MDOT and included a cement treated control section, cement treated with application of a vibratory roller, cement and fly-ash, lime-fly ash, ground granulated blast furnace slag, and a cement treated section precut at 10-ft. intervals. The Department's falling weight deflectometer (FWD) was utilized for testing of the subbase prior to placement of the first lift of asphalt. The final draft of the interim report, which included the construction of these test sections and testing performed in conjunction with this construction, was reviewed.

As part of the first-year field monitoring of the test sections, FWD testing was conducted in, and field cores obtained from, these sections. Interim Report II includes this phase of field monitoring and was reviewed.

As part of the third-year field monitoring of the test sections, FWD tests were performed.

Reviewed Interim Report III during FY 2004.

**Plans for FY 2005:**

Conduct FWD tests and extract cores from pavement test sections. Review final report when submitted from the PI of SS No. 133.

**Cost Estimate for FY 2005** \$12,000

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LINE ITEM NO. 7	STATE STUDY NO. 144
TOTAL STUDY BUDGET: \$161,671	TOTAL STUDY COST TO DATE: \$131,671
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/05
STUDY TITLE:	Profilograph Specification Study
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	James Watkins

**Objective:**

The current roughness specification utilized by the MDOT was developed over 10 years ago and there have been no significant changes since. The specification was developed based on the manual profilograph, which has since been replaced by the automatic unit. Also, unlike 10 years ago, industry is now utilizing high frequency rollers to compact their hot mix asphalt pavements. These rollers have a propensity for creating small scallops in the pavement surface, which due to the blanking band requirement in the current roughness specification are not taken into account when computing a profile index. However, these scallops are certainly felt by the traveling public and create a rougher ride quality. Based on the current specification, industry is not being penalized for a rough ride quality and in some instances contractors are being rewarded with incentive pays for a rough final ride surface. Most states have removed the blanking band from their roughness specification for this very reason. Many of the states have gone to the light weight profiler for their QC/QA of ride quality. The MDOT intends on utilizing the light weight profiler, which instead of producing a profile index value measures the International Roughness Index (IRI). This transition will take some time with undoubtedly a period of time where a dual specification (light weight profiler and profilograph) is in place. If the MDOT is to ever successfully make this transition, the current profilograph specification must be "tightened up" and data must be gathered comparing profile index values to IRI for Mississippi pavements.

**Progress:**

Roughness data has been gathered from approximately twenty (20) projects utilizing the "California type" profilograph, South Dakota type road profiler and the AARB walking profiler. Using this information the department has tentatively revised the current 907-403-12 and the 907-401-22 specifications with regards to surface smoothness. The major change involved in this proposed update is the removal of the .2" blanking band for Profile Index computation. The bump requirement has also been changed from .4" per 25' to .3" per 25' for all pavements.

The department has purchased a lightweight profiler capable of collecting both PI and IRI. Project funds were not utilized to purchase this equipment. Proof testing of the newly acquired lightweight profiler has begun.

**Progress Continued:**

Data was gathered from throughout the State on calibration sections to develop the new IRI specification. The data has been compiled to give an initial best fit correlation between current PI acceptance values and collected IRI values. This initial IRI acceptance correlation data was compared to IRI specifications in other states such as Texas and Virginia.

James Watkins initiated and is continuing development of a software package that will be capable of identifying bumps and dips, as well as being universal to all inertial profiler manufacturers.

Steve Karamihas from the University of Michigan Transportation Institute visited with MDOT Research and Construction Division staff members to assist with the ongoing research effort.

Data was gathered from throughout the State on new construction projects.

**Plans for FY 2005:**

From the data collected on new construction projects from previous year, we will analyze the data and determine a threshold of acceptable continuous IRI values for a 528 foot and a 25 foot lots. If more data is needed to finalize a new IRI specification, the department will collect more data in the spring and/or summer. A new IRI specification will be developed. A workshop for the bump/dip software being developed from the Pooled Fund Study "Improving the Quality of Pavement Profiler Measurement" will be held in the first part of the year. The department will send five representatives to the training. After completing the above tasks, the department starts pilot projects in each of the districts to begin the implementation of the IRI for construction acceptance.

**Cost Estimate for FY 2005** \$30,000

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LINE ITEM NO. 8	STATE STUDY NO: 157
TOTAL STUDY BUDGET: \$150,000	TOTAL STUDY COST TO DATE: \$108,786
DATE STARTED: 03/01/02	COMPLETION DATE: 09/30/06
STUDY TITLE:	Evaluation of DRM System
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATORS:	Randy Battey

**Objective:**

Reflective cracking in flexible pavements is a primary form of distress found in Mississippi highway pavements. To date, few if any, fail safe preventative measures to prevent this distress have been discovered.

The objective of this project is to evaluate an interlayer system, DRM™ (Distress Resistant Membrane), as a preventative treatment for reflective cracking in HMA pavements. (More information on the DRM™ system can be found at <http://www.highwaypreservation.com>) A seven mile long project on MS4 near the community of Galena in Marshall County will be utilized for the evaluation. MS4 near Galena was originally constructed in 1981 and is comprised of 6" of asphalt pavement on top of a soil cement base. Reflective cracking from the soil cement base has caused the pavement condition to become unacceptable.

The study will compare 3½ miles of DRM™ with a subsequent 4" overlay to 3½ miles of no DRM™ with a 4" overlay. A comparison will be made between the amount of reflective cracking in the new 4" overlay between the sections with and without the DRM™ system.

**Progress:**

The performance of the sections was monitored and an Interim Report (Construction Report) was produced.

**Plans for FY 2005:**

Continue monitoring the performance of the DRM test sections by collecting IRI, PCR and video data.

