FINAL REPORT

SPS-9 PROJECT 2809: SUPERPAVE™ ASPHALT BINDER STUDY IH-55, SOUTHBOUND PANOLA COUNTY, MISSISSIPPI

FHWA/LTPP

SOUTHERN REGION COORDINATION OFFICE

November 1996

BRENT RAUHUT ENGINEERING INC.

8240 Mopac, Suite 220 • Austin, Texas 78759 • (512) 346-0870 • FAX (512) 346-8750

FINAL REPORT

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SUPERPAVE™ ASPHALT BINDER STUDY
IH-55, SOUTHBOUND
PANOLA COUNTY, MISSISSIPPI

INTRODUCTION

As part of the Strategic Highway Research Program's (SHRP) Long Term Pavement Performance (LTPP) Studies, sections of highway are being selected to apply very specific treatments to study various facets of construction (both new and rehabilitation). These projects are referred to as Specific Pavement Studies (SPS). This particular project, on IH-55 in Panola County, Mississippi, was identified as a potential candidate for inclusion in the SUPERPAVE™ Asphalt Binder Studies (SPS-9A).

SPS-9 General Experiment Design

The experiment is intended to validate the SHRP binder specifications, to allow direct comparison of asphalt mixtures designed using agency procedures and the newly developed SHRP procedures and to provide initial data for use in refining the mixture performance models also developed as part of the SHRP research. The key elements of the SUPERPAVE™ design process are shown in Table 1.

TABLE 1. KEY ELEMENTS OF THE SUPERPAVE™ DESIGN PROCESS

Address Reduction and Control of:
- Permanent deformation
- Fatigue cracking
- Low temperature cracking

Develop Mixture Having Sufficient/Satisfactory:
- Asphalt binder
- Voids
- Workability
- Performance characteristics

Basis of Design
- Volumetric principles
- Evaluation of engineering properties of trial mixes using increasing levels of testing depending upon the reliability (traffic level) desired
- Three levels of design
  - Level 1 - Low traffic (lower reliability)
  - Level 2 - Medium traffic (better reliability)
  - Level 3 - High traffic (best reliability)
- SHRP gyratory used for laboratory compaction

The SUPERPAVE™ mix design system is being validated using a three-stage process. The first stage validation, conducted by SHRP, confirmed that variation of asphalt binder properties identified as probable, significant determinates of pavement performance caused reasonable, meaningful changes in the relevant performance characteristics of asphalt-aggregate mixtures. This was accomplished by using specifically designed accelerated laboratory tests and existing accelerated load facilities.

The second stage validation, also conducted under SHRP, established the degree of correlation between the asphalt binder properties shown to significantly affect performance-related characteristics of asphalt-aggregate mixtures and relevant field pavement performance parameters. This process provided data to specification limits for the relevant properties selected to control performance. This effort relied heavily on sampling and testing the LTPP General Pavement Studies (GPS) sections.

Although GPS sections provided valuable and timely information, controlled Specific Pavement Studies of newly constructed and reconstructed or rehabilitated (resurfaced) pavement sections are needed in the third stage to provide an accurate estimate of the relative influence of key pavement elements that affect pavement performance for purposes of specification validation. The importance of this experiment is highlighted by its ability to evaluate the interaction of traffic, structural parameters and climatic factors on pavement performance in a controlled manner. The overall SPS-9 experiment objectives are shown in Table 2.

TABLE 2. SPS-9 OVERALL EXPERIMENT OBJECTIVES

1. To further validate the performance-based asphalt and asphalt-aggregate mixture specifications through controlled field experiments.
2. To provide a direct comparison, in terms of measured performance between existing highway agencies' asphalt specifications, asphalt-aggregate mixture specifications, mixture design procedures and SHRP's performance-based specifications and mix design and analysis system.
3. To provide performance data collected over a long term from controlled field experiments and to provide for modification of specifications at the local, regional or national level.
4. To provide training and assistance to Agency personnel in binder characterization procedures, the mix design process and establish the practicality of implementing the SUPERPAVE™ system.
5. To provide data for SUPERPAVE™ models refinement and modifications.

SPS-9A will focus on two main issues: (1) performance of SUPERPAVE™ mixtures relative to local agency mixtures and (2) verification of the SHRP asphalt binder selection process. The SPS-9A experiment design consists of a moisture/temperature factorial to be filled by test sites

constructed by the participating agencies. The environmental conditions in this factorial for the SPS-9A experiment are defined by the SHRP Asphalt Regional Program in specific rainfall amounts and pavement temperatures as opposed to the global environmental conditions used in the other LTPP experiments. Table 3 depicts the experiment design for the SPS-9A experiment that incorporates the SHRP asphalt environmental factors. Temperatures are duplicates of the latest SHRP PG specification, but limited to more commonly found conditions in the United States, as indicated by the unshaded cells. As shown in Table 3, 32 temperature-moisture combinations result in a total of 32 project sites.

Each test site for SPS-9A shall include three test sections, one using the Agency's current mixture design, one using the SUPERPAVE™, and the other using a SUPERPAVE™ mixture with a SHRP binder grade either higher or lower than required by SUPERPAVE™.

For additional information on general experiment design for SPS-9, please refer to "Specific Pavement Studies: Experimental Design and Research Plans for Experiment SPS-9A, SUPERPAVE™ Asphalt Binder Study, September 1994".

Selection/Nomination of IH-55

This project was first offered for consideration by the State of Mississippi in January 1995. After reviewing the details provided by the state on this project and preparation of a tentative layout of the test sections (to ensure that adequate space was available for such a project), the project was officially nominated. Appendix A contains the nomination forms which provide information on the project location, significant dates, traffic information and the Agency's pavement structural design for the project in question. The section was officially approved for use by the FHWA/LTPP Division on 1 February 1995.

Specific Experiment Design for IH-55

Although the plans for this particular project did not originally include the incorporation of an SPS-9A project, the plan's typical section and existing structural features were such that the test sections could be retrofitted into the plans for this project. The only significant modifications required for incorporation of these test sections into this project was in the modification of asphalt mix design for the three SUPERPAVE™ test sections. To ensure that the SUPERPAVE™ mix design criteria were adequately met, copies of the mix designs were provided by the Mississippi DOT. Mr. Ron Cominsky reviewed these mix designs, confirming that they do in fact meet SPS-9A mix criteria. Mix designs for each of the three test sections are included in Appendix B.

During the design phase of this project, the Mississippi DOT decided to use the SUPERPAVE™ mix as the design standard. All of the portions of the roadway not paved with alternate binder mixtures were paved with PG64-22 material. As such, Sections 01 and 02 were effectively identical. Because of this, it was decided that Section 280901 would be dropped, leaving Sections 280902, 280903 and 280904. These sections include the SUPERPAVE™ binder mix for this climate, a SUPERPAVE™ mix with alternate binder (down one grade), and a state option section of modified binder meeting PG76-22 criteria, respectively.

TABLE 3. SPS-9A EXPERIMENT DESIGN FACTORIAL

Moisture		Wet > 635 mm/year of precipitation				Dry < 635 mm/year precipitation			
Average 7 Day Maximum Pavement Design Temperature		<52C	<58C	<64C	<70C	<52C	<58C	<64C	<70C
Minimum Pavement Design Temperature	> -46C								
	> -40C								
	> -34C								
	> -28C								
	> -22C								
	> -16C								
	> -10C								

NOTES:
Traffic rate should exceed 50,000 ESAL/year in study lane.
Total traffic for design (design life) is Agency choice.
The Average 7-day maximum pavement design temperature is the average of the highest daily pavement temperatures for the seven hottest consecutive days.
The minimum pavement design temperature is the coldest pavement temperature of the year.

PRECONSTRUCTION MONITORING

The primary preconstruction monitoring included FWD and profile testing, rod and level measurements made immediately prior to construction (See Appendix C) to evaluate variability in the thicknesses of each layer placed, and extensive material sampling and testing to document the material properties for each of the layers incorporated in these test sections. Preconstruction FWD testing was performed by FWD Unit 059A on 6 June 1995 and profile testing occurred on 7 June 1995. As specified for all SHRP test sections, a thorough material sampling and testing program was established for these test sections on IH-55 in Panola County, Mississippi (See Appendix D.) Preconstruction sampling focused on collection of bulk samples from each of the various pavement layers. All sampling was conducted by the Mississippi DOT.

CONSTRUCTION

The following text details any and all unusual features relating to the construction and completion of the asphalt test sections on IH-55 in Panola County, Mississippi, for inclusion in LTPP's SPS-9A study. For the purposes of discussion here, "unusual" features will be defined as that information which cannot be, or has not been, recorded elsewhere on the data forms associated with this project, or those features which are considered to be particularly unique to this project.

The project (Project Nº. 59-0055-04-061-10) is located on IH-55 between the Tallahatchie River and the Panola-Tate County Line, near Como, Mississippi. The project was let to Lehman-Roberts Construction Company.

In general, construction proceeded with the contractor paving the inside lane and shoulder first, using the inside lane as a control strip to establish a rolling pattern and prepare for placement of the test lane. The stations demarking the test section were identified as a 100% pay zone, meaning that the contractor was required to remove and replace any material not meeting specifications.

Work in the area of the test sections began on Monday, 21 August 1995 and was completed on Wednesday, 30 August 1995. During placement of the PG64-22 material test strip, the contractor encountered problems with low densities, requiring a new test strip be placed. Modifications were made at the plant, including increasing the asphalt content slightly and reducing the mix production temperature by 25°F. Density measurements in the new test strip revealed that the mix placement conformed to project specifications. After a final check of the mix properties, the test section was paved on Wednesday, 23 August without incident.

During compaction of the fresh mat, the contractor encountered problems obtaining a smooth finished surface. Numerous small corrugations were left in the surface, even after the finish rolling. The contractor attributed this to the thick mat and the relatively small top-size aggregate. Numerous attempts were made to control this, to no avail. Similar problems were encountered with the PG58-22 and PG76-22 materials.

During construction, material samples were obtained at the plant by Mississippi DOT personnel. Mississippi set up a gyratory compactor at the plant prior to construction, to be used for project control.

Material placement operations were completed on Wednesday, 30 August 1995. There were no other "unusual" occurrences during construction.

POSTCONSTRUCTION MONITORING

With the completion of the SUPERPAVE™ construction, postconstruction monitoring will be initiated. Rod and level elevation measurements were obtained immediately after construction to document the finished layer thicknesses. Postconstruction coring (Interval A) was conducted by the Mississippi DOT in late September 1995. The project was opened to traffic immediately after completion of the overlay, once the mat had cooled sufficiently. Interval B (6-month) coring occurred in mid-March 1996. Cores were returned to the Mississippi DOT laboratory and are currently being tested in accordance with the Material Sampling and Testing Plan. Postconstruction FWD and profile testing are scheduled for Summer 1996.

SUMMARY

Having completed the construction and initial monitoring of these test sections, it appears that the test sections on IH-55 in Panola County, Mississippi, will contribute significantly to the evaluation of the SUPERPAVE™ asphalt binder study. This project would not have been possible without the support of the Mississippi Department of Transportation. In particular, much of the credit is due to the help of John Avent and Al Crawley.

With the construction completed, we now continue to monitor these sections with time, noting changes in the surface distress, surface profile and structural capacity, and compare those changes against the loadings these sections are exposed to (both environmentally and from traffic), and in combination with other projects like this one around the country, to improve on the SUPERPAVE™ mix design procedures.

APPENDIX A

SITE NOMINATION INFORMATION
AND
OTHER PERTINENT PROJECT CORRESPONDENCE

Brent Rauhut Engineering Inc.

3 February 1995

Mr. Alfred B. Crawley
Research & Development Engineer
Mississippi Department of Transportation
P.O. Box 1850
Jackson, Mississippi 39215-1850

Subject: Nomination for SUPERPAVE™ Asphalt Binder Study (SPS-9A)

Dear Mr. Crawley:

We received notification from the FHWA/LTPP Division that the project you submitted for inclusion in the SPS-9A experiment is approved. Formal acceptance and issuance of incentive funds ($30,000) will be processed through the FHWA Region and Division offices. Since this project has a relatively short fuse, notice was sent to our office directly by fax.

I will be contacting you very soon to begin the coordination and planning activities for construction. I look forward to working with you on this project.

Please do not hesitate to contact me if you have any questions or comments.

Sincerely,

Mark P. Gardner, P.E.
Project Engineer, SRCO

MPG:dmj

c: Mr. James Quin, MS-DOT
Monte Symons, FHWA/LTPP-DO
Morris Reinhardt, RE-SRCO
Brent Rauhut, SRCO

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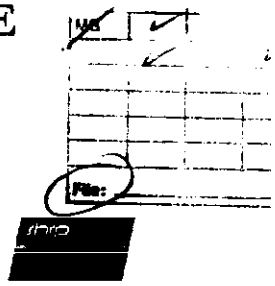
LONG TERM PAVEMENT PERFORMANCE DIVISION

Federal Highway Administration



Turner- Fairbank Highway Research Center, HNR-40
6300 Georgetown Pike, McLean, Virginia 22101-2296
Telephone (703) 285-2730 Fax (703) 285-2767

FACSIMILE MESSAGE
Number of pages including this cover sheet. 1
Copy to be Mailed Yes No

February 1, 1995

TO: Morris Reinhardt and Mark Gardner, SRCOC

FROM: Monte Symons

SUBJECT: Mississippi SPS-9A Nomination

MESSAGE:

John Miller and I have reviewed the Mississippi SPS-9A nomination (fax Dated Jan 19). Weather station information indicates that the site is on borderline between 64-16 and 64-22 PG grade asphalt. Therefore, we have no objections to the use of the nominated PG 64-22 asphalt and the project is approved for inclusion in the SPS-9A experiment.

