

MISSISSIPPI SPR-1(42), PART II

GENERAL COMMENTS ON RESEARCH WORK PROGRAM
FOR FISCAL YEAR 2004

The SPR (Part II) research work program allocation for FY 2004 totals \$1,492,289 (estimated) and includes a National Cooperative Highway Research Program (NCHRP) contribution of \$328,304 for FY 2004, a TRB Correlation Service contribution of \$93,455 and pooled-fund studies totaling \$325,000 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 2004. 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 2004. 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 2004 research work program.

The pooled fund studies, TRB Correlation Service and NCHRP are funded with 100% SPR Part II funds (no state match). The thirty-one 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.

MISSISSIPPI SPR-1(42)
PART II

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 2003 included:

- marking and signing of LTPP sites
- support for field data collection

Activities planned for FY 2004 include:

- maintaining signage for existing LTPP sites
- support for all LTPP activities

Cost Estimate for FY 2004

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

MISSISSIPPI SPR-1(42)
PART II

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 2004

Salaries (Regular Employees)	\$200,000
Employee Benefits	\$56,000
Materials, Supplies, and Services	\$19,000
Travel and Sustenance	<u>\$20,000</u>
 Total	 \$295,000

MISSISSIPPI SPR-1(42)
PART II

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. These are not new activities but have been on going for many years. This line item is included to facilitate better documentation of technology transfer activities.

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. One noteworthy example of work in this area is technology exchange relating to implementing of Superpave. Other examples of technology transfer are:

- making presentations of research results to various groups such as universities and technical societies
- participation in seminars and training courses
- distribution of research results
- inputting research and research-in-progress results into the Transportation Research Information Service (TRIS)

The SPR WORK PROGRAM-PART I, Technology Transfer, 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 2004

Salaries (Regular Employees)	\$27,000
Employee Benefits	\$7,560
Materials, Supplies, and Services	\$1,440
Travel and Sustenance	<u>\$9,000</u>
Total	\$45,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM 4

Pavement Management

This item covers the activities of the Research Division relating to the development, implementation, 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 2004

Salaries (Regular Employees)	\$130,000
Employee Benefits	\$36,400
Materials, Supplies, and Services	\$13,600
Travel and Sustenance	<u>\$20,000</u>
Total	\$200,000

MISSISSIPPI SPR-1(42)
PART II

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 II was submitted to MDOT. This report indicated that all of the stabilized materials gained strength during the 440-day period from time of construction to the time of first-year monitoring, with the LFA stabilized material achieving only marginal strength gain. The modulus of each material increased during this time period. No reflection cracks were observed in the crack survey.

Third-year FWD testing and crack survey are completed.

Plans for FY 2004:

The FWD deflection data from the third-year test cycle will be analyzed and the resulting backcalculated moduli values of the experimental base layers compared to the results from testing in November 2001. Periodic examination of the test sections for possible cracks on the surface will be conducted during the winter months.

Cost Estimate for FY 2004 \$8,000

The PCA and the University of Mississippi are providing funds to supplement this effort.

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 6	STATE STUDY NO: 138
TOTAL STUDY BUDGET: \$75,000	TOTAL STUDY COST TO DATE: \$10,021
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.

FWD tests were performed as part of the third-year monitoring of the test sections.

Plans for FY 2004:

Provide support as required to the principal investigator of SS # 133.

Cost Estimate for FY 2004 \$500

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 7	STATE STUDY NO. 141
TOTAL STUDY BUDGET: \$44,000	TOTAL STUDY COST TO DATE: \$19,837
DATE STARTED: 05/01/00	COMPLETION DATE: 12/31/03
STUDY TITLE:	Performance of Polymer Modified Hot Mix Asphalt Pavements – An Extended Evaluation
RESEARCH AGENCY:	Ergon Technical Development and Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Mike Hemsley and Randy L. Battey

Objective:

The objective of this research project is to continue observation and evaluation of the Polymer Modified Pavement Field Trial sections, located on I-55 northbound near Grenada, MS, for an additional 3 years in order to study any additional or new pavement distresses. This study will evaluate the modifiers in each of the sections, which include five different polymer sections, two crumb rubber sections, a gelled asphalt section and a section with no modifier to serve as the control section. Information gained from this research in using polymers and modifiers to overcome premature rutting and other distresses will continue to set Mississippi as one of the leaders in this field of study. It should be noted that Ergon Technical Development will provide all laboratory testing at no cost to the Mississippi Department of Transportation.

Progress:

Field operations began in May 2000 and comprised of cutting 152 – 6” cores, performing 90 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test sections. All 152 cores were delivered to Ergon Technical Development for testing. Ergon reported all results from round one testing to the MDOT.

A second round of field operations was performed in June 2001 and comprised of cutting 46 – 6” cores, performing 90 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test section. All 46 cores obtained during the second round of field operations were delivered to Ergon Technical Development for testing.

Rut data and surface friction data were collected on the sections in November 2001.

The third round of field operations was performed in August 2002 and was comprised of cutting 36 – 6” cores, performing 30 sand patch tests, gathering rut data, performing friction testing and mapping the distresses in the test sections. Preliminary work on the final report has begun.

Progress continued:

A final round of data collection was completed in April of 2003 that involved the collection of distress data.

Plans for FY 2004:

The final report will be completed and distributed to interested agencies.

Cost Estimate for FY 2004 \$2,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 8	STATE STUDY NO. 144
TOTAL STUDY BUDGET: \$120,000	TOTAL STUDY COST TO DATE: \$93,574
DATE STARTED: 10/01/00	COMPLETION DATE: 09/30/04
STUDY TITLE:	Profilograph Specification Study
RESEARCH AGENCY:	Mississippi Department of Transportation
PRINCIPAL INVESTIGATOR:	Dylan T. Gordy

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 2004:

Continue data collection efforts to assist the Department with its future transition from Profile Index to International Roughness Index (IRI) for construction acceptance.
Develop an automated method to identify areas of localized roughness based on IRI.