**Cost Estimate for FY 2005** \$2,000

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LINE ITEM NO. 9	STATE STUDY NO: 166
TOTAL STUDY BUDGET: \$110,000	TOTAL STUDY COST TO DATE: \$28,835
DATE STARTED: 10/01/02	COMPLETION DATE: 12/31/06
STUDY TITLE:	Hot Mix Asphalt (HMA) Characterization for the 2002 AASHTO Design Guide
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Shane Buchanan

**Objective:**

MDOT currently uses the AASHTO Guide for the Design of Pavement Structures for structural pavement design. This guide is empirically based and utilizes the concept of structural numbers (SN) to determine the overall required thickness of varying pavement layers. These structural numbers were determined from the AASHTO road test in the 1950's.

Currently the AASHTO 2002 Guide for Design of New and Rehabilitated Pavement Structures is being developed. This guide will have three design levels (Level 1,2 and 3) all based on mechanistic-empirical design principles and will potentially replace the existing guide as the structural design guide for MDOT.

The researchers working on the flexible pavement component of the 2002 guide have evaluated many test methods to determine the best relationship between observed HMA mix lab performance and field performance with respect to rutting, fatigue cracking, etc. Currently, the dynamic modulus test will be used to characterize HMA mixes for input into the 2002 design guide. The test is run in accordance with ASTM D 3497 Standard Test Method for Dynamic Modulus of Asphalt Concrete Mixtures.

Mississippi HMA mixes need to be characterized using dynamic modulus testing in preparation for the future implementation of the 2002 design guide. In this study a range of HMA mixes will be characterized using the dynamic modulus testing. Any proposed evaluation will initially be focused on materials and mixes that are currently being used in the state.

Selected mixes will also be evaluated using the asphalt pavement analyzer (APA) and confined repeated deformation testing for comparison purposes. MDOT has performed APA testing on many mixes and a side-by-side comparison of the dynamic modulus and the APA would be very useful.

**Progress:**

A determination was made regarding which HMA mix design variables to include in the study. Discussions were made with personnel from NCAT, the University of Arkansas and Advanced Asphalt Technologies regarding the testing equipment and protocols used for dynamic modulus testing.

Appropriate literature involving the dynamic modulus test and the 2002 design guide was obtained and reviewed and mix design work was conducted during FY 2004.

Mix design work was performed.

Final purchase arrangements for the necessary testing equipment were made during August 2004.

**Plans for FY 2005:**

Final mix design work will be conducted along with determining appropriate laboratory protocols for specimen preparation (i.e., coring and cutting).

Dynamic modulus testing will be conducted on prepared specimens upon delivery and operational setup of the equipment. It is anticipated that the testing will be completed in approximately 6 months after equipment setup.

**Cost Estimate for FY 2005** \$55,000

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LINE ITEM NO. 10	STATE STUDY NO: 167
TOTAL STUDY BUDGET: \$90,000	TOTAL STUDY COST TO DATE: \$70,161
DATE STARTED: 10/01/02	COMPLETION DATE: 12/31/06
STUDY TITLE:	Laboratory Accelerated Stripping Simulator (LASSi) for Hot Mix Asphalt (HMA)
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Shane Buchanan

**Objective:**

The complex mechanism of stripping can be simply defined as a loss of bond between the mineral aggregate and the asphalt binder in the presence of water. The result is a shear strength loss in the pavement, which can lead to rutting and cracking. It is generally recognized that stripping is related to three factors: 1) traffic, 2) water, and 3) high in-place service temperatures.

Currently, MDOT is using two different methods to evaluate moisture resistance. These include MT-63: Resistance of Bituminous Paving Mixtures to Stripping (Vacuum Saturation Method) and MT-59: Determination of Loss of Coating of HMA (Boiling Water Test). The MT-63 test requires in excess of 24 hours to complete and includes a visual examination to determine the amount of visual stripping of the asphalt cement from the aggregate along the failure plane following the indirect diametral tensile test. The MT-59 test relies on visual examination to evaluate the amount of stripping present in uncompacted material.

The proposed study is designed to evaluate a test method that utilizes the Laboratory Accelerated Stripping Simulator (LASSi) that is designed to condition a compacted HMA sample, either laboratory prepared or field core, in a manner that closely simulates the stripping mechanism that occurs in the field when the pavement structure is exposed to water, repeated loading, and elevated in-place service temperatures. This is accomplished by subjecting the test specimen to alternating pressure and vacuum stages thus forcing water to correspondingly move in two opposite directions through the specimen. It is anticipated that conditioning of the sample in this manner can be completed within one hour or less as opposed to the 24-hour conditioning time when using the MT-63 test procedure.

This study includes several phases. In the first phase, mixes comprised of 100 percent gravel, 50/50 gravel and limestone, 100 percent limestone and 100 percent granite will be evaluated using the LASSi device along with conventional MDOT procedures (MT-63 and MT-59). The results will be used to determine if the LASSi device can delineate potentially moisture susceptible mixes. Additionally, this testing will allow for the testing protocol of the device to be refined.

**Progress:**

Two prototype LASSi devices were evaluated. The second generation LASSi prototype built by Instrotek was used in developing a test protocol. Testing of base and SMA mixes with the LASSi device was conducted in addition to testing these mixes using the MT59 and MT63 test procedures.

Project testing was completed for all mixes using the established protocol of 70 psi test pressure, 3000 test cycles, loose specimens and 60 degree C temperature.

Comparison stripping evaluations were made using a new rotary wheel tester (RWT) manufactured by Pine Instrument Company. This RWT appears to be very successful in evaluating moisture susceptible mixes.

Preliminary results from this project were presented at the 2004 Transportation Research Board (TRB) annual meeting in Washington D.C.

**Plans for FY 2005:**

Laboratory work with the prototype stripping simulator has been completed. There are several problems with the prototype device. Among the problems are high variability in the measured conditioning water turbidity and inadequate conditioning pressure. These problems are being reviewed by the device manufacturer to determine if modifications to the unit are feasible. A draft final report will be delivered to MDOT in December of 2004.