Formal acceptance and issuance of incentive funds ($30,000) will be processed through the FHWA Region and Division office. The letter is being drafted by this office.

If anyone has any questions, please have them contact me.

Monte

Mississippi Department of Transportation / P.O. Box 1850 / Jackson, MS 39215-1850 / FAX (601) 359-2233

NAME	INFO	ACTN	COPY
BR	✓		
MG		✓	✓
MR	✓		✓
File:			

January 13, 1995

Mr. Morris C. Reinhardt, P.E.
LTPP Southern Region Engineer
8240 N. MoPac, Suite 250
Austin, Texas 78759

Dear Mr. Reinhardt:

SUBJECT: **Nomination for SUPERPAVE™ Asphalt Binder Study (SPS-9A)**

Attached are replacement nomination forms for the candidate SPS-9A project submitted in December, 1994. It was necessary to re-locate to another project due to complications in using an on-going project. We have switched to another project scheduled for letting on March 28, 1995. Due to deadlines in getting pay items ready for the contract documents, we need a fairly quick response to this candidate. I regret any problems this replacement may cause.

If additional information is needed, please contact me or Mr. John Avent of this office.

Sincerely,

Alfred B. Crawley
Research Engineer

Attachment

pc: Mr. James D. Quin
Mr. Walter S. Jordan
LTPP file

c:\msoffice\winword\ltppshrp\sps9a951.doc

SHEET A. SPS-9A CANDIDATE PROJECT NOMINATION AND INFORMATION

STATE Mississippi SHRP SECTION NO. _____

GENERAL PROJECT INFORMATION

PROJECT LOCATION

ROUTE NUMBER 55

ROUTE SIGNING [x] Interstate [ ] U.S. [ ] State [ ] County

Other _____

PROJECT LOCATION Start Milepost 257 End Milepost 260

Start Station 1286+62 End Station 1452+51

DIRECTION OF TRAVEL [ ] North B. [x] South B. [ ] West B. [ ] East B.

PROJECT LOCATION DESCRIPTION Interstate 55 between Tallabatchie River and the Panola-Tate County line

COUNTY Panola

HIGHWAY AGENCY DISTRICT NUMBER 2

ENVIRONMENTAL CONDITIONS

AVERAGE 7-DAY MAXIMUM PAVEMENT DESIGN TEMPERATURE		MINIMUM PAVEMENT DESIGN TEMPERATURE		MOISTURE (Annual Precipitation)	
< 52C (126F)	[ ]	> -46C (-51F)	[ ]		
< 58C (136F)	[ ]	> -40C (-40F)	[ ]	< 625 mm (25 inches)	[ ]
< 64C (147F)	[x]	> -34C (-29F)	[ ]		
< 70C (158F)	[ ]	> -28C (-18F)	[ ]	> 625 mm (25 inches)	[x]
		> -22C (-8F)	[ ]		
		> -16C (3F)	[x]		
		> -10C (14F)	[ ]		

SIGNIFICANT DATES

LATEST DATE OF APPROVAL NOTIFICATION FROM FHWA LTPP February 1, 1995

CONTRACT LETTING DATE March 28, 1995

ESTIMATED CONSTRUCTION START DATE July 1, 1995

ESTIMATED DATE TEST SECTIONS OPENED TO TRAFFIC September 30, 1995

ESTIMATED CONSTRUCTION COMPLETION DATE September 30, 1995

SHEET A. SPS-9 CANDIDATE PROJECT NOMINATION AND INFORMATION FORM
(Continued)

PROJECT DESCRIPTION

PROJECT TYPE [ ] New Route [x] Resurfacing Flexible [ ] Resurfacing Rigid

Other _____

FACILITY [x] Divided [ ] Undivided NUMBER OF LANES (One Way) 2

DESIGN TRAFFIC DATA

ANNUAL AVERAGE DAILY TRAFFIC (TWO DIRECTIONS)	15,000
% HEAVY TRUCKS AND COMBINATIONS (OF AADT)	24
EST. 18K ESAL RATE IN STUDY LANE (1,000 ESAL/YR)	1,300
TOTAL DESIGN 18K ESAL APPLICATIONS IN DESIGN LANE	26,000
DESIGN PERIOD (Years)	20

SPS-9A Nomination F m/Jul, [illegible]

SHEET B. SPS-9 CANDIDATE PROJECT NOMINATION AND INFORMATION FORM

STATE Mississippi SHRP SECTION NO.:

AGENCY'S PAVEMENT STRUCTURE DESIGN FOR SITE

LAYER[1] NO.	LAYER[2] DESCRIPTION CODE	MATERIAL TYPE[3] CLASS CODE	THICKNESS[4] (mm)	STRUCTURAL[5] COEFFICIENT
1	SUBGRADE (7)	56	---	---
2	06 Cmt Treated Subgrade →	43	152.4	1.20
3	06 Soil Agg →	26	304.8	1.20
4	05 Crushed Stone →	23	203.2	1.12
5	04 HMAC	01	101.6	1.76
* 6	04 "	01	114.3	1.98
7	05 "	28	50.8	0.68
8	04 "	01	50.8	0.88
9	03 "	01	63.5	1.10

STRUCTURAL DESIGN METHOD

[x] 1972 AASHTO [ ] 1986 AASHTO [ ] 1993 AASHTO [ ] Modified AASHTO

Other_____

AASHTO DESIGN RELIABILITY FACTORS R%_____ S_o_____

OUTSIDE SHOULDER TYPE

[ ] Turf [ ] Granular [x] Asphalt Concrete [ ] Surface Treatment

[ ] PCC [ ] Curb and Gutter Other_____

OUTSIDE SHOULDER WIDTH (Feet) 10

SUBSURFACE EDGE DRAINS [ ] Yes [x] No

NOTES

1. Layer 1 is the natural occurring subgrade soil. The pavement surface will have the largest assigned layer number.
2. Layer description codes:

Surface Layer:	03	Base Layer:	05	Subgrade:	07
Subsurface HMAC:	04	Subbase Layer:	06	Embankment (Fill):	11

3. Refer to Tables A-1 through A-4 for material class codes.
4. If subgrade depth to a rigid layer is known, enter this depth for subgrade thickness, otherwise leave subgrade layer thickness blank.
5. Enter AASHTO structural layer coefficient value, as appropriately modified, used in pavement design or typical coefficient used by agency for this material. For the subgrade, enter either AASHTO soil support value or resilient modulus value (psi) used in design.

* Single surface treatment #11 class code @ 63.5 mm in this layer

SHEET C. SPS-9A CANDIDATE PROJECT NOMINATION AND INFORMATION FORM

STATE Mississippi SHRP SECTION NO. _____

TEST SECTION LAYOUT

NUMBER OF TEST SECTIONS ENTIRELY ON: FILL 4 CUT _____
SHORTEST TRANSITION BETWEEN CONSECUTIVE TEST SECTIONS (meters) 335
VERTICAL GRADE (Avg %) (+ upgrade; - downgrade) 0.19%
HORIZONTAL CURVATURE (Degrees)___ [x] Tangent
COMMENTS ON DEVIATIONS FROM DESIRED SITE LOCATION CRITERIA
Due to cut/fill requirements, the transition between test sections #3 and #4 will be 1158 meters. No access or outlet roadways exist between these sections.

OTHER SHRP TEST SECTIONS

DOES AGENCY DESIGN CONFORM TO GPS-1, GPS-2, GPS-6 OR GPS-7 PROJECT CRITERIA? [ ] YES [x] NO
DISTANCE TO NEAREST GPS TEST SECTION ON SAME ROUTE (Miles) ___
TEST SECTION NUMBER OF NEAREST GPS SECTION ___
ARE OTHER SPS SECTIONS LOCATED ON SAME PROJECT? [ ] YES [x] NO
IF YES: [ ] SPS-1 [ ] SPS-5 [ ] SPS-6 [ ] OTHER

SUPPLEMENTAL TEST SECTIONS

IF SUPPLEMENTAL EXPERIMENTAL TEST SECTIONS ARE PROPOSED, COMPLETE THE FOLLOWING:
TOTAL NUMBER OF SUPPLEMENTAL TEST SECTIONS ___
FACTORS TO BE INVESTIGATED Polymer modified high traffic surface course mix design with PG 7622 binder vs. Superpave SPS-9A

APPENDIX B

MIX DESIGNS

Zack Stewart
Northern District Commissioner

Wayne O. Burkes
Central District Commissioner

Ronnie Shows
Southern District Commissioner

MDOT

Dr. Robert L. Robinson
Executive Director

James D. Quin
Deputy Executive Director/
Chief Engineer

Mississippi Department of Transportation / P O Box 1850 / Jackson, MS 39215-1850 / FAX (601) 359-7110

August 16, 1995

NAME	INFO	ACTN	COPY
BR			
MG			
MG	✓		
File:			

Mr. Ronald J. Cominsky, P.E.
Brent Rauhut Engineering, Inc.
8240 MoPac, Suite 220
Austin, Texas 78759

Dear Mr. Cominsky:

SUBJECT: MISSISSIPPI SPS 9-A PROJECT

Attached for your information are copies of the mix designs for the subject project. The state agency mix will be the same as the SUPERPAVE™ PG 64-22. If additional information is needed, please advise.

Sincerely,

Alfred B. Crawley
Research Engineer

Attachments

pc: Mr. Mark Gardner (w/attachments)
SPS 9-A file

C \MSOFFICE\WINWORD\LTPPSHRP\SPS9AMX2 DOC

86-01

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: District Materials Engineer (Walker) DATE: August 14, 1995

FROM: Laboratory Operations Engineer (Crisco) ALC

SUBJECT OR PROJECT NO: 59-0055-04-061-10
Bituminous Mix Design for Superpave Surface (12.5 mm Nominal Size) (PG 64-22)

COUNTY: Panola

INFORMATION COPY TO:
Central File
Research Engineer (Crawley
State Construction Engineer (James)
Contract Administration Division (Deaton)
District Engineer (Langley)
Project Engineer (Allen)
I. A. S. Section (Leatherwood)
Lehman-Roberts Company
Asphalt Design Section
Lab File

We are attaching results of our tests on aggregates submitted for use for Superpave Surface (12.5 mm Nominal Size) (PG 64-22) mix on the above captioned project.

The job mix formula shown on the attached is recommended by this office for use on the above project. Final acceptance of this job mix formula shall be contingent upon the plant produced mixture obtaining the required characteristics and upon proper placement qualities at the time the mix is laid.

ALC/cla

Attachments

TMD-042
(Rev. 7-91)

Richard Allen **MISSISSIPPI DEPARTMENT OF TRANSPORTATION** (12.5mm Nominal Size)

BITUMINOUS HOT MIX DESIGN FOR Superpave Surface Course(s) (PG64-22)

Test Code	
0	021

Cost Distribution										
Fd	A/C No	Func	Obj	Detail Code						Par
12	7211	154	846	59	0055	04	061	1	0	1

Quantity	
1	0

MSHD No. 9619336 Accept Code 4 Resp. Code 14 Date August 10, 1995

Project No. 59-0055-04-061-10 County Panola Sub-Contractor _____ Contractor Lehman-Roberts Co.

TEST DATA: [X] Original Design: [ ] Revised Design: [ ] Transfer from Project

Sample No.	A5532	A5533	A5534	A5535	A5536	A5537	Agg Blend	Job Mix	Spec.
Type Material	3/4 Crushed Gravel	1/2 Crushed Gravel	Manuf. Sand	Coarse Sand	#10 Lst	Hyd Lime			
Aggregate Source	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Vicn (KY)	Falco			
Recommended Mtl. Blend (%)	11	49	13	12	14	1	% Passing	% Passing	Design Range
Sieve Size	Gradation (Percent by Weight Passing)								
1 1/2"									
1"									
3/4"	100.0						100.0	100	100
1/2"	60.0	100.0	100.0				95.6	96	90-100
3/8"	23.0	85.0	96.0	100.0	100.0		83.7	84	
No. 4	5.0	44.0	62.0	99.0	90.0		55.7	56	
No. 8	1.0	22.0	32.0	94.0	62.0		36.0	36	28-58
No. 16	0.0	12.0	19.0	79.0	31.0		23.2	23	
No. 30		7.0	14.0	61.0	26.0	100.0	17.2	17	
No. 50		5.0	12.0	12.0	19.0	99.0	9.1	9	
No. 200		2.5	4.5	0.5	10.0	97.0	4.2	4.2	2-10
App. Sp. Grav.	2.623	2.650	2.617	2.657	2.702	2.274	A C	5.70	
Bulk Sp. Grav.	2.535	2.518	2.470	2.590	2.671	2.274	Job Mix Temperature	300	°F
% Total Clay				2.4			Air Voids	4.0	%
PI-40 Mtl.				NP			VMA 14.9 %	Flow	
% Abs. Moisture	1.30	2.00	2.40	0.97	0.43	0.00	Max. Sp. Grav.	2.393	
Anti-strip None		Rate		% by weight of AC			Comb. Bulk Sp. Grav.	2.540	
Asphalt Source Marathon		TSR 86.1		Stability			Absorbed A C.	0.90	%
Remarks: Sand Equivalent = 62 Flat & Elong Particles = 0 F.A. Angularity = 45.4 C.A. Angularity = 96/92 Abs. Moist. (Blend) = 1.61							Effective A C	4.80	%

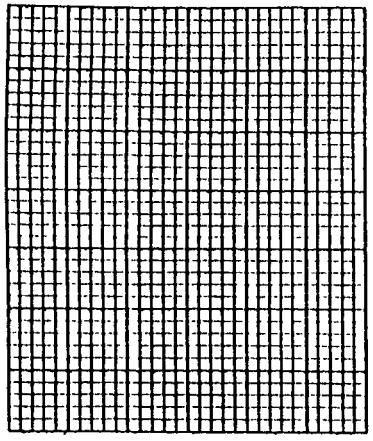
The percentage of Asphalt Cement (PG64-22) to be used with the above blend of mineral aggregates for the Superpave Surface (12.5mm Nominal Size) (PG64-22) Course(s) is 5.70 % by weight of the total mixture.