Cost Estimate for FY 2004 \$26,426

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 9	STATE STUDY NO. 145
TOTAL STUDY BUDGET: \$86,000	TOTAL STUDY COST TO DATE: \$80,521
DATE STARTED: 10/01/00	COMPLETION DATE: 12/31/03
STUDY TITLE:	The Effect of End-Point Compaction on Superpave Mix Designs
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Tom White

Objective:

With fixed contact pressure and gyration angle, Superpave compaction effort is controlled by number of gyrations. Traffic level determines the desired initial (N_{ini}), design (N_{des}) and maximum (N_{max}) number of gyrations. Design asphalt content is selected at N_{des} . The initial Superpave protocol specified that specimens are compacted to N_{max} and the bulk density at N_{des} is interpolated based on specimen change in height. This approach is reasonable for some mixtures, however the change in height may not be linear for other mixtures, which could lead to an error in volumetric determinations. There is thought of changing the protocol to call for specimens to be compacted to N_{des} for selecting design asphalt content. After the design asphalt content is selected then the mixtures are compacted to N_{max} , to confirm air voids will be adequate through the mixture service life. There is industry concern about the effect of this change on design asphalt contents.

Progress:

Contact has been made with aggregate suppliers. Typical gradations and aggregate data have been obtained. Some of the information is being verified and information on typical mix designs has been received. Our library of standard test methods is being completed. Through discussion with the MDOT Materials Division a decision has been made to include five to ten percent RAP in each mix design. Ergon Refining has supplied asphalt for the project. Two asphalts are being utilized; PG 67-22 and polymer modified PG 76-22.

A test matrix has been developed to incorporate factors identified in the research proposal. The matrix also addresses comments from discussions with MDOT Research and Materials Divisions. The matrix is shown on the following page.

			<i>Gradations (Referenced to Restricted Zone)</i>											
			19 mm						12.5 mm					
			Above/Through			Below			Above/Through			Below		
			SS	LS	GR	SS	LS	GR	SS	LS	GR	SS	LS	GR
<i>Asphalt Binders</i>	PG 76-22	$N_{des\ 2}$												
		$N_{des\ 1}$												
	PG 67-22	$N_{des\ 2}$												
		$N_{des\ 1}$												

- SS: Sandstone
- LS: Limestone
- GR: Chert Gravel
- Neat
- PG 67-22: Asphalt Polymer Modified
- PG 76-22: Asphalt
- N_{des} : Number of revolutions for design characteristics

Aggregate testing including stockpile gradation, specific gravity, absorption, uncompacted void content, flat and elongated particle percentages and sand equivalences were performed on chert gravel, sand, and limestone aggregates. Aggregate blends were proposed for chert gravel 12.5 and 19 mm maximum size mixture gradations. APAC's Columbus laboratory conducted binder extraction of the RAP. Mixtures have been designed using aggregate types used in Mississippi.

A CoreLok device has been obtained and has been incorporated in evaluations of compacted specimens. This device was included to obtain additional information on which to evaluate results of compaction. It also helped to answer questions concerning bulk specific gravity determinations.

The draft final report has been started.

Forty eight mix designs and optimum compactions have been completed along with comparison of specimen Gmb based on volumetric (height and diameter), CoreLok device and AASHTO T166. All of the data was reviewed for completeness in preparation for beginning the draft report.

Plans for FY 2004:

Publish and distribute the final report.

Cost Estimate for FY 2004 \$5,479

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 10	STATE STUDY NO: 147
TOTAL STUDY BUDGET: \$192,503	TOTAL STUDY COST TO DATE: \$176,692
DATE STARTED: 10/01/00	COMPLETION DATE: 12/31/03
STUDY TITLE:	Long Term Effect of Lime Fly Ash Treated Soils
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

For approximately 20 years, the Mississippi Department of Transportation has been utilizing lime fly ash in base course construction. Recently questions as to the long-term effect lime fly ash has on soil strength and stability have been raised. This study intends on answering those questions by performing the following two tasks:

- A thorough literature search will be performed to determine what other agencies have discovered based on their experiences with lime fly ash treated bases that are over 10 years in age.
- Mississippi constructed several of their early lime fly ash treated bases as part of "Demonstration" or Research projects. These projects were well documented and the strength of the bases at the time of construction is known. As part of this project these early sites will be revisited and core samples will be taken. A comparison of the present day core properties will be made to the earlier data.

Upon completion of these two tasks, a comprehensive report will be generated detailing the findings of the study. It is estimated that it will take approximately one year to complete this research.

Progress:

This study was substantially expanded in scope subsequent to its initiation due to information obtained during the literature search. This information identified issues relevant to the performance of lime-fly ash (LFA) stabilized soil base and subbase course construction. These issues include: The determination of in-situ structural layer coefficients of LFA stabilized soil base/subbase material and comparison of these values to the design value, the effect of late-season construction of this stabilized material on its subsequent performance, and the development of autogeneous healing in this material. In addition, factors were identified to improve the performance of this material.

Progress Continued:

Nine existing pavements were tested with the falling weight deflectometer (FWD) and pavement coring was performed at each of those locations tested with the FWD. A computational procedure based on the 1993 AASHTO Guide for Design of Pavement Structures was utilized to determine the in-situ structural layer coefficient of the LFA stabilized soil base/subbase course materials. Intact LFA cores were tested for unconfined compressive strength. Three of the nine projects had both late season and subsequent construction season LFA stabilized material placed during the course of construction.

An extensive laboratory testing program was developed and implemented to further address the late-season construction issue and the relationship between compacted density and strength of LFA stabilized material.

All field and laboratory testing associated with this study has been completed.