**Cost Estimate for FY 2005** \$19,839

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LINE ITEM NO. 11	STATE STUDY NO: 168
TOTAL STUDY BUDGET: \$50,000	TOTAL STUDY COST TO DATE: \$39,322
DATE STARTED: 10/01/02	COMPLETION DATE: 12/31/05
STUDY TITLE:	Field Tack Coat Evaluator (Atacker™)
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Shane Buchanan

**Objective:**

A variety of materials (emulsions, asphalt cements, etc.) can successfully be used for tack coats for hot mix asphalt (HMA) pavements. However, in many cases, bond loss between pavement layers is evident in the form of pushing and shoving even though tack coats were applied. Bond loss can occur for many reasons; some of which are 1) emulsion not breaking prior to overlay, 2) emulsion dilution, 3) too little or too much tack coat applied, 4) material (primarily dust) covering the tack coat prior to overlay, 5) old tack coat materials being used which have lost some adhesive properties.

The “ideal” application rate will likely vary between different tack coat materials. The key is to determine that rate and set specification targets and tolerances accordingly. Laboratory tack coat evaluations can be used to determine acceptable tack coat materials and rates. However, the real and ultimate measure of the tack coat performance should be determined in the field so that environmental, construction, and other factors are considered. Currently, a device referred to as the Atacker™, is being developed to measure the asphalt tack coat shear resistance in the field. The unit can be calibrated against different strength tack coats and will automatically indicate a relative strength. Agencies can specify required strengths based on known and acceptable coating materials.

This study will consist of a laboratory and a field study. The laboratory portion will determine appropriate operational parameters of the Atacker™ and baseline results when evaluating standard tack coat materials and methods meeting current MDOT specifications. The effect of tack coat application rate, pavement surfaces type (concrete and asphalt), and pavement surface conditions will be evaluated as a minimum.

The field study will consist of evaluating a minimum of 12 to 15 construction projects to determine the relationship between the laboratory-measured properties and the field properties. The evaluated projects will be selected to provide similar variables as the laboratory evaluation such as different pavement surfaces type (concrete and asphalt), tack coat application rate, pavement surface conditions (new, oxidized, milled, etc.). Individual relationships will be developed for the various construction variables.

**Objective continued:**

Additionally, the interaction of variables will be evaluated to determine the most significant effect(s) on tack coat bond strength.

The Atacker™ will provide MDOT with a field method to evaluate tack coat materials and application methods. MDOT can specify required strengths based on known performance and acceptable tack coating materials. This device will help ensure materials used are consistent and meet the required specification.

**Progress:**

A second generation prototype testing device was obtained from Instron, Inc. This unit is equipped with a digital readout and has a greater testing capacity than the previous unit.

After discussion with Pine Instrument Company regarding their shear fixture, it was decided to fabricate a fixture locally to save on costs. A local machine shop fabricated the interface shear fixture and it was successfully tested for project utilization.

**Plans for FY 2005:**

Final laboratory investigation of the Atacker™ will be conducted. This work will focus on developing correlations between the amount of visible set time of a tack coat material and tensile strength. Additionally, the interface shear strength of specimens with varying levels of tack application will be determined. A draft final report will be delivered to MDOT in December of 2004.

Original plans called for a field investigation of tack coat strength. However, due to project unavailability, this portion of the study will not be conducted. It is possible that a follow up study could be conducted to correlate Atacker™ results with field interface shear strength.

**Cost Estimate for FY 2005** \$10,678

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LINE ITEM NO. 12

STATE STUDY NO: 170

TOTAL STUDY BUDGET: \$307,163 (SP&R)	TOTAL STUDY COST TO DATE: \$0 SP&R
<u>\$500,000 (Non SP&amp;R)</u>	<u>\$62,149 Non-SP&amp;R</u>
\$807,163 Total	\$62,149 Total

DATE STARTED: 03/01/04

COMPLETION DATE: 03/01/08

STUDY TITLE:

Implement the 2002 Design Guide for MDOT  
(Phase II)

RESEARCH AGENCY:

ERES Consultants Division of ARA, Inc.

PRINCIPAL INVESTIGATOR:

Athar Saeed

**Objective:**

ERES Consultants Division of Applied Research Associates, Inc. is finalizing the development of the 2002 Guide for Design of New and Rehabilitated Structures through NCHRP Project 1-37A. The 2002 Guide 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 2002 Design Guide 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 2002 designs with current procedure
- Develop and execute a plan for calibration of Guide performance and distress models

**Progress:**

- A technical memorandum describing the ME PDG inputs for new and rehabilitated pavement design was submitted to Mississippi DOT.
- A three-day meeting was held with Mississippi DOT personnel from July 12 through July 14, 2004 to discuss and review PDG inputs.

**Progress Continued:**

- Work started on the sensitivity analysis of the ME PDG software.
- Each Mississippi DOT district was contacted to facilitate development of a database of typical subgrade materials used within Mississippi. The project team collected the desired data, developed a database of subgrade materials, and tentatively selected 30 materials for resilient modulus testing. These tests will be conducted using NCHRP 1-28A test protocol.
- A meeting with the District Materials Engineers was conducted on August 19, 2004 to familiarize them with the new ME PDG and coordinate sampling of subgrade soils for laboratory testing.
- The project team coordinated with several other on-going and proposed Mississippi DOT research efforts to ensure compatibility of research results with ME PDG data requirements.
- A review was completed of the procedure to estimate traffic inputs for the new Design Guide that was developed by Mississippi State University (MSU) via SS No. 165.
- Began setting up laboratory and field testing program to obtain pavement and foundation layer properties that will represent the range of mixes, materials, and site conditions around the state.
- Began selection of pavement sections to calibrate models in MEPDG.

**Plans for FY 2005:**

- Complete design guide software sensitivity analysis.
- Complete setting up laboratory and field testing program.
- Establish materials and traffic estimation procedures and default values.
- Finalize the selection of pavement sections to calibrate models in MEPDG.
- Prepare and submit Phase II Interim Report - During FY 05, a draft report will be prepared and submitted documenting the research results for FYs 04 and 05 and will provide a detailed research plan for the next 24 months.