SUBMITTED BY: L.J. Pepper

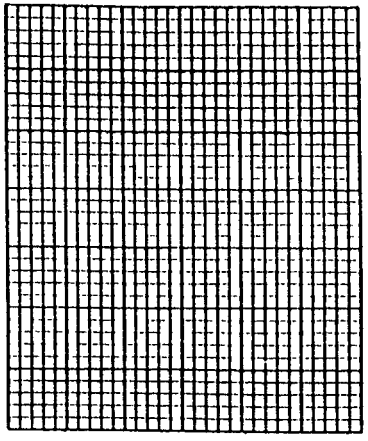
Asphalt Design Section

ND 106

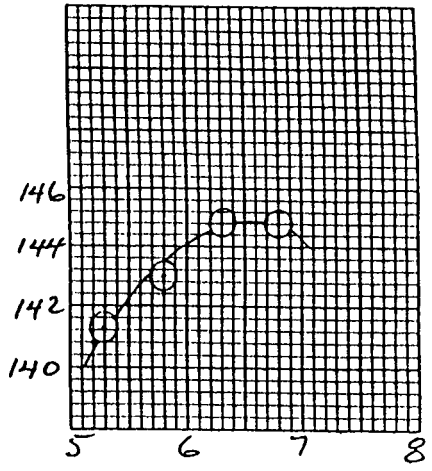
FLOW-1/100 INCHES



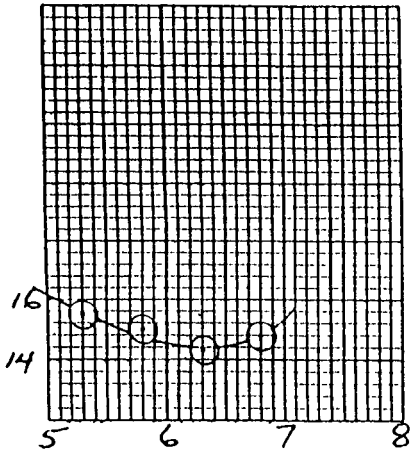
STABILITY-LBS



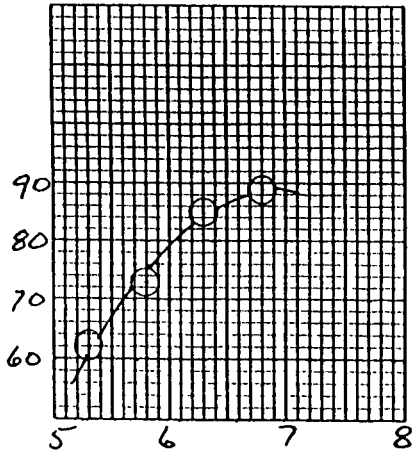
UNIT WEIGHT-LBS PER CU FT
TOTAL MIX



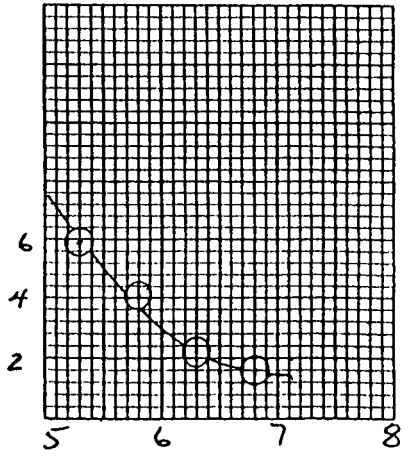
ND 106
PERCENT V.M.A.



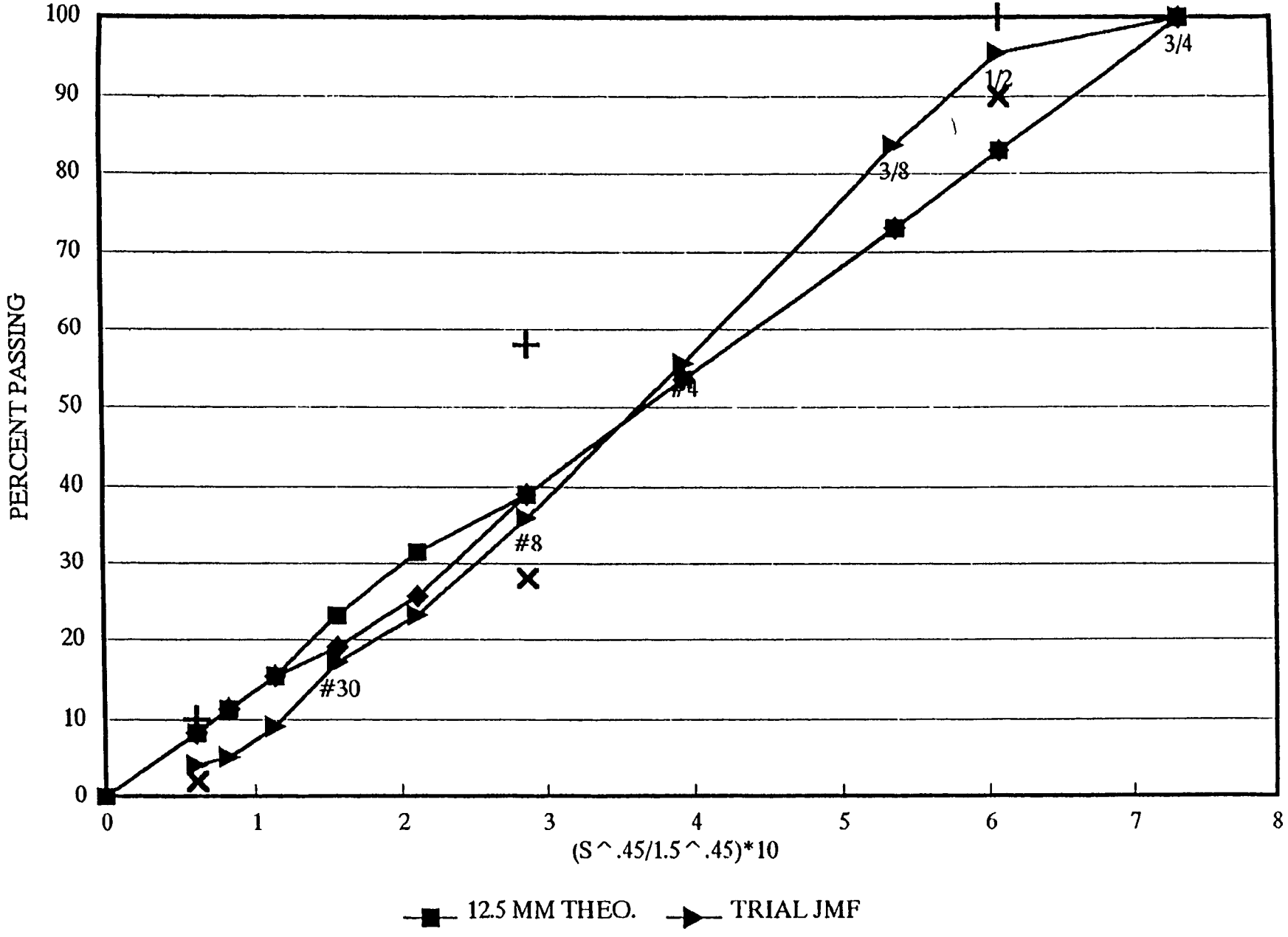
ND 106
PERCENT V.F.A.



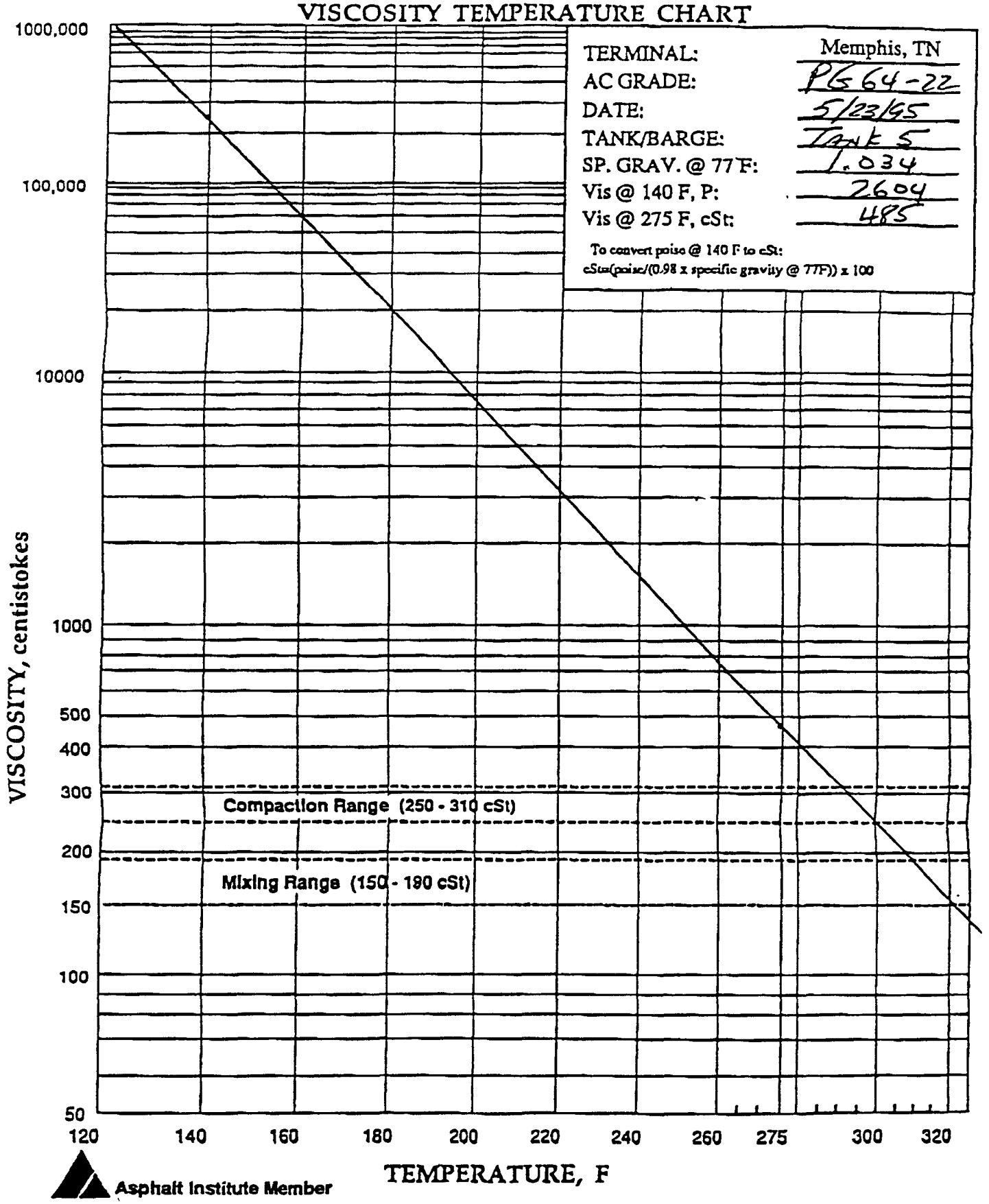
ND 106
PERCENT VOIDS-TOTAL MIX



12.5 MM NOMINAL SIZE GRADATION ANALYSIS



MARATHON OIL COMPANY
VISCOSITY TEMPERATURE CHART



96-01

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: District Materials Engineer (Walker) DATE: August 14, 1995

FROM: Laboratory Operations Engineer (Crisco) ALC

SUBJECT OR PROJECT NO: 59-0055-04-061-10
Bituminous Mix Design for Superpave Surface (12.5 mm Nominal Size) (PG 58-22)

COUNTY: Panola

INFORMATION COPY TO:
Central File
Research Engineer (Crawley ✓
State Construction Engineer (James)
Contract Administration Division (Deaton)
District Engineer (Langley)
Project Engineer (Allen)
I. A. S. Section (Leatherwood)
Lehman-Roberts Company
Asphalt Design Section
Lab File

We are attaching results of our tests on aggregates submitted for use for Superpave Surface (12.5 mm Nominal Size) (PG 58-22) mix on the above captioned project.

The job mix formula shown on the attached is recommended by this office for use on the above project. Final acceptance of this job mix formula shall be contingent upon the plant produced mixture obtaining the required characteristics and upon proper placement qualities at the time the mix is laid.