Analyses of asphalt and LFA structural layer coefficients have been completed. Developed conclusions and recommendations based on these analyses and developed a power point presentation for the purpose of briefing MDOT personnel. It was determined that the average in-situ LFA stabilized soil base course structural layer coefficient was very close to the design value; however, the variation of the data will require a significant reduction in the design value for 85% reliability. Recommendations call for a significant increase in the required compacted density of LFA stabilized soil for base course construction, and field construction changes to reduce the variability in the spread of the water, lime and fly ash. An increase in the required level of pulverization of the blend was also recommended.

These conclusions and recommendations generated considerable discussion both within MDOT and with the contractors. A significant amount of time was expended addressing issues raised by both parties.

It was determined that the increase in the required level of compaction for the base layer requires a concurrent increase in the required level of compaction for the basement soil, design soil, and the chemically stabilized subgrade layer that collectively constitute the foundation for a given pavement structure. Recommendations were made to increase the required level of compaction for each of these pavement foundation components.

The effect of construction loading on partially cured LFA base layers was evaluated for different combinations of pavement layer configuration and moduli. The effect of long-term traffic loading was evaluated on completed pavement containing an LFA base layer. The Bisar computer program was used to facilitate these evaluations. The results of these evaluations were incorporated into a power point presentation and presented in a briefing to MDOT personnel. These evaluations substantiated MDOT's requirement for a chemically stabilized subgrade to support the overlying pavement.

A required adjustment was made to the backcalculated HMA moduli values to account for the difference in loading frequency between FWD field testing and laboratory resilient modulus testing during the first quarter of FY 2003. This adjustment in turn required a reevaluation of HMA structural layer coefficients based on the revised asphalt moduli values. The revised in-situ HMA structural layer coefficients for the 5 newer pavements were in very good agreement with the design value of 0.44 for this pavement material.

Progress Continued:

The in-situ LFA structural layer coefficients for the 5 newer pavements were then revised based on the revised HMA layer coefficients. The same conclusions and recommendations are maintained for design/construction of LFA stabilized base course layers as previously advanced, with the refinement in the analyses resulting in these conclusions and recommendations applying to a design reliability of 90 percent instead of 85 percent.

The backcalculated HMA modulus values were not utilized to evaluate the in-situ HMA structural layer coefficients of the 4 older pavements because this approach resulted in an over prediction of the in-situ HMA structural layer coefficient values. A relationship was developed between LFA backcalculated modulus and in-situ LFA structural layer coefficient from the data obtained from the 5 newer pavements. This relationship was then applied to the 4 older pavements to obtain in-situ LFA layer coefficients from the LFA backcalculated modulus values.

A revised representative summertime HMA pavement layer modulus value was derived using typical HMA pavement layer temperatures predicted from the LTPP High-Temperature Model. This modulus value was used in conjunction with the calculations involving the determination of LFA flexural strength/flexural stress ratios. The WESLEA computer program was used to calculate the LFA flexural stresses used in these ratios. These ratios were then used in a transfer function to predict the number of loads to affect fatigue failure of LFA base course layers for selected pavement geometries.

Ten of the 12 chapters to be included in the final report have been written along with the compilation of supporting tables and figures.

Plans for FY 2004:

Publish a final report of the research conducted in this study.

Cost Estimate for FY 2004 \$15,811

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 11	STATE STUDY NO: 149
TOTAL STUDY BUDGET: \$52,600	TOTAL STUDY COST TO DATE: \$31,560
DATE STARTED: 10/01/01	COMPLETION DATE: 01/01/04
STUDY TITLE:	Development of a Transportation Kit for Elementary Students
RESEARCH AGENCY:	RIDES Inc. & Mississippi Department of Transportation - Human Resources Division
PRINCIPAL INVESTIGATOR:	William Sumrall

Objective:

The current available pool of qualified applicants for jobs in transportation is inadequate in meeting industry demands. It is estimated that this inadequacy will grow over the next 20-50 years. It is important to create an awareness of the field at the earliest age possible in order to adequately equip students with the academic skills necessary to enter the field. This study will involve the design of a program to increase elementary (K-6) students' awareness of career opportunities in the field of transportation and civil engineering. The program will address learning objectives across the curriculum including math, science, social studies, reading, music, art and history. Included in this study will be the development of a teachers' guide, a "transportation kit" and an age-appropriate video.

Progress:

The necessary contract documents were prepared and commission approval received to utilize the University of Mississippi as a consultant for this project.

Two writing teams met as a group bi-monthly and began the process of planning for and creating curriculum units focused upon increasing elementary (k-6) students' awareness of career opportunities in the field of transportation and civil engineering. Matching state and national standards for specific grade levels in math and science, consistent lesson plan formats, units topics, and interdisciplinary connection requirements were determined during these bi-monthly meetings. Progress was made toward developing the four-unit proposed set of curriculum units which include Transportation and Energy, Humans and Nature, Roadway Math and Future/Designing Ways.

The interdisciplinary team developed lesson activities for lessons paralleling lessons within the Transportation and Energy Unit. The Math/Science Team completed the math/science lessons within the Humans and Nature Unit and completed lessons for the Roadway Geometry and Designing Ways units.

Progress Continued:

TRAC writing team met and discussed reformatted lessons plans. Particular emphasis was placed on making the lessons consistent and more “user friendly” for teachers.

The science writers developed lessons within the Roadway Geometry and the Humans and Nature units. The interdisciplinary team developed activities that paralleled the Roadway Geometry and Humans and Nature Units in Art, Music, Language Arts, and Social Studies.

TRAC writing team met with Esther Slay who is an MDOT employee. She expressed satisfaction with what has been developed so far. She requested that the units address water pollution and run-off issues at some point in the curriculum. Questions regarding trunk development were discussed.

Completed all units in the Interdisciplinary connections and matched state and national standards in math/science. Data sheets were completed for each unit. Budgets were developed for Transportation Kits on the material lists in the two units and the upper and lower grade level modifications were completed for these two units.