<b><u>Cost Estimate for FY 2005</u></b>	\$52,051 SP&R
	\$187,851 Non SP&R

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LINE ITEM NO. 13	STATE STUDY NO: 171
TOTAL STUDY BUDGET: \$200,000	TOTAL STUDY COST TO DATE: \$29,123
DATE STARTED: 03/01/04	COMPLETION DATE: 03/01/08
STUDY TITLE:	In-House Support to State Study 170
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

**Objective:**

This study will be conducted to support the proposed study "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 2002 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:**

The PI of SS No. 170, the MDOT Technical Advisory Committee members and PIs of support studies were coordinated to facilitate the implementation of the new MEPDG.

The technical memorandum provided by the PI of SS No 170 was reviewed and the NHI Course No. 131064 "Introduction to Mechanistic-Empirical Pavement Design" workbook was reviewed for general background regarding the new MEPDG and material property and traffic inputs for the new design procedure.

A list of roads was supplied to ERES Consultants to be reviewed as candidates for the test sections to be included in the factorial experiment design.

**Plans for FY 2005:**

Continue coordination activities and review of NHI Course No. 131064 "Introduction to Mechanistic-Empirical Pavement Design" workbook. Review Phase II Interim Report.

Begin process of collecting requisite MDOT data for calibration of performance models.

**Cost Estimate for FY 2005** \$50,000

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 14	STATE STUDY NO: 172
TOTAL STUDY BUDGET: \$19,098	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/03	COMPLETION DATE: 12/31/04
STUDY TITLE:	Resilient Modulus Prediction Employing Soil Index Properties
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	K.P. George

**Objective:**

Characterizing subgrade soil in terms of resilient modulus, ( $M_r$ ), provides a necessary input into the 2002 Pavement Design Guide. State Study # 153, Falling Weight Deflectometer for Estimating Subgrade Moduli, recommends the use of the FWD to characterize the in-situ soil  $M_r$  for the purpose of design, however, the requisite testing cannot be performed until the subgrade is in place. The primary objective of this study is to evaluate five existing equations that predict the soil  $M_r$  from soil index properties and the state of stress in the soil. The best equation for a realistic estimate of  $M_r$  will be selected making use of the results from testing eight Mississippi subgrade soils conducted in conjunction with the referenced study. This estimate of  $M_r$  will enable a preliminary pavement design to be completed during the conceptual stages of a given project. Since soil test results utilized to determine soil index properties are likely to show large variation, it is important to estimate how this variability would affect the predicted  $M_r$  values. Another source of variation in predicted  $M_r$  values arises from the use of the materials library to be developed in conjunction with the proposed study to implement the 2002 Design Guide. The materials library will provide an estimate of  $M_r$  based upon the soil's AASHTO soil classification. A given soil is assigned a soil classification based on its soil index properties. The mean and standard deviation of the soil index properties for each of the soil classifications typically encountered with Mississippi subgrade soils will be evaluated for estimating the range in predicted  $M_r$  values when using the materials library. The proposed study will evaluate these two sources of variation in the predicted  $M_r$  value when using the selected best equation.

**Progress:**

Seven models were selected for evaluation in this study. The validity of each of these models was examined by comparing the predicted values with laboratory values of soils from eight projects located throughout Mississippi.

**Plans for FY 2005:**

A sensitivity study will be undertaken to evaluate the significance of explanatory variables that are included in each model. The final report will be written.

**Cost Estimate for FY 2005 \$19,098**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 15	STATE STUDY NO: 173
TOTAL STUDY BUDGET: \$90,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/03	COMPLETION DATE: 09/30/08
STUDY TITLE:	Evaluation of Preventive Maintenance Treatments
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

**Objective:**

Preventive maintenance is the planned treatment of pavements which provides protection, decreases the rate of deterioration and adds 5 to 10 years to the service life of the pavement. Agencies must determine which of the many treatments that are available provides the most benefit for the various stages of a pavements life. In this study an evaluation will be performed of two seal treatments to provide cost/benefit data and assist in the updating of Mississippi DOT's "decision trees" that are utilized to determine which preventive maintenance treatment provides the most benefit for each pavement condition.

**Progress:**

In the fall of 2003 a portion of MS 27 in Copiah county was selected to receive the maintenance treatments in 2004. However upon re-inspection of the proposed project location in the spring of 2004, it was determined that the additional distresses now present in the pavement that would reduce the effectiveness of the project treatments.

**Plans for FY 2005:**

A new project location will be identified with a target construction date sometime in the Spring of 2005.

**Cost Estimate for FY 2005 \$40,000**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 16	STATE STUDY NO: 174
TOTAL STUDY BUDGET: \$37,224	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/03	COMPLETION DATE: 02/28/05
STUDY TITLE:	Potential Application of Paving Fabrics to Reduce Reflective Cracking
RESEARCH AGENCY:	Jackson State University
PRINCIPAL INVESTIGATOR:	Farshad Amini

**Objective:**

Asphalt concrete overlay on the existing pavement is often used as a cost-saving surface treatment for deteriorating pavements. A major problem encountered with asphalt resurfacing is the phenomenon termed reflective cracking, the propagation of existing cracks from old or existing pavements through the new overlay. Studies have shown that nonwoven geotextile interlayer systems (known as paving fabric) in conjunction with asphalt overlays, typically 1.5 to 2 inches, may be used to absorb the stresses normally transferred from cracks in the old pavement into the overlay, and reduce or prevent the reflective cracking. In this project a thorough literature review will be conducted to determine potential applications of the paving fabrics in MDOT pavement rehabilitation strategies. Additionally, a survey of the paving fabric practices in Mississippi will be conducted. Based on the results of the literature review and survey, a testing program will be recommended to demonstrate these potential applications.