ALC/cla

Attachments

TMD-042 (Rev. 7-81) Richard Allen

MISSISSIPPI DEPARTMENT OF TRANSPORTATION (12 mm Nominal Size)

BITUMINOUS HOT MIX DESIGN FOR Superpave Surface Course(s) (PG 58-22)

Test Code
0 021

Cost Distribution										
Fd.	A/C No	Func	Obj	Detail Code						Par
12	7211	154	846	59	0055	04	061	1	0	1

Quantity
0 0

MSHD No. 9619337 Accept Code 4 Resp. Code 14 Date August 10,1995

Project No 59-0055-04-061-10 County Pahola Sub-Contractor _____ Contractor Lehman-Roberts Company

TEST DATA ☒ Original Design: ☐ Revised Design: ☐ Transfer from Project

Sample No.	A5538	A5539	A5540	A5541	A5542	A5543	Agg. Blend	Job Mix	Spec.
Type Material	3/4 Crushed Gravel	1/2 Crushed Gravel	Manuf. Sand	Coarse Sand	#10 Lst	Hyd Lime			
Aggregate Source	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Vicn (KY)	Falco			
Recommended Mtl. Blend (%)	11	49	13	12	14	1	% Passing	% Passing	Design Rahde
Sieve Size	Gradation (Percent by Weight Passing)								
1 1/2"									
1"									
3/4"	100.0						100.0	100	100
1/2"	60.0	100.0	100.0				95.6	96	90-100
3/8"	23.0	85.0	96.0	100.0	100.0		83.7	84	
No. 4	5.0	44.0	62.0	99.0	90.0		55.7	56	
No. 8	1.0	22.0	32.0	94.0	62.0		36.0	36	28-58
No. 16	0.0	12.0	19.0	79.0	31.0		23.2	23	
No. 30		7.0	14.0	61.0	26.0	100.0	17.2	17	
No. 50		5.0	12.0	12.0	19.0	99.0	9.1	9	
No. 200		2.5	4.5	0.5	10.0	97.0	4.2	4.2	2-10
App. Sp. Grav.	2.623	2.650	2.617	2.657	2.702	2.274	A. C.	5.70	
Bulk Sp. Grav.	2.535	2.518	2.470	2.590	2.671	2.274	Job Mix Temperature	300	°F
% Total Clay				2.4			Air Voids	4.0	%
PI-40 Mtl.				NP			VMA 14.9 %	Flow	
% Abs. Moisture	1.30	2.00	2.40	0.97	0.43	0.00	Max. Sp. Grav.	2.393	
Anti-strip None		Rate		% by weight of AC			Comb. Bulk Sp. Grav.	2.540	
Asphalt Source Marathon		TSR 86.1		Stability			Absorbed A. C.	0.90 %	
Remarks: Sand Equivalent = 62 F.A. Angularity = 45.4		Flat & Elong Particles = 0 C.A. Angularity = 96/92 % Abs. Moist.(Blend) = 1.61					Effective A. C.	4.80 %	

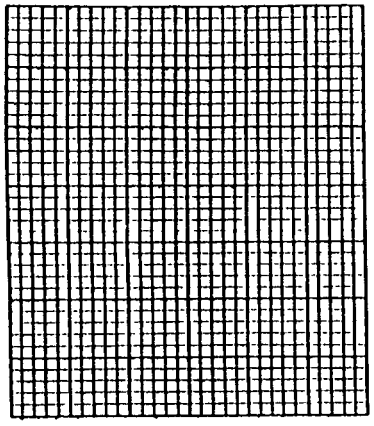
The percentage of Asphalt Cement (PG58-22) to be used with the above blend of mineral aggregates for the Superpave Surface (12.5 mm Nominal Size) (PG 58-22) Course(s) is 5.70 % by weight of the total mixture.

SUBMITTED BY: L.J. Pepper

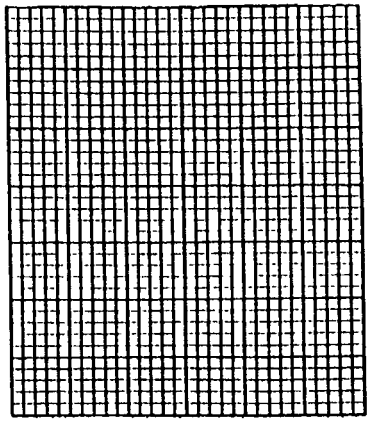
Asphalt Design Section

ND 106

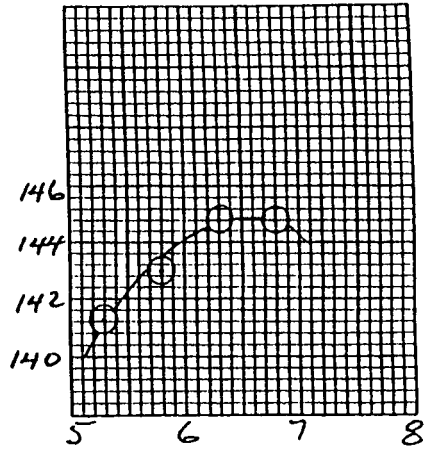
FLOW-1/100 INCHES



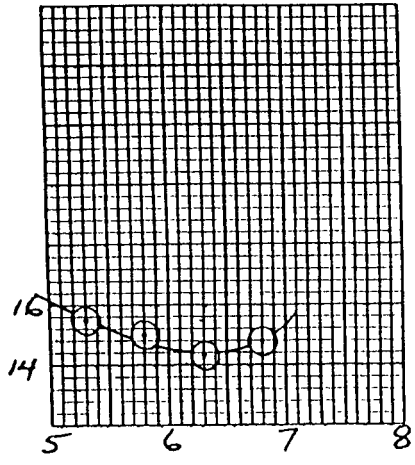
STABILITY-LBS



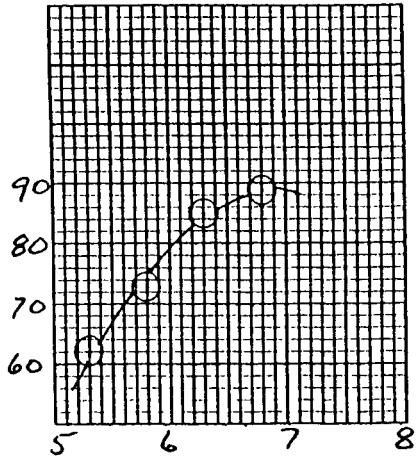
UNIT WEIGHT-LBS PER CU FT
TOTAL MIX



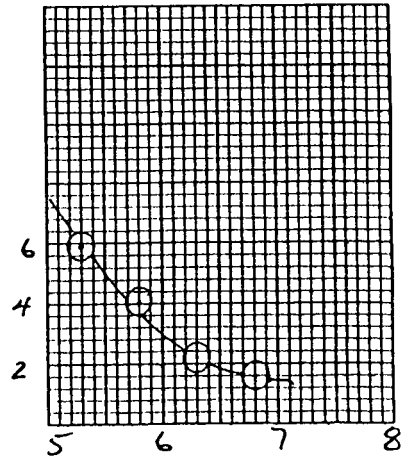
ND 106
PERCENT V.M.A.



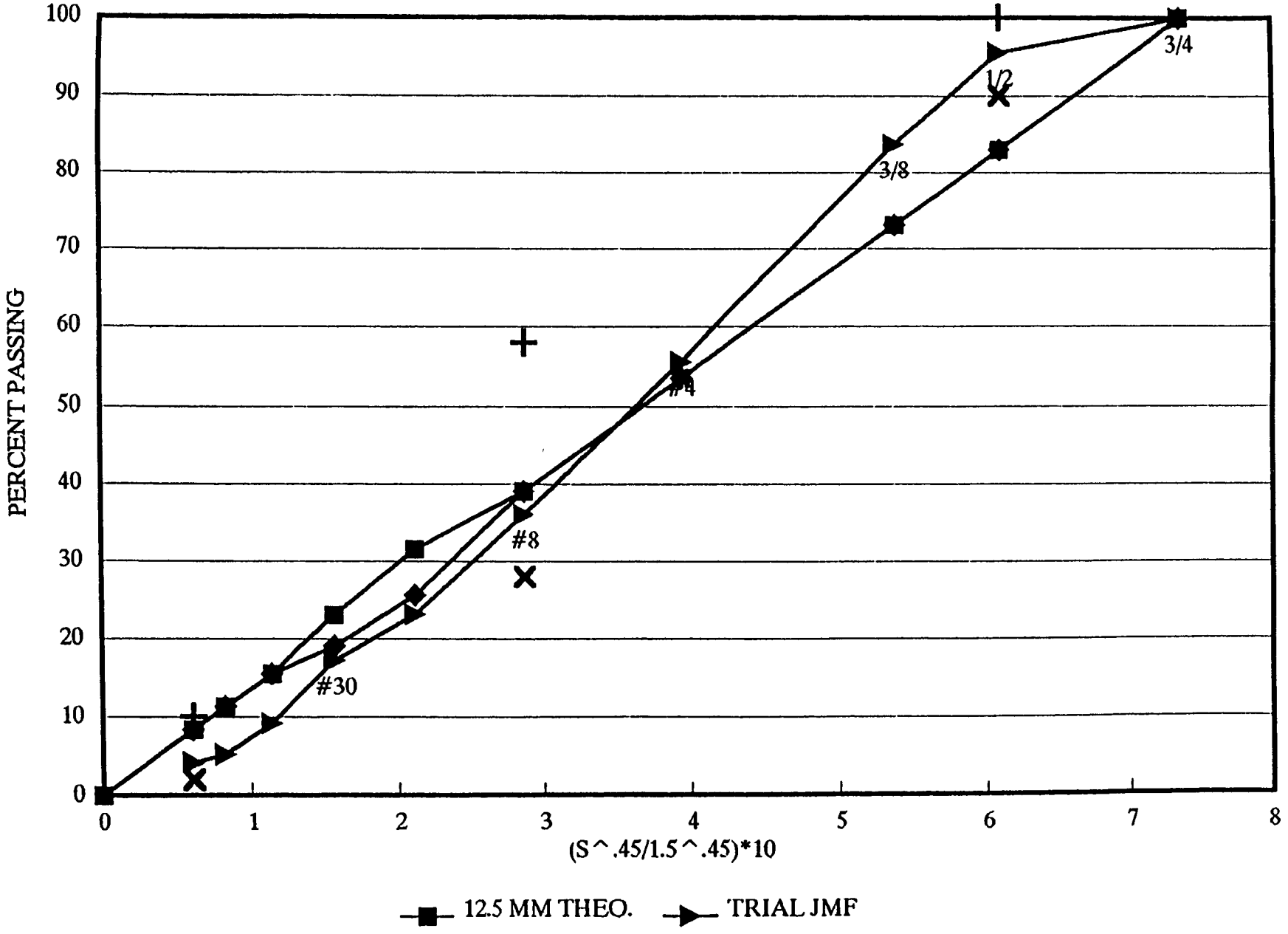
ND 106
PERCENT V.F.A.



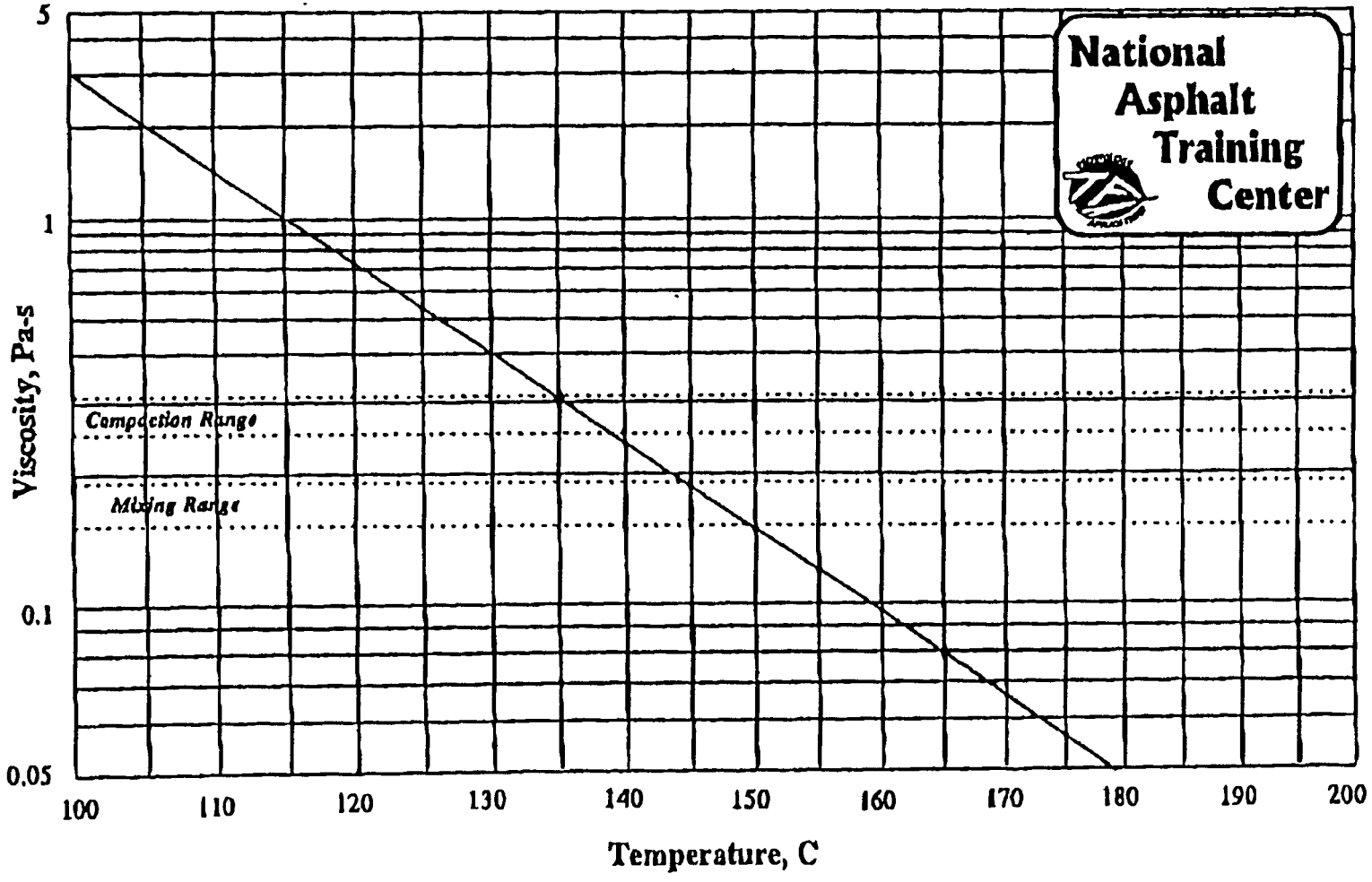
ND 106
PERCENT VOIDS-TOTAL MIX



12.5 MM NOMINAL SIZE GRADATION ANALYSIS



PG 58-22
Typical



86-01

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

Inter-Departmental Memorandum

TO: District Materials Engineer (Walker)