Plans for FY 2004:

The Roadways Into Developing Elementary Students (RIDES) curriculum developed by the Curriculum Development Company will be completed and ready for implementation during October, 2003. Curriculum units titled Transportation and Energy, Roadway Geometry, Designing Ways, and Humans and Nature will be completed during October. Purchase of materials for the development of traveling "trunks", the development of a promotional video, and field testing in schools within the north Mississippi area are planned for the upcoming fiscal year.

Cost Estimate for FY 2004 \$21,040

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 12	STATE STUDY NO: 151
TOTAL STUDY BUDGET: \$99,650	TOTAL STUDY COST TO DATE: \$22,361
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/04
STUDY TITLE:	Sample, Describe, and Map Yazoo Clay
RESEARCH AGENCY:	Mississippi Department of Transportation Materials Division
PRINCIPAL INVESTIGATOR:	Richard V. Martin

Objective:

The Yazoo Clay is notorious as a problem in Central Mississippi and in particular the Greater Jackson area. Its high-volume-change properties can have a devastating effect on roads, buildings, bridges, and embankments. The Yazoo Clay has never been studied systematically to determine what controls its properties and what is the distribution of these properties. All efforts have been local in nature and problem oriented. This study will seek to define the areal limits and stratigraphic units of the Yazoo Clay deposit based on engineering properties. These units can then be mapped showing the distribution of these engineering properties. A map showing this distribution will serve as a basis for designing solutions for projects located in a given unit. Also included in the study will be an analysis of how effective the current MDOT design policies with regards to Yazoo Clay have been and recommendations will be made as to any changes to the current policy that could be made.

Progress:

Holes were drilled under Site number 1864 to evaluate the upper Yazoo Clay, in Madison County to evaluate the middle Yazoo Clay and in Yazoo County to evaluate the lower part of the Yazoo Clay. Laboratory testing of samples taken from these holes have been conducted.

A search has been undertaken to find all of the historical geotechnical data related to the Yazoo Clay formation with the data being entered into an Access database. This data is on various paper files located in the MDOT Geotechnical warehouse and other published data. Map data is not available from the Mississippi Geological Survey. Basemaps have been created using GIS software so that both historical and new data can be viewed. A preliminary isopach map has been drawn of the Yazoo Clay and an initial subdivision of this clay by thickness has been completed.

Drilling was performed in Yazoo, Jasper, Rankin and Scott Counties. Clay mineralogy analyses were performed on samples of the Yazoo Clay. Kriging software was obtained and used for spatial analysis.

Plans for FY 2004:

The drilling program, testing of obtained samples and analyses of data will be completed. The results of the analyses will be compared to the clay mineralogy data from MSU. Maps and a report will be generated.

Cost Estimate for FY 2004 \$33,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 13	STATE STUDY NO: 153
TOTAL STUDY BUDGET: \$122,655	TOTAL STUDY COST TO DATE: \$74,920
DATE STARTED: 10/01/01	COMPLETION DATE: 12/31/03
STUDY TITLE:	Falling Weight Deflectometer for Estimating Subgrade Moduli
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	K.P. George

Objective:

Characterizing the subgrade in terms of resilient modulus (M_r) is essential for AASHTO pavement design/evaluation. Due to the complexity of the laboratory M_r test procedure, highway agencies have been exploring Non Destructive Tests (NDT), such as the Falling Weight Deflectometer, (FWD), to determine the M_r of a given material. In this study, four test sections with subgrade reflecting a range of soil types (fine- and coarse-grain soils) will be tested with FWD measurements obtained directly on the prepared subgrade. Shelby tube samples of subgrade material will be obtained for laboratory M_r testing and Dynamic Cone Penetrometer (DCP) field testing will be conducted. Either a modification to a currently existing backcalculation routine, or a completely new FWD backcalculation program, will be developed for this study. Current backcalculation routines have been developed for layered pavement systems where each layer, except for possibly the subgrade, are modeled for linear moduli behavior. The subgrade consists of one or more non-linear behaving soil layers. This modified/new backcalculation program will be capable of handling a system of multiple layers where each layer can be modeled for non-linear behavior. Employing this modified/new backcalculation program, M_r of the subgrade layers will be calculated and compared first with the laboratory M_r values and second with the M_r values derived from the DCP index. The results will be statistically analyzed exploring how closely the FWD-backcalculated values agree with the laboratory M_r values. The M_r -DCP index relationship, recently derived in State Study # 131, will also be substantiated. This proposed study fundamentally differs from SS #131 in that the FWD test apparatus, equipped with a much larger plate than that used in the previous study or used for routine FWD pavement testing, is the field testing equipment being employed for modulus characterization. The need for a larger plate was determined in the previous study during field testing directly on untreated subgrade. In this previous study, the Automated DCP was the primary field testing equipment evaluated for modulus characterization. In summary, this proposed study offers another, potentially more accurate and faster, method of subgrade characterization for pavement design.

Progress:

A literature review was conducted which focused on the subject of FWD testing on pavements and subgrades. Methods of calculating subgrade modulus from FWD deflection data were investigated.

Progress continued:

Three test sections were tested in April using the FWD, ADCP, geogauge and nuclear gauge. Shelby tube samples were obtained. Both the 300mm and the 450mm plates were used in conjunction with the FWD testing on two of the sections. Large variations in material properties with depth were encountered. Due to these variations, both subsequent sets of three sections had exploratory testing performed with the ADCP prior to FWD testing and sample extraction to ensure uniformity with depth.

The testing for the second set of three sections was conducted with both plate sizes and modified sensor tips. Large tips of 16mm replaced the 10mm tips.

The testing for the third set of three sections was conducted with both plate sizes and both tip sizes were used when testing with the 300mm plate.

Elastic calculations were performed. Laboratory resilient modulus tests on core samples were completed. FWD deflection-based modulus was correlated to the laboratory modulus.