**Progress:**

Completed a literature search on relevant topics of pavement fabrics including basic mechanisms, use and applications, life cycles costs and cost effectiveness, fabric specifications, factors influencing performance, recent innovations and lessons learned from installation.

**Plans for FY 2005:**

Summarize the findings based on the previously performed literature review. Conduct a survey of the paving fabric practices in the State of Mississippi. Based on the results of these efforts provide preliminary recommendations for the type of paving fabrics and design approaches appropriate for use at MDOT and provide recommendations for appropriate testing and long-term monitoring to determine the performance of paving fabric systems in rehabilitation schemes. Provide final report.

**Cost Estimate for FY 2005 \$37,224**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 17 STATE STUDY NO: 175  
TOTAL STUDY BUDGET: \$92,222 TOTAL STUDY COST TO DATE: \$0  
DATE STARTED: 10/01/04 COMPLETION DATE: 09/30/06  
STUDY TITLE: Effectiveness of Increased Highway Patrol Surveillance on Work Zone Safety in Mississippi  
RESEARCH AGENCY: The University of Southern Mississippi  
PRINCIPAL INVESTIGATOR: Tulio Sulbaran & David Marchman

**Objective:**

Among the MDOT work zone safety initiatives, MDOT has established an agreement with the Mississippi Highway Patrol (MHP). As part of the agreement, MDOT has provided funds to the MHP to increase surveillance in high profile work zones. The objective of this project is to evaluate the safety impact of this increased surveillance. This will be achieved by the following means:

- Collecting historical and field data from selected Mississippi work zones before, during and after the increased highway patrol surveillance
- Reviewing nationwide literature of increased highway patrol surveillance in work zones
- Analyzing the compiled Mississippi data and the nationwide literature search findings

The data collection in Mississippi work zones will begin by consolidating MDOT and other government entities historical data. The data consolidation will include:

- Characteristics of work zones (i.e. locations, safety programs, conditions before, during and after construction)
- Traffic parameters (such as traffic volume before, after and during construction)
- Accident information (location, time, severity and cause of accident)

Once the historical consolidation has been performed, similar information will be gathered on projects currently under construction.

Ultimately correlations will be established to relate traffic parameters such as volume and speed to accidents in work zones. A second correlation between increased highway patrol surveillance, traffic parameters and accident rate will be established. Using these correlations the impact of increased highway patrol surveillance on accident reduction will be identified.

**Cost Estimate for FY 2005 \$31,166**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 18	STATE STUDY NO: 176
TOTAL STUDY BUDGET: \$50,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Raised Pavement Markers (RPM) Durability Evaluation
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Shane Buchanan

**Objective:**

Raised pavement markers (RPMs) have been used for many years to improve the day and night visibility of traffic facilities. According to the *FHWA Roadway Delineation Practices Handbook*, RPMs offer the following advantages over standard painted markings:

- Increased retroreflectivity in wet weather conditions
- Increased durability
- Increased audible tone produced by the vehicle making contact with the RPMs
- Increased directional control through the use of varying colors

While the RPMs offer many advantages over painted marking materials, the higher initial cost is their main disadvantage.

MDOT has expressed concern that the current RPM usage protocol needs to be evaluated to insure the most cost effective protocol possible. Concern has been expressed that the observed increased loss of RPMs may be a result of the pavement surface type, pavement age and placement location. Additionally, there is a question regarding the time available for RPM application after adhesive application.

The research proposed will involve reviewing MDOT District RPM inventory data. The percent of RPMs lost will be used as the study response variable. An analysis of project variables will be conducted to determine which factors most influence RPM loss over time. Specifically, data will be analyzed with regards to several research factors documented below:

- Pavement Type (HMA or PCC)
- Pavement Age
- Highway Type
- RPM Type
- RPM Adhesive Type
- Application temperature

The study will provide MDOT with critical information regarding the durability of RPMs.

**Cost Estimate for FY 2005 \$35,000**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 19	STATE STUDY NO: 177
TOTAL STUDY BUDGET: \$89,808	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Inputs of Portland Cement Concrete Parameters Needed for the Design of New and Rehabilitated Pavements in Mississippi
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	Ahmed Al-Ostaz

**Objective:**

MDOT is implementing the mechanistic-empirical pavement design methodology developed under NCHRP 1-37A. This pavement design method characterizes the pavement materials by fundamental properties such as modulus and Poisson's Ratio. For rigid pavement design the Portland Cement Concrete (PCC) is characterized by:

- Modulus of Rupture
- Compressive Strength
- Modulus of Elasticity
- Tensile Strength
- Coefficient of Thermal Expansion
- Concrete Shrinkage
- Unit Weight
- Poisson's Ratio

In this study PCC mixes encompassing a range of aggregate types with various blends of Type I cement, Class F or C fly ash and slag that are typically encountered in Mississippi will be evaluated for these parameters.

**Cost Estimate for FY 2005 \$73,890**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 20	STATE STUDY NO: 178
TOTAL STUDY BUDGET: \$195,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/07
STUDY TITLE:	Cogongrass Inventory and Management
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	John Byrd

**Objective:**

MDOT is faced with the control and management of a very aggressive grass known as Cogongrass (*Imperata cylindrica*). Cogongrass is an invasive weed which continues to spread along MDOT right of ways, as well as to adjacent properties. Because it is so hardy, it colonizes on a site and quickly becomes the dominant vegetation. No other plant species can compete with the extensive root system. It is a threat to both the local plant community and the native wildlife because it displaces all native plant materials, resulting in a near sterile monoculture. Neither wild nor domestic animals can digest the leaf tissue because of the high silica content.

The proposed research will be a three-phase approach. A comprehensive inventory will be completed which identifies colony locations on a regional and then state wide basis. This inventory will also identify adjacent land uses and the level of threat the Cogongrass poses to particular areas. From this information, a priority system will be developed which identifies the areas most in need of treatment. This treatment may be one of two types, management or eradication. Due to the extensive spread of this plant in south Mississippi, it will have to be managed in some areas while eradication efforts are conducted in the high need areas.