DATE: August 14, 1995

FROM: Laboratory Operations Engineer (Crisco) ALC

SUBJECT OR PROJECT NO: 59-0055-04-061-10
Bituminous Mix Design for Superpave Surface (12.5 mm Nominal Size) (PG 76-22)

COUNTY: Panola

INFORMATION COPY TO:
Central File
Research Engineer (Crawley
State Construction Engineer (James)
Contract Administration Division (Deaton)
District Engineer (Langley)
Project Engineer (Allen)
I. A. S. Section (Leatherwood)
Lehman-Roberts Company
Asphalt Design Section
Lab File

We are attaching results of our tests on aggregates submitted for use for Superpave Surface (12.5 mm Nominal Size) (PG 76-22) mix on the above captioned project.

The job mix formula shown on the attached is recommended by this office for use on the above project. Final acceptance of this job mix formula shall be contingent upon the plant produced mixture obtaining the required characteristics and upon proper placement qualities at the time the mix is laid.

ALC/cla

Attachments

TMD-042 (Rev. 7-91) Richard Allen

MISSISSIPPI DEPARTMENT OF TRANSPORTATION

BITUMINOUS HOT MIX DESIGN FOR Superpave Surface Course(s) (12.5 mm Nominal Size) (PG 76-22)

Test Code
0 021

Cost Distribution									
Fd	A/C No	Func	Obj	Detail Code					Par
12	7211	154	846	590055	04	061	1	0	1

Quantity
1 0

MSHD No. 9619338 Accept Code 4 Resp. Code 14 Date August 10, 1995

Project No. 59-0055-04-061-10 County Panola Sub-Contractor _____ Contractor Lehman-Roberts Co.

TEST DATA [X] Original Design: [ ] Revised Design: [ ] Transfer from Project

Sample No.	A5544	A5545	A5546	A5547	A5548	A5549	Agg Blend	Job Mix	Spec
Type Material	3/4 Cr. Gravel	1/2 Cr. Gravel	Manuf. Sand	Coarse Sand	#10 Lst	Hyd Lime			
Aggregate Source	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Memphis S&G Batesville	Vicn (KY)	Falco			
Recommended Mtl. Blend (%)	11	49	13	12	14	1	% Passing	% Passing	Design Range
Sieve Size	Gradation (Percent by Weight Passing)								
1 1/2"									
1"									
3/4"	100.0						100.0	100	100
1/2"	60.0	100.0	100.0				95.6	96	90-100
3/8"	23.0	85.0	96.0	100.0	100.0		83.7	84	
No. 4	5.0	44.0	62.0	99.0	90.0		55.7	56	
No. 8	1.0	22.0	32.0	94.0	62.0		36.0	36	28-58
No. 16	0.0	12.0	19.0	79.0	31.0		23.2	23	
No. 30		7.0	14.0	61.0	26.0	100.0	17.2	17	
No. 50		5.0	12.0	12.0	19.0	99.0	9.1	9	
No. 200		2.5	4.5	0.5	10.0	97.0	4.2	4.2	2-10
App. Sp. Grav.	2.623	2.650	2.617	2.657	2.702	2.274	A C.	5.70	
Bulk Sp Grav.	2.535	2.518	2.470	2.590	2.671	2.274	Job Mix Temperature	300	°F
% Total Clay				2.4			Air Voids	4.0	%
PI-40 Mtl.				NP			VMA	14.9 %	Flow
% Abs Moisture	1.30	2.00	2.40	0.97	0.43	0.00	Max Sp Grav.	2.393	
Anti-strip None		Rate		% by weight of AC			Comb Bulk Sp Grav.	2.540	
Asphalt Source Marathon		TSR 86.1		Stability			Absorbed A C.	0.90	%
Remarks: Sand Equivalent = 62 F.A. Angularity = 45.4		Flat & Elong Particles = 0 C.A. Angularity = 96/92					Effective A C	4.80	%
		% Abs. Moist. (Blend) = 1.61							

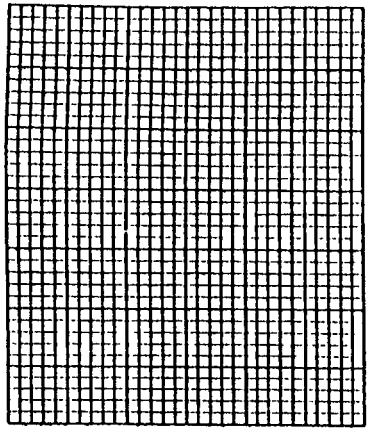
The percentage of Asphalt Cement (PG76-22) to be used with the above blend of mineral aggregates for the Superpave Surface (12.5mm Nominal Size) (PG76-22) Course(s) is 5.70 % by weight of the total mixture.

SUBMITTED BY: L.J. Pepper

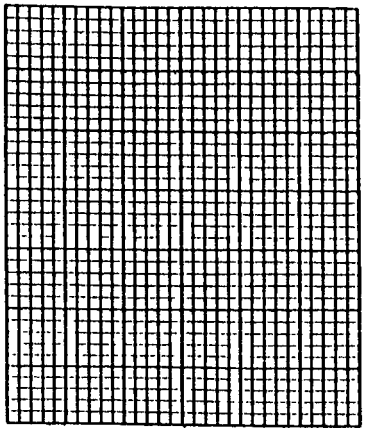
Asphalt Design Section

ND 106

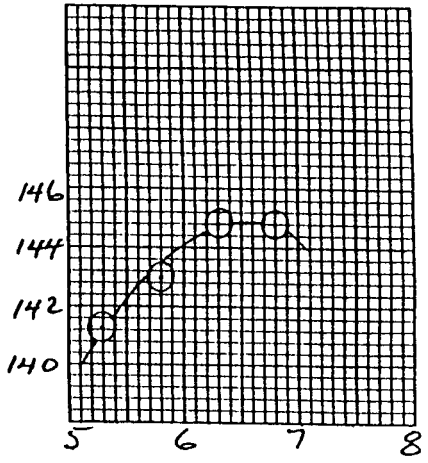
FLOW-1/100 INCHES



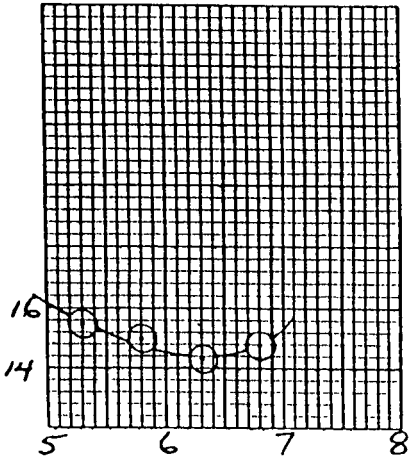
STABILITY-LBS



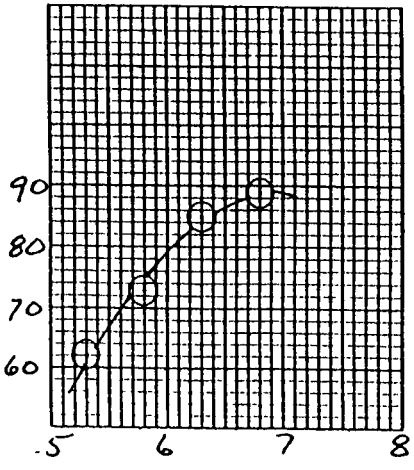
UNIT WEIGHT-LBS PER CU FT
TOTAL MIX



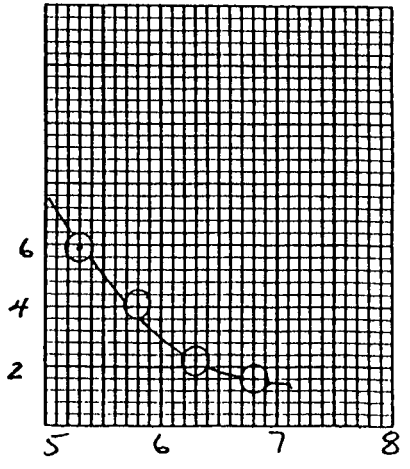
ND 106
PERCENT V.M.A.



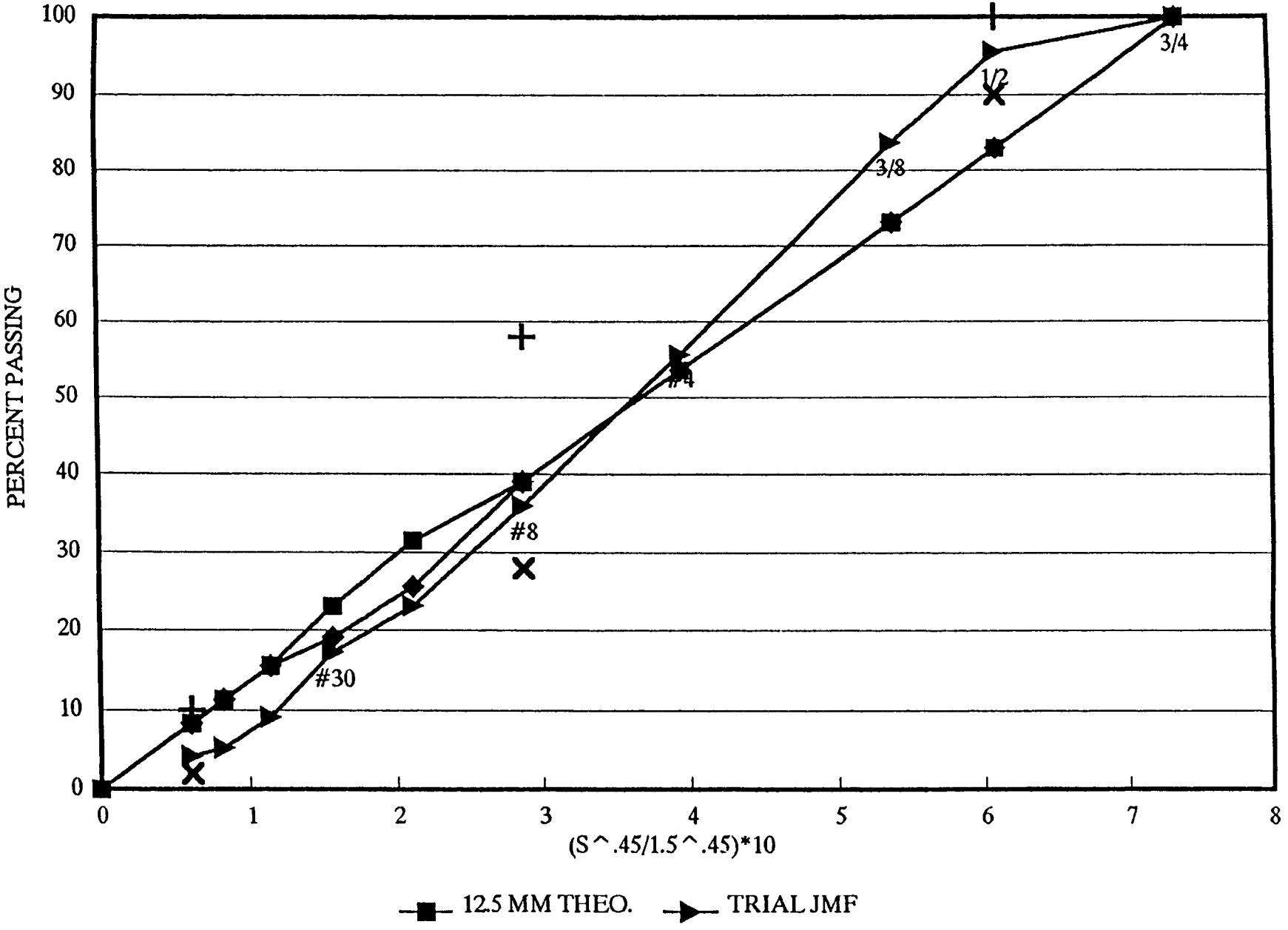
ND 106
PERCENT V.F.A.