Richard Stubstad of ERES Consultants was retained as a consultant, especially to provide technical advice during the data analysis phase.

A subsequent single test section was tested to serve as a verification of the models developed from data obtained in the previous test sections.

Both the FWD-based moduli and the corresponding TP-46 moduli have been scrutinized for outliers and the resulting data has been regressed against each other. Two power equations have been derived with one equation relating the first sensor moduli E_1 (FWD-based) vs. the TP-46 values and the second one relating the average of the third to fifth sensor E_{3-5} vs. TP-46 moduli values. The procedure for selection of characteristic modulus of a section/station will be to choose the lowest TP-46 value estimated based on E_1 and E_{3-5} . The 18 inch load plate will be used in lieu of the 12 inch load plate for this purpose.

The computer program FWDSUBGRADE has been completed which allows for the dynamic segmentation of the section of subgrade into “uniform sections.” The output of this program includes the mean and standard deviation of M_r values of the section or subsections, as the case may be.

The final report for this study is being written.

Plans for FY 2004:

The final report, including a procedure to arrive at a “design resilient modulus”, and the computer program FWDSUBGRADE, including a brief manual, will be submitted.

Cost Estimate for FY 2004 \$47,735

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 14	STATE STUDY NO: 154
TOTAL STUDY BUDGET: \$32,000	TOTAL STUDY COST TO DATE: \$13,987
DATE STARTED: 10/01/01	COMPLETION DATE: 03/31/04
STUDY TITLE:	In-House Support to State Study 153
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	William F. Barstis

Objective:

This study is being proposed to support the proposed study "Falling Weight Deflectometer for Estimating Subgrade Moduli". Most of the field testing to support the contract study will be conducted by this in-house study. Engineering time is also allocated for reviewing the draft and final report copies submitted by the Principal Investigator of the contract study.

Progress:

Performed FWD, automated DCP, manual DCP and geogauge testing on ten test sections. Burns, Cooley, Dennis Inc. was used to obtain undisturbed Shelby tube samples and nuclear gauge testing at these test sections.

FWD testing was conducted on an unstabilized subgrade to provide data for evaluating the computer program FWDSUBGRADE. This program was evaluated and comments provided to the principal investigator.

Plans for FY 2004:

Review the final report and the computer program FWDSUBGRADE.

Cost Estimate for FY 2004 \$4,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 15	STATE STUDY NO: 155
TOTAL STUDY BUDGET: \$115,000	TOTAL STUDY COST TO DATE: \$60,403
DATE STARTED: 10/01/01	COMPLETION DATE: 09/30/04
STUDY TITLE:	Use of Asphalt Pavement Analyzer to Study In-Service Asphalt Mixture Performance
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Tom White

Objective:

Aggregates and their combination into mixture gradations are significant variables affecting the rutting potential of an asphalt mixture. Because aggregates vary from state to state, it is important to evaluate Asphalt Pavement Analyzer (APA) rutting criteria for local aggregates. Another issue is whether laboratory compaction will produce test specimens with the same magnitude of rutting as field compacted specimens. This study addresses both of these issues. Cores will be taken from in-service pavements for APA testing and for extraction to determine asphalt content and aggregate gradation. Specimens with the same gradation and asphalt grade and content will be prepared, compacted and tested in the APA using aggregates obtained from the same sources as used in the in-service pavements. An analysis will be conducted to determine if there are differences in rutting of field and laboratory compacted specimens. Appropriate APA rutting criteria will be recommended for asphalt mixtures utilizing aggregates available in Mississippi.

Progress:

A meeting with MDOT Research and Materials Divisions was held and a finalized test matrix was decided upon.

A list of projects to be evaluated in the study was finalized. Field coring and rut measurements have been completed on these 24 projects.

Aggregate characterization testing was conducted for the aggregates obtained in preparation for mix design verifications.

Plans for FY 2004:

Field obtained cores from the 24 project sites will be analyzed to determine the asphalt content, gradation, and in-place density. Once the in-place properties have been determined gyratory compacted samples will be prepared for testing in the asphalt pavement analyzer (APA). APA testing will also be competed on the obtained cores from outside the wheel path. Traffic data will be used to develop relationships between the amount of in-place densification and the applied ESALs. It is anticipated that the

Plans for FY 2004 continued:

project testing will be complete by April of 2004, with the draft final report being prepared and sent to MDOT by early summer.

Cost Estimate for FY 2004 \$54,597

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 16 STATE STUDY NO: 157
TOTAL STUDY BUDGET: \$150,000 TOTAL STUDY COST TO DATE: \$108,358
DATE STARTED: 03/01/02 COMPLETION DATE: 09/30/05
STUDY TITLE: Evaluation of DRM System
RESEARCH AGENCY: Mississippi Department of Transportation
Research Division
PRINCIPAL INVESTIGATORS: Dylan Gordy

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 (Construction) report has been completed.

Plans for FY 2004:

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

Cost Estimate for FY 2004 \$2,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 17 STATE STUDY NO: 158
TOTAL STUDY BUDGET: \$110,404 TOTAL STUDY COST TO DATE: \$53,513
DATE STARTED: 06/01/02 COMPLETION DATE: 09/30/04
STUDY TITLE: Port Sedimentation Solutions
RESEARCH AGENCY: Mississippi State University,
Ports & Waterways, Research Division
Mississippi Department of Transportation
PRINCIPAL INVESTIGATORS: William H. McAnally

Objective:

The purpose of the investigation is to determine if there are feasible, affordable engineering solutions to reduce or eliminate dredging requirements at docks and mooring areas at the Mississippi public ports on the Tennessee-Tombigbee Waterway, and to compare feasible solutions to public purchase and operation of a dredge.