**Cost Estimate for FY 2005 \$25,000**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 21	STATE STUDY NO: 179
TOTAL STUDY BUDGET: \$157,462	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/06
STUDY TITLE:	Portable FWD for In-Situ Subgrade Evaluation
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	K.P. George

**Objective:**

MDOT is implementing the mechanistic-empirical pavement design methodology developed under NCHRP 1-37A. In this design procedure the subgrade materials are characterized by resilient modulus ( $M_R$ ) and Poisson's Ratio. The Department has already initiated a study to determine  $M_R$  values of typical Mississippi soils using the laboratory harmonized test procedure. This laboratory effort will result in the development of a materials library that will enable the estimation of a given subgrade  $M_R$  based soil classification.

In-situ testing of the completed subgrade provides a better method for estimating the subgrade  $M_R$  than laboratory testing. Bag samples of soil obtained from borrow pits may not adequately represent the soil that will be encountered in-place on the project site. The reconstitution of the bag sample material into a laboratory test specimen will not duplicate the soil structure, density and moisture content to that existing in the field. Given these considerations, performing tests on top of the in-place subgrade will provide an estimate of subgrade  $M_R$  that will better model this parameter for input into the new MEPDG thus resulting in a more reliable pavement design.

The PRIMA 100 is a portable falling weight deflectometer (PFWD) that can be used to perform in-situ testing of subgrade soils. It is carried and operated by one person at a fraction of the cost of a conventional trailer conveyed and hydraulically operated FWD. This study will evaluate the use of the PRIMA 100 to rapidly determine a design  $M_R$  value for a given subgrade as well as ascertain the variability of this soil property for use in a reliability-based pavement design.

**Cost Estimate for FY 2005 \$66,402**

MISSISSIPPI SPR-1(45)  
PART II

LINE ITEM NO. 22	STATE STUDY NO: N/A
TOTAL STUDY BUDGET: \$25,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/04	COMPLETION DATE: 09/30/05
STUDY TITLE:	Minor Research Studies
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	Randy L. Battey

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.

These research projects are short-term, and will employ only MDOT personnel in the research project. Brief, concise work plans will be developed for each of these projects.

**Cost Estimate for FY 2005**    \$25,000

MISSISSIPPI SPR-1(45)  
PART II

**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 for entirely utilizing SPR Part II funds even though the formula for determining the annual contribution is based on both Part I & II funding. Estimated contribution for FY 2005 is **\$374,753**.

MISSISSIPPI SPR-1(45)  
PART II

**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 2005 TRB Correlation Service is funded for \$93,455, which corresponds to the current annual subscription cost for Mississippi.

**Cost Estimate for FY 2005** \$93,455

## POOLED FUND STUDIES

Pooled Fund Study:    ***Auburn University Accelerated Pavement Test Facility - Round 2***

Host Agency - Alabama Department of Transportation

The objective of this pooled-fund study is to continue to operate, and analyze the data from Mississippi's existing two sections on the NCAT test track and to construct an additional section utilizing a 4.75mm SuperPave mix design. Ten states (Alabama, Florida, Georgia, Indiana, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, and Tennessee) are currently participating in this study that will evaluate hot mix asphalt pavement under an additional traffic loading of 10 million equivalent single axle load (ESALs) over a three year period. This will result in a total traffic loading on MDOT's existing two sections of 20 million ESALs. Each participating state was responsible for the pavement design for any new test sections. The National Center for Asphalt Technology (NCAT) will be responsible for monitoring the experiment to include periodic data collection and data analysis. The MDOT has committed to the second round of test section construction, trafficking and analysis. This commitment will be for fiscal years 2003 through 2005 in the following amounts:

FY 2003 - \$170,000      FY 2004 - \$170,000      FY 2005 - \$170,000

Pooled Fund Study:    ***Structural Improvement of Flexible Pavement Using GeoSynthetics for Base Course Reinforcement***

Host Agency - Maine Department of Transportation

High-modulus geogrids and geotextiles are being marketed as base course reinforcement to increase the structural capacity of flexible pavement sections constructed on weak subgrades. The AASHTO Task Force on Geogrid/Geotextile Specification is attempting to develop design standards for aggregate base course reinforcement; however, this effort is being hindered by the lack of field performance measurements for pavement sections designed for traffic loadings typical of state DOTs. This study will provide this missing data by constructing full-scale sections of pavement and underlying subgrade and then loading these pavements to failure using a Heavy Vehicle Simulator (HVS). Reinforced and unreinforced sections will be compared considering the effects of subgrade strength, aggregate base course thickness, pavement thickness, and frost action. A total of 32 sections will be tested with 8 sections tested per year. The study is estimated to cost \$2,120,000. MDOT will contribute a total of \$100,000 during the fiscal years 2002 through 2006.

FY 2002 - \$25,000                      FY 2004 - \$25,000  
FY 2005 - \$25,000                      FY 2006 - \$25,000

Pooled Fund Study: ***Improve a FHWA Device to Test for Potential Soil Liquefaction Caused by Earthquakes***

Host Agency – FHWA

The New Madrid Fault, located 120 miles north of Memphis, Tennessee, is a seismic threat to north Mississippi. Soft to medium stiff clays are vulnerable to amplified ground motions and loose to medium-dense saturated sands are moderately to highly susceptible to liquefaction and large deformations. The objective to this study is to develop several necessary enhancements to an existing FHWA impulse shear test device. This device provides site-specific information from results of tests performed in-situ on soil deformation characteristics and liquefaction potential needed for seismic analysis procedures. The study is estimated to cost approximately \$400,000 over a three-year period. MDOT will contribute a total of \$30,000 during the fiscal years 2002 through 2005. Due to a need for additional project participants, MDOT has delayed its FY 2004 funding obligation until FY 2005.