ND 106
PERCENT VOIDS-TOTAL MIX



12.5 MM NOMINAL SIZE GRADATION ANALYSIS



For: Lehman Roberts I-55 SP59A
PG Grade 76-72

From: Koch Materials Co. - Memphis, TN.

Temperature-Viscosity Graphs

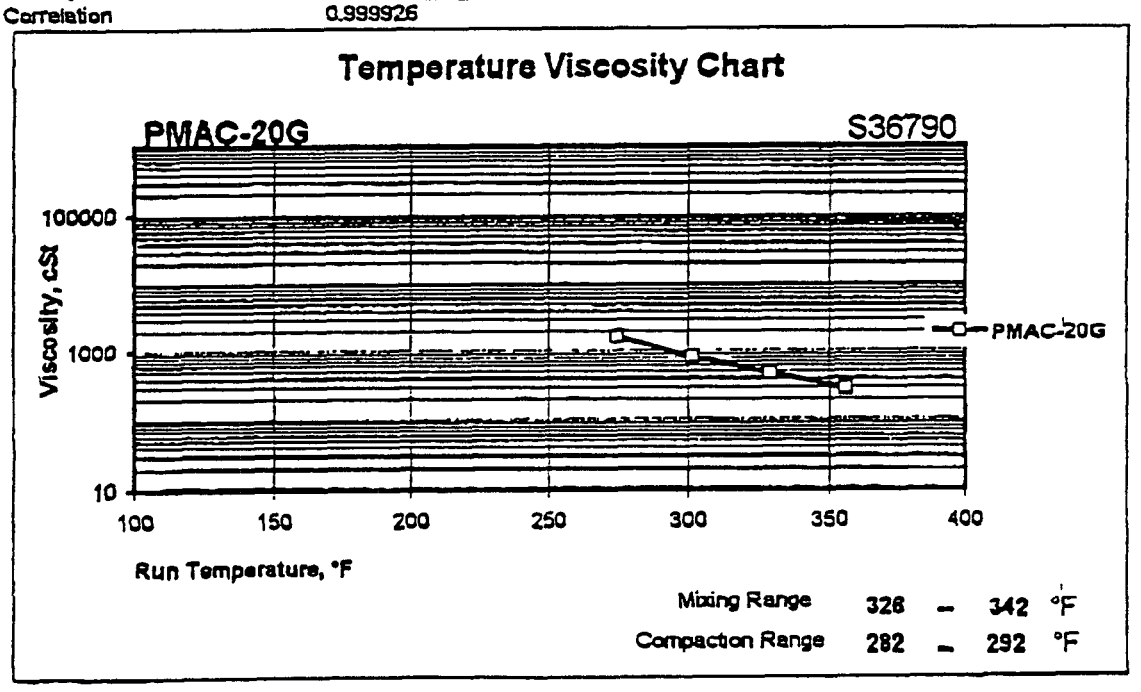
Material	PMAC-20G
Polymer Loading, %	
Sample #	S36790
Specific Gravity, 15°C	1.031

Temp °C	Temp °F	Viscosity cps
135	275	1610
150	302	810
165	329	465
180	356	280

Instructions: 1. Fill in the type of Material and the sample #. 2. Fill in the polymer loading. 3. Enter zero for conventional asphalt (ASTM D 1559 criteria will be used). 4. Fill in the specific gravity of the Material. 6. Fill in the temperature; if you know the °F, put that in, otherwise the spreadsheet will calculate °F if the °C is entered.

Notes: 1. There must be data in the Polymer Loading, Specific Gravity, all the Temp °F and Viscosity boxes 2. Data points may be repeated. 3. If the polymer loading is greater than 6%, the recommendations may be inaccurate! Fortunately, finished products seldom exceed 6%. 4. The graph may be copied and pasted onto work order or other spreadsheets. 5. This worksheet should be saved on a network drive with the file name such as: S36XXXTV.XLS. 6. Report any problems or constructive criticism on this sheet to Mickey Hines

	°F			
Mixing Hi Limit	342	@	340	cSt
Mixing Low Limit	326	@	460	cSt
Compaction High Limit	292	@	990	cSt
Compaction Low Limit	282	@	1270	cSt
Correlation	0.999926			

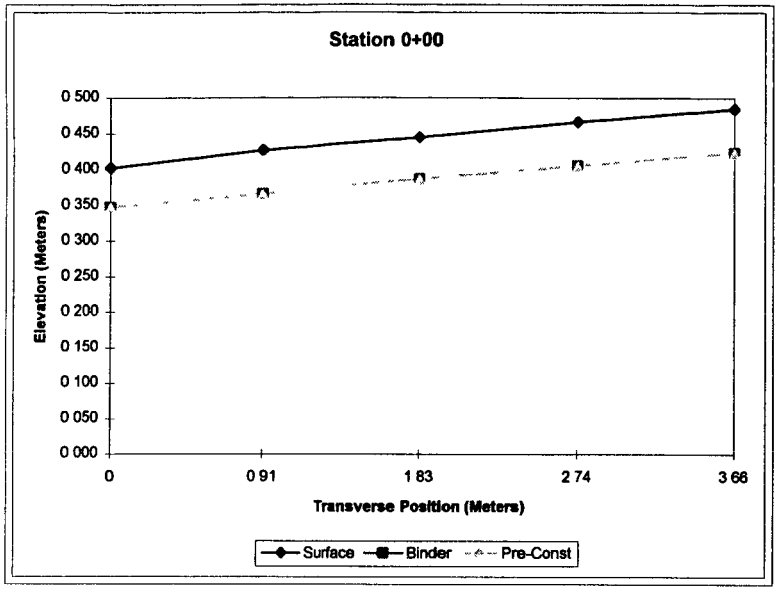


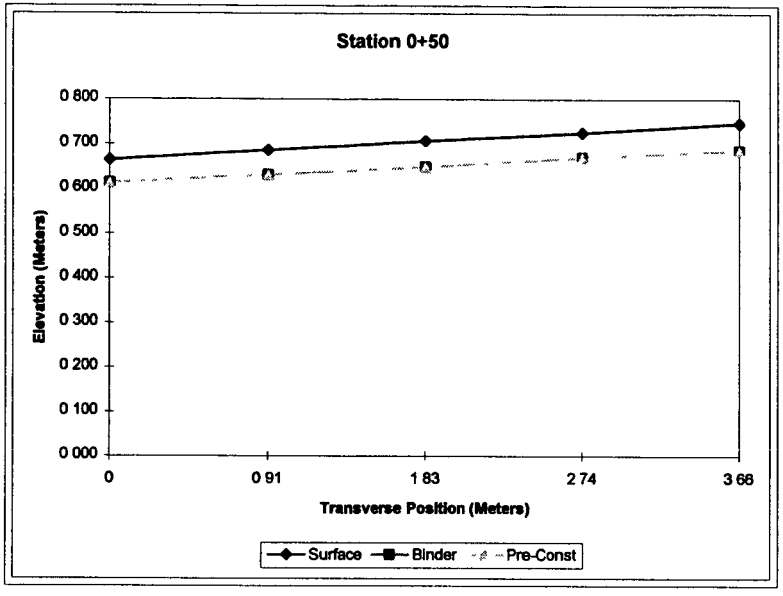
APPENDIX C

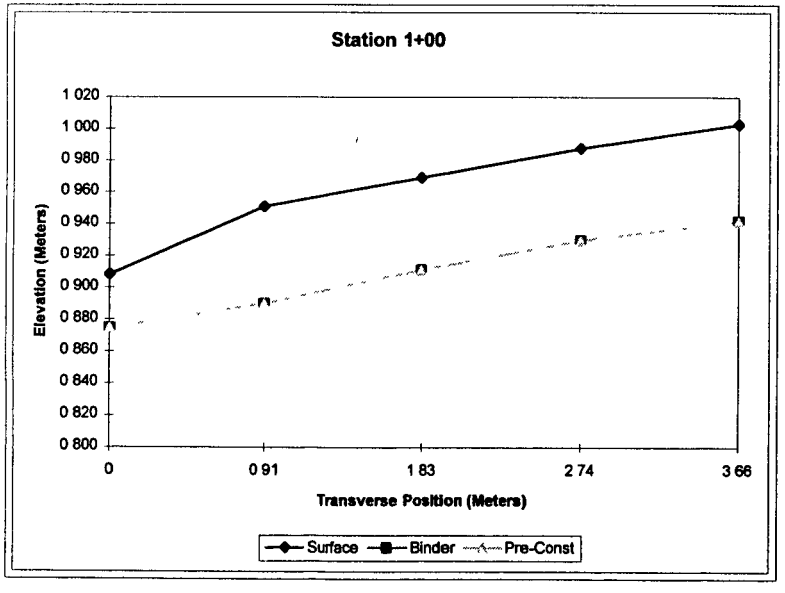
SURFACE PROFILE DATA

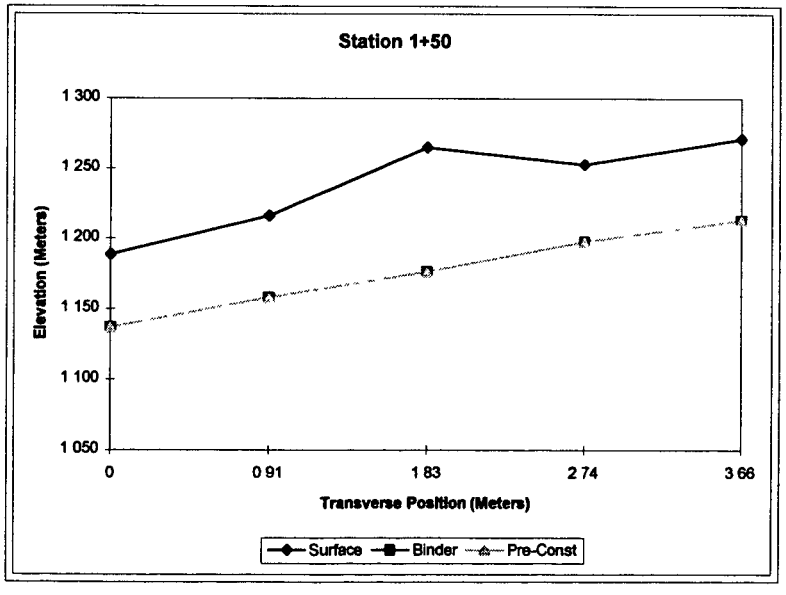
Mississippi, SPS-9, (280902)

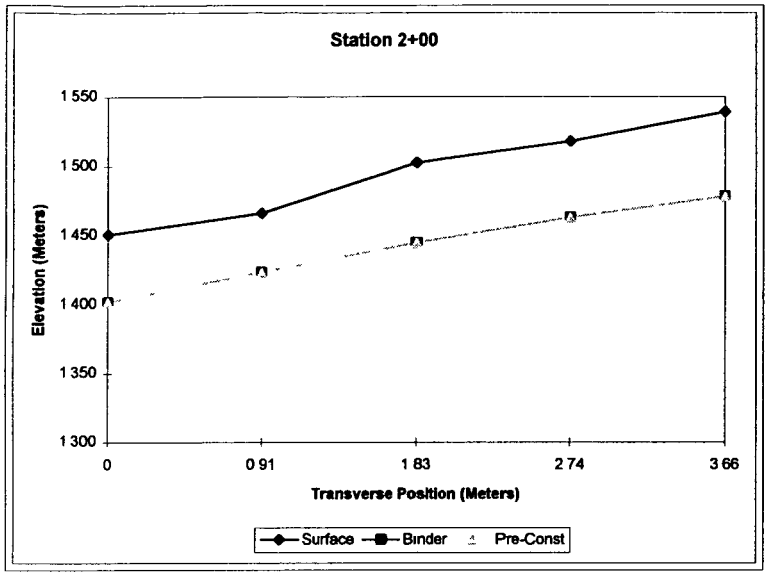
Transverse Offset	3 LAYERS	ELEVATION 0 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 0.91 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 1.83 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 2.74 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 3.66 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters
0+00	Surface	0 402	0 055	0 000	0 427	0 061	0 000	0 445	0 058	0 000	0 466	0 061	0 000	0 485	0 061	0 000
	Binder	0 347			0 366			0 387			0 405			0 424		
	Pre-Const	0 347			0 366			0 387			0 405			0 424		
0+50	Surface	0 664	0 052	0 000	0 686	0 055	0 000	0 707	0 058	0 000	0 725	0 055	0 000	0 747	0 061	0 000
	Binder	0 613			0 631			0 649			0 671			0 686		
	Pre-Const	0 613			0 631			0 649			0 671			0 686		
1+00	Surface	0 908	0 034	0 000	0 951	0 061	0 000	0 969	0 058	0 000	0 988	0 058	0 000	1 003	0 061	0 000
	Binder	0 875			0 890			0 911			0 930			0 942		
	Pre-Const	0 875			0 890			0 911			0 930			0 942		
1+50	Surface	1 189	0 052	0 000	1 216	0 058	0 000	1 265	0 088	0 000	1 253	0 055	0 000	1 271	0 058	0 000
	Binder	1 137			1 158			1 177			1 198			1.213		
	Pre-Const	1 137			1 158			1 177			1 198			1 213		
2+00	Surface	1 451	0 049	0 000	1 466	0 043	0 000	1 503	0 058	0 000	1 518	0 055	0 000	1 539	0 061	0 000
	Binder	1 402			1 423			1 445			1 463			1 478		
	Pre-Const	1 402			1 423			1 445			1 463			1 478		
2+50	Surface	1 713	0 055	0 000	1 737	0 055	0 000	1 759	0 058	0 000	1 777	0 058	0 000	1 795	0 061	0 000
	Binder	1 658			1 682			1 701			1 719			1 734		
	Pre-Const	1 658			1 682			1 701			1 719			1 734		
3+00	Surface	1 984	0 055	0 000	2 009	0 055	0 000	2 030	0 061	0 000	2 045	0 058	0 000	2 067	0 061	0 000
	Binder	1 929			1 954			1 969			1 987			2 006		
	Pre-Const	1 929			1 954			1 969			1 987			2 006		
3+50	Surface	2 256	0 052	0 000	2 283	0 061	0 000	2 304	0 061	0 000	2 320	0 058	0 000	2 341	0 061	0 000
	Binder	2 204			2 222			2 243			2 262			2 280		
	Pre-Const	2 204			2 222			2 243			2 262			2 280		
4+00	Surface	2 509	0 037	0 000	2 548	0 055	0 000	2 573	0 061	0 000	2 591	0 061	0 000	2 643	0 094	0 000
	Binder	2 472			2 493			2 512			2 530			2 548		
	Pre-Const	2 472			2 493			2 512			2 530			2 548		
4+50	Surface	2 789	0 049	0 000	2 816	0 058	0 000	2 832	0 058	0 000	2 853	0 064	0 000	2 871	0 064	0 000
	Binder	2 740			2 758			2 774			2 789			2 807		
	Pre-Const	2 740			2 758			2 774			2 789			2 807		
5+00	Surface	3 036	0 046	0 000	3 063	0 055	0 000	3 088	0 061	0 000	3 106	0 061	0 000	3 121	0.061	0 000
	Binder	2 990			3 008			3 027			3 045			3 060		
	Pre-Const	2 990			3 008			3 027			3 045			3 060		
	AVG	0 048	0 000		0.057	0.000		0.062	0.000		0.059	0.000		0.064	0.000	
	MAX	0.055	0.000		0.061	0.000		0.088	0.000		0.064	0.000		0.094	0.000	
	MIN	0 055	0 000		0.061	0.000		0.088	0 000		0.064	0.000		0.094	0.000	
	STD	0.007	0 000		0.003	0.000		0.009	0 000		0.003	0 000		0 010	0.000	