Progress:

Authorization to proceed was received on 3 June 2002. Six public ports on the Tennessee-Tombigbee Waterway and the Corps of Engineers Area Office were visited to seek information on the types, location, and volumes of sediment accumulating within the port boundaries, plus any other information that the port directors believed to be important. Background information was obtained regarding the waterway, flow data, and maps of the region. Specific activities included:

1. Literature Review

Publications describing the construction of and the problems faced by the Tenn-Tom Waterway were reviewed, with the focus on sedimentation. Previous studies on environmental aspects of the Waterway performed by MSU were obtained, including data files for computer models.

2. Port Visit Summary

Visits were made to each of the six public ports on the Waterway. The primary purposes of visiting the port authorities were to introduce the project and personnel involved in this study, and to inspect the ports. The port representatives were also asked to provide available data on the physical properties of the port and waterway. During these port visits photos were taken, physical observations recorded, and three sediment samples collected for visual inspection. The ports provided information, typically including:

- Maps of ports showing facilities and geographic features;
- Contact information of other knowledgeable persons;
- Location and size of dredged material disposal area;
- Current sediment problems;
- Channel profiles.

3. Data Gathering

In addition to the information provided by the ports, the Corps of Engineers Tenn-Tom Waterway Management Office was visited to obtain data and consultation was made with the Corps' Mobile District staff by phone.

4. Research Plan

After reviewing the relevant literature, studying past research efforts on the Tennessee-Tombigbee Waterway focusing on modeling and sedimentation, work began on development of detailed plans for the balance of the research. Hypotheses were formulated on the sediment transport mechanisms for each port and possible engineering solutions for the sedimentation problems. These hypotheses will be used to design the data collection and analysis plan.

The main tasks for the last quarter of FY 2002 included:

- Selected in consultation with MDOT the ports on which to focus
- Determined specific data requirements and acquired additional data
- Updated port authorities on progress
- Started developing model for channel flow simulation
- Conducted preliminary data analysis.

The Preliminary Evaluation task has been completed and a preliminary report was submitted to MDOT, the Corps of Engineers and the ports.

The Corps of Engineers hydrographic data was converted to AutoCad format and the data examined in the depth contour form. Shoaling volumes were calculated for each port and the dominant sedimentation processes for each port were characterized and a list formulated of the most probable engineering solutions for each based on the available data.

The ports of Amory, Lowndes and Itawamba were visited and samples of water and sediment were collected for laboratory analyses.

Data has been compiled for the dredge analysis. A search of the literature and the web was conducted to find design data for pneumatic barriers (bubble screens), silt screens and resuspension of sediment by vessel traffic. Preliminary designs were completed for engineering solutions.

Plans for FY 2004:

Mississippi State University will complete feasibility level designs for engineering solutions at Mississippi public ports on the Tennessee-Tombigbee Waterway that will reduce or eliminate the need for maintenance dredging in the ports. We will estimate the costs of these engineering solutions and compare them to the cost of public ownership and operation of a dredge. Findings will be published in a final report.

Cost Estimate for FY 2004 \$56,891

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 18	STATE STUDY NO: 159
TOTAL STUDY BUDGET: \$70,000	TOTAL STUDY COST TO DATE: \$51,186
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
STUDY TITLE:	In-House Support to State Study No. 155
RESEARCH AGENCY:	Mississippi Department of Transportation Research Division
PRINCIPAL INVESTIGATOR:	James Watkins

Objective:

This study will be conducted to support State Study No. 155 "Use of Asphalt Pavement Analyzer to Study In-Service Asphalt Mixture Properties" which is under contract with the Department of Civil Engineering at Mississippi State University. The field site locations, layout, and sampling to support the contract study will be conducted by this in-house study.

Progress:

An exhaustive search of the mix design information from the Materials Division and of the Pavement Management Data was performed to obtain 24 project sites from all over the state for the study. Coring was performed on all of these sections. The MDOT Planning Division provided some of the traffic data for these projects.

Plans for FY 2004:

The MDOT Planning Division will provide the balance of the required traffic data for the project sites. Review the final report.

Cost Estimate for FY 2004 \$2,500

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 19	STATE STUDY NO: 164
TOTAL STUDY BUDGET: \$45,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
STUDY TITLE:	Real – Time Implement of an Intersection Accident Detection System – Phase I
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Yunlong Zhang

Objective:

The current MDOT-sponsored project being conducted at MSU, State Study No. 150 entitled “Automated Accident Detection at Intersections” has produced accident detection algorithms to detect accident events from the ambient sound signals. The proposed project is intended to implement these algorithms in a real-world system. Based on cost, performance, reliability and scalability, the optimal system architecture will be decided and designed. The system will include four modules performing the functions of acoustic signal collection, digital signal processing, data transmission and accident reporting. The proposed project will include two phases. Phase I is expected to require four to five months for completion. In this phase the following tasks will be performed:

Conduct a literature review to obtain the latest information on real-time accident detection, related instrument technology and protocols for DSP and communication hardware

Survey state transportation agencies to learn about the existing facilities such as the detection equipment, the communication networks and the computer networks

Determine the final system architecture and specifications of all system components, including the requirements and specifications of communication links, processors at intersections, and either the active sensor’s DSP hardware or the central server

Phase II of the study will be the implementation of the real-time system. The choice of the final system architecture implemented in this phase depends upon the results of Phase I; therefore, the necessary funding for Phase II will be determined at the conclusion of Phase I.

Progress:

Data obtained from the Kentucky Transportation Cabinet was analyzed using developed algorithms. A real time data collection and processing system is under development and testing. A research plan on different options of communication was developed.

Plans for FY 2004:

Conduct multiple real-world tests of the real-time processing algorithm and program. Finalize real-time data collection and processing code. Make recommendations on system architecture and the corresponding communication and processing configurations, and present plan for system implementation. Prepare documents and reports on program development, testing, and use.