FY 2002 - \$10,000

FY 2003 - \$10,000

FY 2005 - \$10,000

Pooled Fund Study: ***Full-Scale Accelerated Performance Testing for SuperPave and Structural Validation***

Host Agency – FHWA

Although the SuperPave system is a vast improvement over previous practices, research conducted by the FHWA has identified shortcomings in the SuperPave binder specification's ability to characterize the performance of modified asphalt binders. The current inability to effectively characterize modified asphalt binders is a growing concern to highway agencies. In 1996, subsequent to the FHWA's findings on the inadequacy of the SuperPave specification, the National Cooperative Highway Research Program (NCHRP) initiated Project 9-10, "SuperPave Protocols for Modified Asphalt Binders." In August 2001, this million-dollar study, conducted by the Asphalt Institute, generated several recommended enhancements to the SuperPave binder specification. Prior to adoption by AASHTO, these recommendations are being validated and reviewed by the Transportation Research Board (TRB) SuperPave Binder Expert Task Group (ETG).

The FHWA, with funding from NCHRP, has completed an extensive laboratory evaluation of the proposed protocols. The second phase of the experiment is employing full-scale accelerated performance testing. The TRB SuperPave Committee recommended that the FHWA seek financing for this portion of the experiment through a pooled fund.

The pooled fund project was established to study, build and test up to 12 lanes of asphalt pavement. The construction of 12 lanes is expected to be completed in September of 2002 with loading of these lanes starting in mid-October. The loading will be accomplished with Accelerated Load Facility (ALF) machines. The ALF loading, laboratory work, and data analysis cost is approximately \$600,000 per year, so the total funding required for this project is between \$1.5 and \$2.0 million dollars over a minimum loading period of 2.5 years. MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2005.

FY 2003 - \$20,000

FY 2004 - \$20,000

FY 2005 - \$20,000

Pooled Fund Study: ***Falling Weight Deflectometer (FWD) Calibration Centers and Operational Improvements***

Host Agency – FHWA

The objectives of this study are to minimize the variability in pavement deflection data obtained with FWD and to develop and implement long-term plans for FWD calibrations. This study will be conducted in two phases. The first phase would include numerous tasks that would provide an assessment of State highway agency and other FWD owner needs, including a long-term strategy, improved QC/QA techniques for FWD operation, and appropriate training. The second phase would be to implement recommendations from the first phase. Phase I estimated cost is \$175,000 and Phase II estimated cost is \$850,000. MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2005.

FY 2003 - \$20,000    FY 2004 - \$20,000    FY 2005 - \$20,000

Pooled Fund Study: ***Improving the Quality of Pavement Profiler Measurement***

Host Agency – FHWA

This pooled fund effort will provide agencies with information and first hand experience to address issues and concerns related to profiler operation, equipment, and procedures. There is an increasing need for State Highway Agencies to purchase and upgrade profiling equipment to provide network level and project specific smoothness information. This includes profilers operated at close to posted speed limits that are most often used to determine ride quality on a network level and smaller units, such as lightweight profilers (LWP). The project objectives include:

Deliver sample procurement specification, maintenance guidelines and profile analysis software program

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

The estimated total cost of this study is \$1,632,900. MDOT will contribute a total of \$120,000 during the fiscal years 2003 through 2006.

FY 2003 - \$30,000    FY 2004 - \$30,000    FY 2005 - \$30,000    FY 2006 - \$30,000

Pooled Fund Study:    ***Construction of Crack-Free Concrete Bridge Decks***

Host Agency – Kansas Department of Transportation

The purpose of this study is to implement the most cost-effective techniques for improving bridge deck life through the reduction of cracking. The work will involve cooperation between cement companies, contractors and designers. The following tasks will be used to achieve this objective:

1. Develop a detailed plan to construct bridge decks with minimum cracking by incorporating “best practices” dealing with materials, construction procedures, and structural design.
2. Work with State DOT’s, designers, contractors, inspectors, and material suppliers to modify designs, specifications, contracting procedures, and structural design.
3. Select bridges to be constructed using “best practices,” and pre-qualify designers and contractors in application of the techniques. Twenty bridges, 10 in northeast Kansas and 10 in other participating states, will be constructed using the new techniques. Researchers from the University of Kansas and state DOT personnel will work closely with designers and contractors to achieve the desired results.
4. Carry out detailed crack surveys on the bridge decks, three months, six months, one year, two years, and three years after construction.
5. Correlate the cracking measured in Task 4 with the environmental and site conditions, construction techniques, design specifications and material properties and compare with earlier data. Similar data from participating states, where it exists, will be incorporated in the analysis.
6. Document the results of the study and prepare and disseminate a final report to participating states regarding the findings of Tasks 1-5.
7. Develop a training program, including a video produced by KDOT Support Services, to assist the participating states in implementing the findings of the study. The program will consist of workshops to be held at the representative state DOT offices. These workshops will be individually coordinated with each participating DOT.

MDOT will contribute a total of \$60,000 during the fiscal years 2003 through 2006.

FY 2003 - \$15,000    FY 2004 - \$15,000    FY 2005 - \$15,000    FY 2006 - \$15,000

Pooled Fund Study: ***Development of Geotechnical Procedures/Operations Manual***

Host Agency – FHWA

Currently, there are a number of State DOT's that have either outdated, incomplete or no procedures manuals for design, construction and inspection of geotechnical features (structural foundations, earth retaining structures and earthworks) for structures and roadways. This activity will develop a manual that provides detailed technical guidance on Geotechnical procedures and selection, management, quality, and cost control of products/services from Geotechnical consultants and drillers. The project will also include development of a web enabled template with an implementation plan and a user interface application that will allow State Departments of Transportation to adopt the manual in a form that is most suitable to their needs. The estimated total cost of this three-year study is \$275,000.

MDOT will contribute a total of \$15,000 during the fiscal years 2004 through 2006.