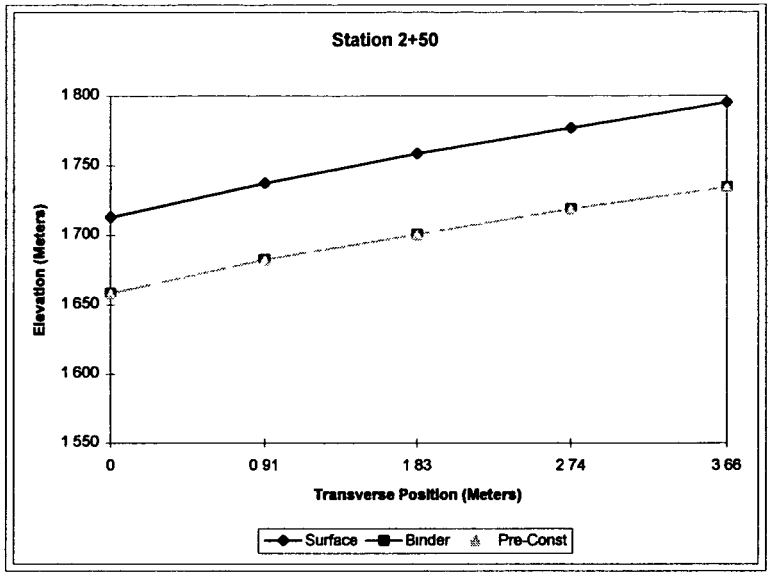

Station 0+00
0 500
0 450
0 400
0 350
0 300
0 250
0 200
0 150
0 100
0 050
0 000
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

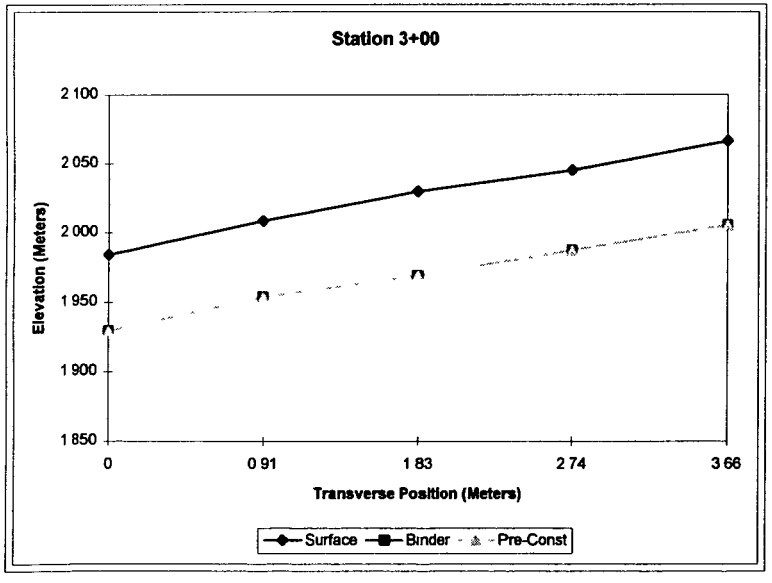

Station 0+50
0 800
0 700
0 600
0 500
0 400
0 300
0 200
0 100
0 000
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

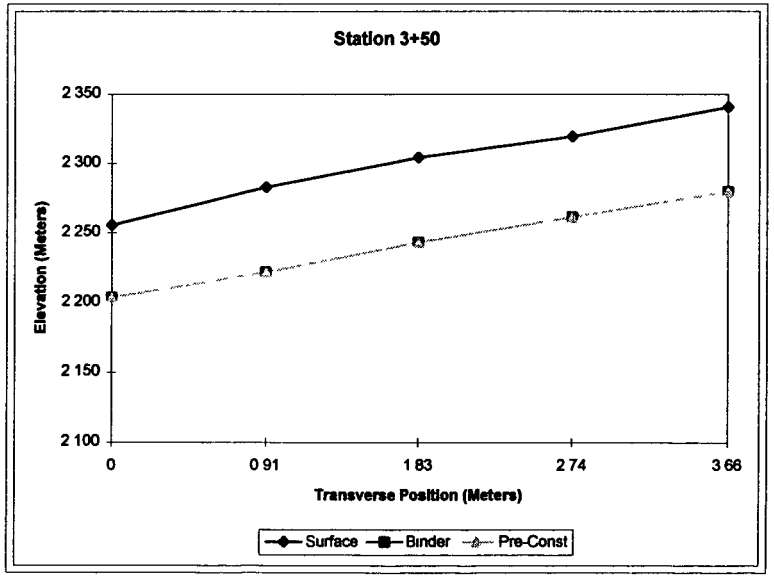

Station 1+00
1 020
1 000
0 980
0 960
0 940
0 920
0 900
0 880
0 860
0 840
0 820
0 800
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

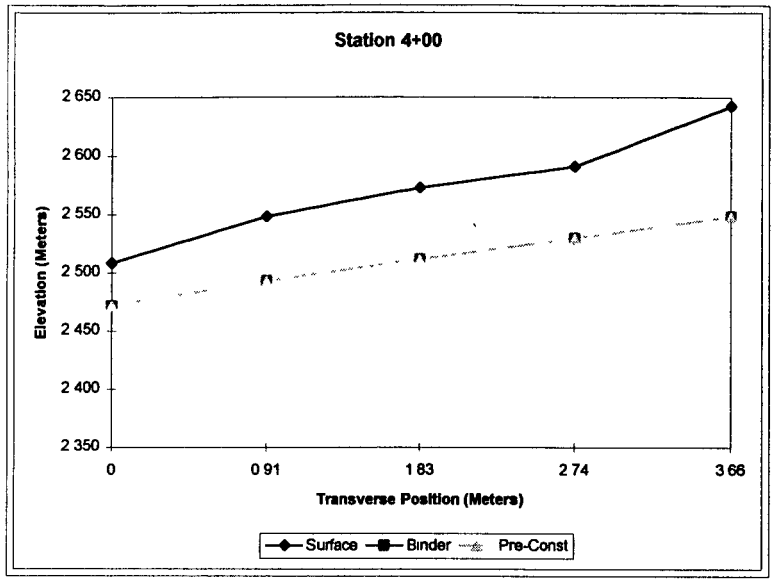

Station 1+50
1 300
1 250
1 200
1 150
1 100
1 050
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

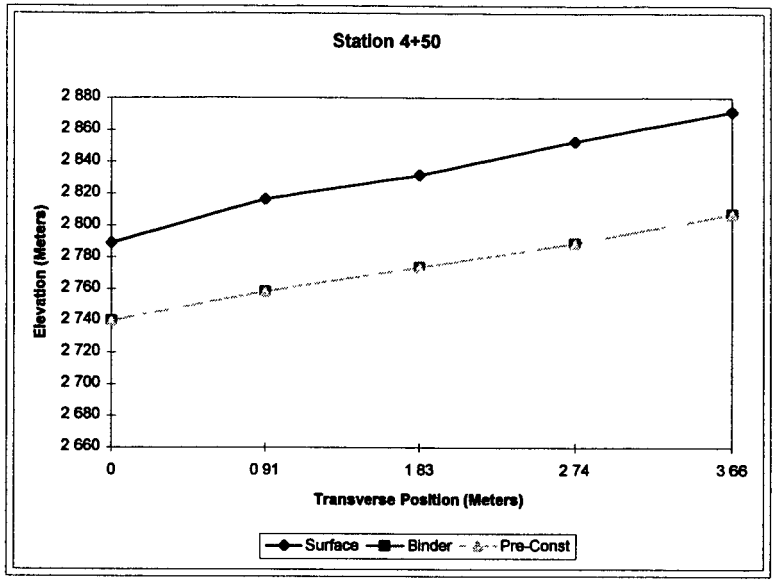

Station 2+00
1 550
1 500
1 450
1 400
1 350
1 300
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

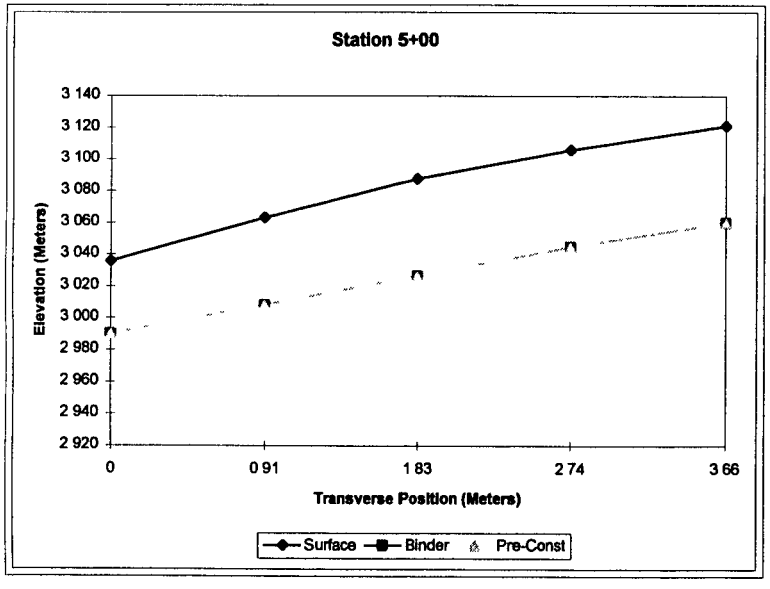

Station 2+50
1 800
1 750
1 700
1 650
1 600
1 550
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 3+00
2 100
2 050
2 000
1 950
1 900
1 850
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 3+50
2 350
2 300
2 250
2 200
2 150
2 100
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

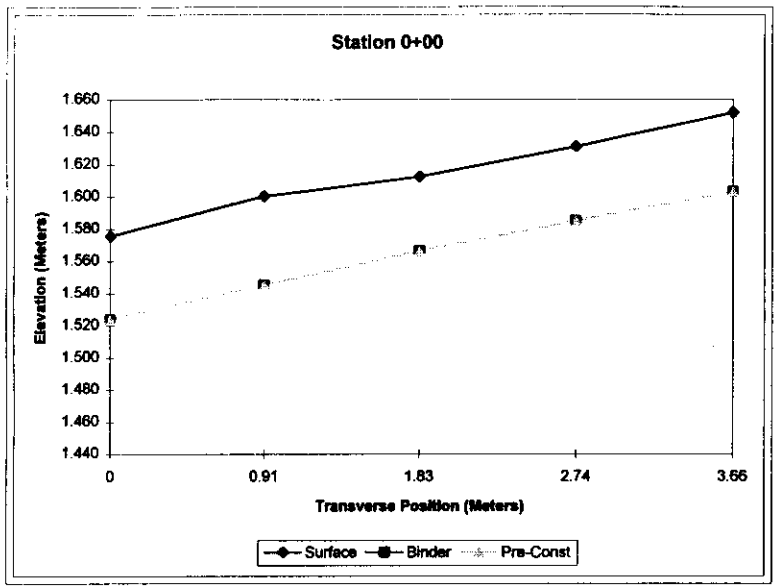

Station 4+00
2 650
2 600
2 550
2 500
2 450
2 400
2 350
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