Cost Estimate for FY 2004 \$45,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 20	STATE STUDY NO: 165
TOTAL STUDY BUDGET: \$40,000	TOTAL STUDY COST TO DATE: \$6,885
DATE STARTED: 10/01/02	COMPLETION DATE: 12/31/03
STUDY TITLE:	Traffic Load Spectra Development for the 2002 AASHTO Design Guide
RESEARCH AGENCY:	Mississippi State University
PRINCIPAL INVESTIGATOR:	Shane Buchanan

Objective:

The current AASHTO structural pavement design guide utilizes design traffic input in terms of equivalent single axle loads (ESALS). The traffic input for the new 2002 AASHTO Guide for Design of New and Rehabilitated Pavement Structures will be in terms of load spectra. Load spectra is a change from ESAL calculation and consists of classifying the traffic loading in terms of the number of load applications of various axles configuration (single, dual, tridem and quad) within a given weight classification.

Load spectra analysis is conducted by counting, classifying, and weighing vehicles for a given time period. The design traffic (load spectra) for the pavement design life can then be calculated in a similar manner as currently used for ESALs, through the application of a traffic growth factor based on historical and anticipated traffic on the facility.

The focus of the study will be to determine how the existing traffic information gathered by MDOT can be used to determine load spectra information. A number of roadway types (two-lane, four-lane and interstates) will be evaluated. Traffic volume and distribution data will be reviewed and load spectra developed for each site. Assistance with traffic data collection will be given to MDOT, if necessary, to insure accurate load spectra development. The final report will provide a clear, easy to follow methodology for developing load spectra from traffic volume and distribution data.

Progress:

All Mississippi roadways were sorted into one of the following developed truck loading groups: two-lane roadways, four lane highways, and rural and urban interstates.

Mississippi long term pavement performance traffic data was acquired for review, analysis and load spectra development for those sites.

The information from 45 traffic data collection sites were obtained from the MDOT Planning Division and work was conducted to formalize a procedure for determining the traffic load spectra for each of the established traffic loading groups. A Mississippi highway traffic volume bandwidth was developed and sent to MSU for review for possible additional traffic data collection sites.

Plans for FY 2004:

Traffic data from MDOT and the FHWA Long Term Pavement Performance (LTPP) program will continue to be analyzed so that appropriate load spectra can be developed. Annual load spectra will be first developed for a given traffic loading group, with monthly, daily, and hourly variation factors also developed. A copy of the new 2002 design software will be obtained and evaluated with the developed load spectra to insure proper operation. It is anticipated that all project work will be concluded within the next fiscal year.

Cost Estimate for FY 2004 \$33,115

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 21	STATE STUDY NO: 166
TOTAL STUDY BUDGET: \$110,000	TOTAL STUDY COST TO DATE: \$1,337
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
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.

Plans for FY 2004:

Dynamic modulus testing equipment will be obtained and installed. Laboratory mix designs and material processing will continue. Mix samples will be prepared and evaluated using the dynamic modulus test procedures. Master frequency curves will be developed for each mixture combination proposed. It is anticipated that the majority of the testing will be completed and data reduction will be completed within the next fiscal year.

Cost Estimate for FY 2004 \$55,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 22	STATE STUDY NO: 167
TOTAL STUDY BUDGET: \$90,000	TOTAL STUDY COST TO DATE: \$26,565
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
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.

Plans for FY 2004:

A final testing protocol for the stripping simulator will be established. Using this protocol, testing will be conducted for each mixture combination. The effect of the various mix components on observed stripping will be established. It is anticipated that a relationship between stripping and turbidity will be developed so that the use of the indirect tensile strength test for moisture susceptibility determination can be eliminated from the specifications.

Cost Estimate for FY 2004 \$45,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 23	STATE STUDY NO: 168
TOTAL STUDY BUDGET: \$50,000	TOTAL STUDY COST TO DATE: \$8,318
DATE STARTED: 10/01/02	COMPLETION DATE: 03/31/04
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:

The prototype tack coat evaluator (Atacker™) was delivered by Instrotek, Inc.

Plans for FY 2004:

The developed field tack coat device will be used to evaluate different tack coat materials on concrete and asphalt surfaces in the laboratory. A field testing program will be established with the assistance of MDOT. The program will involve evaluating a number of projects under construction to determine the strength of the tack coat used in construction. Cores will be obtained from each project and the interface shear strength determined. A relationship between the shear strength and the results from the tack coat evaluation device will then be determined and a draft specification developed.

Cost Estimate for FY 2004 \$41,682

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 24	STATE STUDY NO: 169
TOTAL STUDY BUDGET: \$49,836	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 05/01/03	COMPLETION DATE: 06/30/04
STUDY TITLE:	Diagnostic Evaluation and Repair of Deteriorated Concrete Bridges
RESEARCH AGENCY:	University of Mississippi
PRINCIPAL INVESTIGATOR:	Ahmed Al-Ostaz

Objective:

Concrete bridge deck degradation has been observed in several bridges located in north Mississippi. In this study a survey will be conducted to collect and document instances of deterioration in concrete bridges located throughout the State and a determination of the mechanisms effecting the observed degradation. This task will be accomplished with the assistance of the District Maintenance Engineers. A guideline for selection of suitable repair materials will be developed as a matrix of repair material vs. application to assist MDOT personnel in the selection of a suitable repair material for a given type deterioration. The work involved in developing this guideline will include input from the District Materials Engineers of repair methodologies and subsequent performance of these methodologies previously employed by MDOT. Additional work in this study includes the use of the Slant Shear Test to quantitatively evaluate the bond between repair materials and parent concrete, and any subsequent degradation of this bond due to thermal cycling or wet/dry cycling.