FY 2004 - \$5,000    FY 2005 - \$5,000    FY 2006 - \$5,000

Pooled Fund Study: ***Traffic Control Device (TCD) Consortium***

Host Agency – FHWA

The goal of this project is to assemble a consortium composed of regional, State, local entities, appropriate organizations and the FHWA to do the following:

1. Establish a systematic procedure to select, test, and evaluate approaches to novel TCD concepts, as well as incorporation of results into the Manual of Uniform Traffic Control Devices (MUTCD)
2. Select novel TCD approaches to test and evaluate
3. Determine methods of evaluation for novel TCD approaches
4. Initiate and monitor projects intended to address evaluation of the novel TCD's
5. Disseminate results
6. Assist MUTCD incorporation and implementation of results

MDOT will contribute a total of \$60,000 during the fiscal years 2003 & 2005.

FY 2003 - \$30,000    FY 2005 - \$30,000

Pooled Fund Study: ***Maintenance Quality Assurance Peer Exchange***

Host Agency – Wisconsin DOT

The Maintenance Quality Assurance Peer Exchange will serve as a national workshop on quality assurance of state DOT maintenance programs. The objectives of the workshop are to collect and disseminate current and best practices utilized by state DOT maintenance programs.

MDOT will contribute \$5,000 during fiscal year 2005 to support this effort.

FY 2005 - \$5,000

Pooled Fund Study: ***Southern States Pavement Preservation Programs***

Host Agency – Alabama DOT

The National Center for Pavement Preservation (NCP) would be retained collectively by the states of Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina and Tennessee to provide expert assistance in the areas of establishing preventive maintenance programs, specifications for methods and materials, treatment identification and selection guidelines and training for key staff.

MDOT will contribute \$15,000 during fiscal year 2005 to support this effort.

FY 2005 - \$15,000

Pooled Fund Study: ***Evaluation of the Safety Edge***

Host Agency – FHWA

The goal of the proposed pooled fund study is to evaluate the effectiveness of using the Safety Edge (edge wedge) to help prevent and reduce severity of pavement edge drop-off related crashes. A before and after evaluation (Empirical Bayes method) will be performed on sites with upcoming installations of the safety edge in the U.S. FHWA is spending a total of \$150,000 to support this project.

MDOT will contribute a total of \$45,000 during the fiscal years 2005 through 2007 to support this effort.

FY 2005 - \$15,000    FY 2006 - \$15,000    FY 2007 - \$15,000



**Plans for FY 2005:**

Continue monitoring and documenting the condition of the pavement sections.

**Cost Estimate for FY 2005:** \$10,000

100% State Funded Research for FY 05

LINE ITEM NO. N/A	STATE STUDY NO. 146
TOTAL STUDY BUDGET: \$170,000	TOTAL COST TO DATE: \$80,000 SP&R \$30,000 Non-SP&R \$110,000 Total
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/06
STUDY TITLE:	Updating Mississippi Flood Frequency Reports
RESEARCH AGENCY:	United States Geological Survey
PRINCIPAL INVESTIGATOR:	K. Van Wilson

**Objective:**

Knowledge of magnitude and frequency of floods is essential to the design of bridges, highway embankments, culverts, levees, dams, and other structures near streams. Effective flood-plain management and determination of flood insurance rates require accurate information on magnitude and frequency of floods.

The statewide flood-frequency reports by Landers and Wilson (1991) and Wilson and Landers (1991) provided estimates of magnitude and frequency of floods at gaging stations and provided techniques for estimating magnitudes and frequency of floods at ungaged sites in Mississippi. Observed annual peak-flow data collected through 1988 at 358 gaging stations were used in the analyses. Since the 1991 statewide flood-frequency reports, an additional 11 years of observed annual peak-flow data has become available and data have been collected on several large floods. Also, the 1991 regional flood-frequency equations were developed using generalized least-squares (GLS) regression (Stedinger and Tasker, 1985; and Tasker and Stedinger, 1989). GLS regression had and still has advantages over the ordinary least-squares and weighted least-squares regression, but since the 1991 reports, Tasker and Slade (1994) demonstrated that GLS regression coupled with a site-specific approach [referred to as "interactive" by Tasker and Slade (1994) and as "region-of-influence" by Hodge and Tasker (1995)] had smaller root-mean-square errors than the traditional geographic regional approach. Analyses of flood frequency using these additional data with a site-specific approach may substantially change and improve the accuracy of techniques for estimating magnitudes and frequencies of floods in Mississippi.

**Estimated Costs:**

The project will be done in cooperation with the MDOT, Research Division. The 6-year project will begin October 1, 2000, and will end September 30, 2006. The total estimated cost of the project is \$340,000 distributed over six Federal Fiscal years (October 1 to September 30) as follows:

	<u>2001</u>	<u>2002</u>	<u>2003</u>	<u>2004</u>	<u>2005</u>	<u>2006</u>	<u>Total</u>
MDOT	\$20,000	\$30,000	\$30,000	\$30,000	\$30,000	\$30,000	\$170,000
USGS	<u>\$20,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$30,000</u>	<u>\$170,000</u>
Total	\$40,000	\$60,000	\$60,000	\$60,000	\$60,000	\$60,000	\$340,000

**Note that MDOT utilized SP&R Part II monies to fund our FY 2001 – FY 2003 commitment to this project. FYs 2004 & 2005 were funded with 100% state funds.**

**Products:**

Reports will be published that contain maximum known flood data, annual peak-flow data, flood-frequency estimated at gaging stations, and equations and (or) computer programs for estimating the magnitude and frequency of annual floods in Mississippi.

The reports will be provided in paper form (with a diskette or CD) and will also be made available in digital form on the Internet.

**Cost Estimate for FY 2005**      \$30,000 (Non-SP&R funds)

**Mississippi**  
**Department of Transportation**

**RESEARCH WORK PROGRAM**  
**SPR-1(45), Part II**  
**H56**

**For the Fiscal Period**  
**October 1, 2004 to September 30, 2005**



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

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

**Mississippi  
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