Progress:

District Engineers and MDOT maintenance specialists were consulted regarding deteriorated concrete structures in Mississippi. A guideline for visual inspections, techniques employed for durability surveys and methodology for evaluation of survey results were developed. An atlas was started for photographic documentation of concrete deterioration. A questionnaire was designed for collecting information from repair consultants and suppliers of repair materials. Data was collected using the questionnaire and analyzed. Wooden molds were fabricated for casting concrete plaques. Concrete specimens were cast and subsequently fractured using the requirements of the Slant Shear Test.

Plans for FY 2004:

For next year, a survey will be conducted to collect and document instances of deterioration in concrete bridges located throughout the State and a determination of the mechanisms effecting the observed degradation. This task will be accomplished with the assistance of the District Maintenance Engineers. A guideline for selection of suitable repair materials will be developed as a matrix of repair material vs. application

Plans for FY 2004 continued:

to assist MDOT personnel in the selection of a suitable repair material for a given type deterioration. The work involved in developing this guideline will include input from the District Materials Engineers of repair methodologies and subsequent performance of these methodologies previously employed by MDOT. Additional work in this study includes the use of the Slant Shear Test to quantitatively evaluate the bond between repair materials and parent concrete, and any subsequent degradation of this bond due to thermal cycling or wet/dry cycling.

Cost Estimate for FY 2004 \$49,836

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 25

STATE STUDY NO: 170

TOTAL STUDY BUDGET: \$307,163 (SP&R) TOTAL STUDY COST TO DATE: \$0
\$500,000 (Non SP&R)
\$807,163 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:

TBD

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

Cost Estimate for FY 2004 \$0 SP&R

\$125,000 Non SP&R

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 26	STATE STUDY NO: 171
TOTAL STUDY BUDGET: \$200,000	TOTAL STUDY COST TO DATE: \$0
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.

Cost Estimate for FY 2004 \$20,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 27	STATE STUDY NO: 172
TOTAL STUDY BUDGET: \$19,098	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/03	COMPLETION DATE: 09/30/04
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.

Cost Estimate for FY 2004 \$19,098

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 28	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.

Cost Estimate for FY 2004 \$40,000

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 29	STATE STUDY NO: 174
TOTAL STUDY BUDGET: \$37,224	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/03	COMPLETION DATE: 09/30/04
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.

Cost Estimate for FY 2004 \$37,224

MISSISSIPPI SPR-1(42)
PART II

LINE ITEM NO. 30	STATE STUDY NO: N/A
TOTAL STUDY BUDGET: \$25,000	TOTAL STUDY COST TO DATE: \$0
DATE STARTED: 10/01/02	COMPLETION DATE: 09/30/04
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 2004 \$25,000

MISSISSIPPI SPR-1(42)
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 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. Estimated contribution for FY 2004 is **\$328,304**.

MISSISSIPPI SPR-1(42)
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 2004 TRB Correlation Service is funded for \$93,455, which corresponds to the current annual subscription cost for Mississippi.

Cost Estimate for FY 2004 \$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. Nine states (Alabama, Florida, Georgia, Mississippi, Missouri, North Carolina, Oklahoma, South Carolina, and Tennessee) are currently committed to participate 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 will be 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: ***Southeast SUPERPAVE Center***

Host Agency - Alabama Department of Transportation

The objective of this pooled-fund study will be to support the implementation of the products of the SHRP research effort within the state DOTs through the ***Southeast SUPERPAVE Center***. Each state can select from a list of services that will best satisfy their needs. The list includes:

- Develop and provide, for the DOTs and Industry, training on the volumetric analysis of HMA pavements using the Superpave Gyratory Compactor.
- Conduct at least 1 (more if needed) four day Superpave binder school at NCAT.
- Provide troubleshooting expertise to the states on the development of Superpave designs - both over the phone and as required by visits to the DOT laboratory and/or project site.
- Provide support for implementation of Superpave by conducting round robin studies to evaluate the accuracy of laboratories within the region.

If additional work is needed, each state can determine from the list of services the cost for performing this additional work.

FY 2004 - \$20,000

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 2005.

FY 2002 - \$25,000	FY 2003 - \$25,000
FY 2004 - \$25,000	FY 2005 - \$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 2004.

FY 2002 - \$10,000	FY 2003 - \$10,000	FY 2004 - \$10,000
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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: ***Electronic Appraisal Development Study – Phase I***

Host Agency – Texas DOT

The objective of the study is to develop and deliver a “How To” manual of instruction for the electronic transmittal of Real Estate appraisal documents (appraisals, data books, and review appraiser reports). The manual will describe alternative options for implementation, listing pros and cons to each alternative, with recommendations for each participating state agency regarding respective hardware and software requirements. The estimated total cost of this one-year study is \$100,000.

MDOT will contribute a total of \$10,000 during the fiscal year 2004.

FY 2004 - \$10,000

Pooled Fund Study: ***It All Adds Up to Cleaner Air***

Host Agency – FHWA

The “It All Adds Up to Cleaner Air” (IAAUCA) initiative began in 1995 in response to State and local transportation agency requests for commercial-quality public education materials to raise awareness about the connection between transportation choices, congestion and air quality. U.S. DOT and U.S. EPA developed a national initiative that, through partnerships with local communities and a national coalition called the “Alliance for Clean Air and Transportation” (ACAT), distributes messages and materials throughout the country. The goal of this effort is to assemble regional, State and local agencies, FHWA, EPA and other interested parties to develop a second generation of IAAUCA messages and supporting materials and to do this in a manner consistent with the existing program so as to provide continuity and familiarity to the driving public.

MDOT will contribute a total of \$60,000 during the fiscal years 2004 through 2006.

FY 2004 - \$20,000 FY 2005 - \$20,000 FY 2006 - \$20,000

Mississippi
Department of Transportation

RESEARCH WORK PROGRAM
SPR-1(42), Part II
Q56

For the Fiscal Period
October 1, 2003 to September 30, 2004



Prepared by the
Mississippi Department of Transportation
RESEARCH DIVISION

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

**Mississippi
Department of Transportation**

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