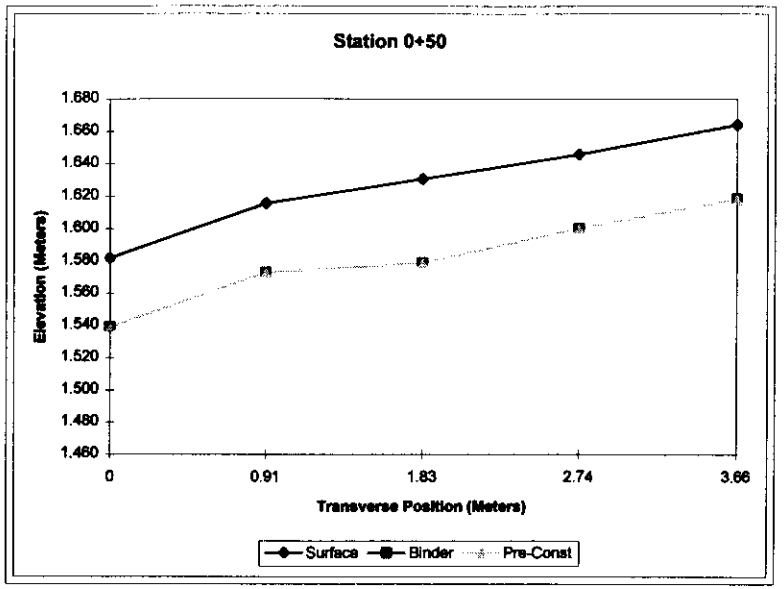

Station 4+50
2 880
2 860
2 840
2 820
2 800
2 780
2 760
2 740
2 720
2 700
2 680
2 660
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

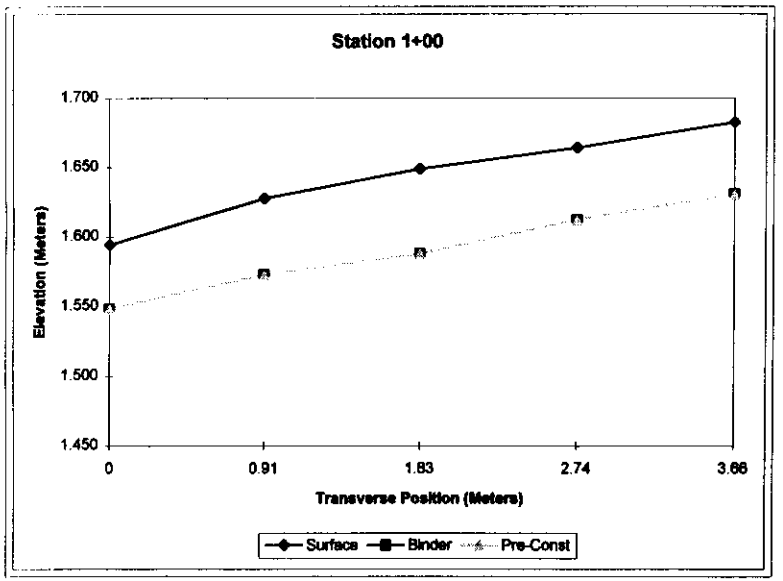

Station 5+00
3 140
3 120
3 100
3 080
3 060
3 040
3 020
3 000
2 980
2 960
2 940
2 920
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

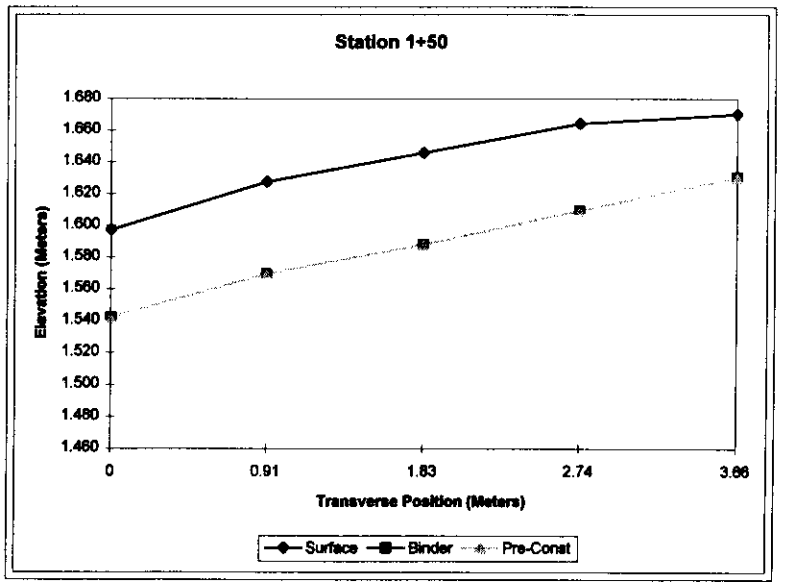
Mississippi, SPS-9, (280903)

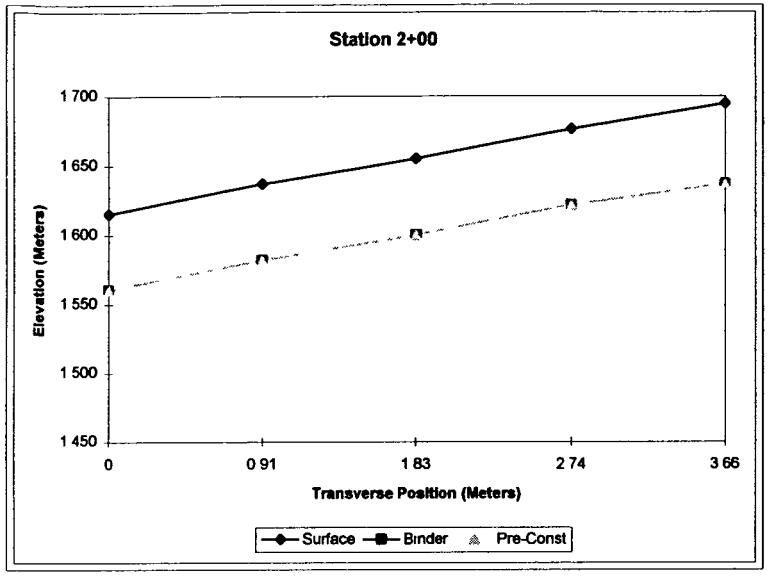
Transverse Offset	3 LAYERS	ELEVATION 0 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 0.91 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 1.83 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 2.74 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 3.66 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters
0+00	Surface	1 576	0 052	0 000	1 600	0 055	0 000	1 612	0 046	0 000	1 631	0 046	0 000	1 652	0 049	0 000
	Binder	1 524			1 545			1 567			1 585			1 603		
	Pre-Const	1 524			1 545			1 567			1 585			1 603		
0+50	Surface	1 582	0 043	0 000	1 615	0 043	0 000	1 631	0 052	0 000	1 646	0 046	0 000	1 664	0 046	0 000
	Binder	1 539			1 573			1 579			1 600			1 618		
	Pre-Const	1 539			1 573			1 579			1 600			1 618		
1+00	Surface	1 594	0 046	0 000	1 628	0 055	0 000	1 649	0 061	0 000	1 664	0 052	0 000	1 682	0 052	0 000
	Binder	1 548			1 573			1 588			1 612			1 631		
	Pre-Const	1 548			1 573			1 588			1 612			1 631		
1+50	Surface	1 597	0 055	0 000	1 628	0 058	0 000	1 646	0 058	0 000	1 664	0 055	0 000	1 670	0 040	0 000
	Binder	1 542			1 570			1 588			1 609			1 631		
	Pre-Const	1 542			1 570			1 588			1 609			1 631		
2+00	Surface	1 615	0 055	0 000	1 637	0 055	0 000	1 655	0 055	0 000	1 676	0 055	0 000	1 695	0 058	0 000
	Binder	1 561			1 582			1 600			1 622			1 637		
	Pre-Const	1 561			1 582			1 600			1 622			1 637		
2+50	Surface	1 686	0 049	0 000	1 710	0 052	0 000	1 728	0 055	0 000	1 747	0 055	0 000	1 765	0 058	0 000
	Binder	1 637			1 658			1 673			1 692			1 707		
	Pre-Const	1 637			1 658			1 673			1 692			1 707		
3+00	Surface	1 780	0 046	0 000	1 804	0 049	0 000	1 823	0 055	0 000	1 826	0 040	0 000	1 859	0 052	0 000
	Binder	1 734			1 756			1 768			1 786			1 807		
	Pre-Const	1 734			1 756			1 768			1 786			1 807		
3+50	Surface	1 890	0 046	0 000	1 923	0 061	0 000	1 939	0 055	0 000	1 960	0 055	0 000	1 978	0 049	0 000
	Binder	1 844			1 862			1 884			1 905			1 929		
	Pre-Const	1 844			1 862			1 884			1 905			1 929		
4+00	Surface	2 060	0 040	0 000	2 100	0 058	0 000	2 115	0 055	0 000	2 134	0 049	0 000	2 152	0 052	0 000
	Binder	2 021			2 042			2 060			2 085			2 100		
	Pre-Const	2 021			2 042			2 060			2 085			2 100		
4+50	Surface	2 301	0 040	0 000	2 329	0 058	0 000	2 344	0 049	0 000	2 362	0 046	0 000	2 390	0 052	0 000
	Binder	2 262			2 271			2 295			2 316			2 338		
	Pre-Const	2 262			2 271			2 295			2 316			2 338		
5+00	Surface	2 563	0 037	0 000	2 600	0 055	0 000	2 618	0 052	0 000	2 637	0 049	0 000	2 658	0 049	0 000
	Binder	2 527			2 545			2 566			2 588			2 609		
	Pre-Const	2 527			2 545			2.566			2 588			2 609		
	AVG	0 046	0 000		0 054	0 000		0.054	0 000		0.049	0 000		0.050	0.000	
	MAX	0 055	0 000		0.061	0.000		0.061	0.000		0.055	0.000		0.058	0.000	
	MIN	0 055	0 000		0 061	0.000		0 061	0.000		0.055	0 000		0.058	0.000	
	STD	0 006	0 000		0.005	0.000		0.004	0.000		0.005	0 000		0.005	0 000	

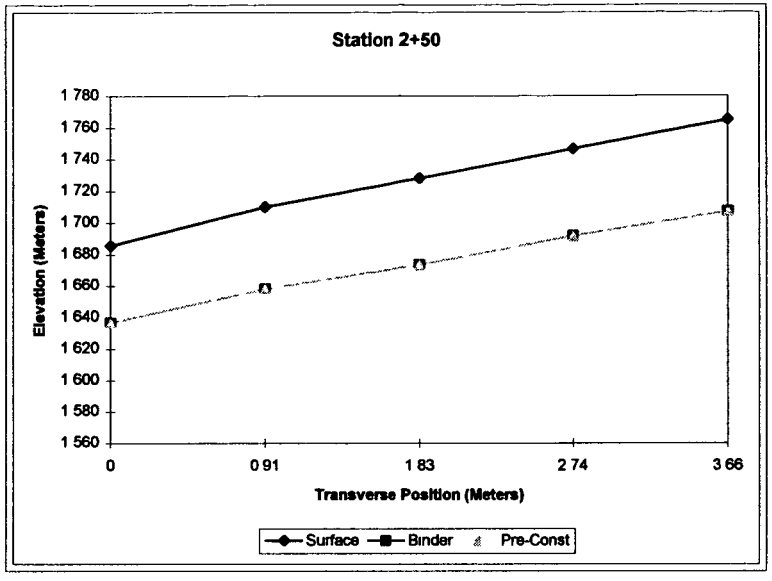

Station 0+00
Elevation (Meters)
1.660
1.640
1.620
1.600
1.580
1.560
1.540
1.520
1.500
1.480
1.460
1.440
0
0.91
1.83
2.74
3.66
Transverse Position (Meters)
Surface
Binder
Pre-Const

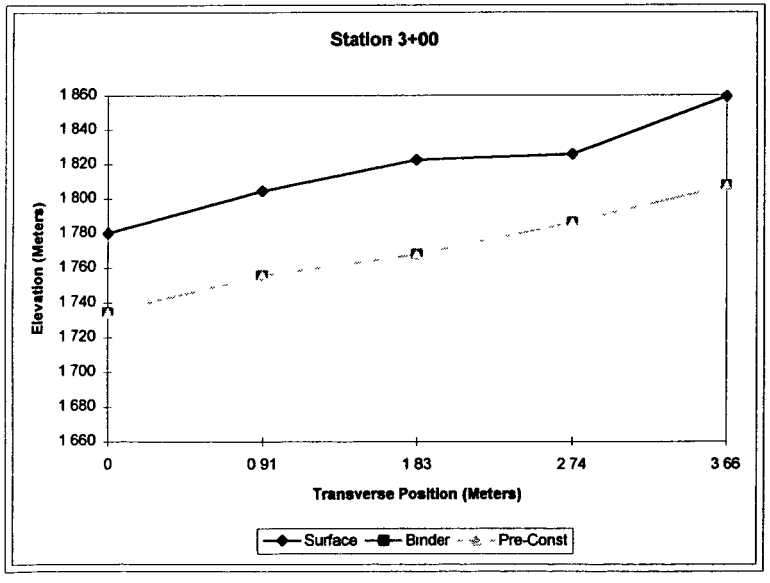

Station 0+50
Elevation (Meters)
1.680
1.660
1.640
1.620
1.600
1.580
1.560
1.540
1.520
1.500
1.480
1.460
0
0.91
1.83
2.74
3.66
Transverse Position (Meters)
Surface
Binder
Pre-Const

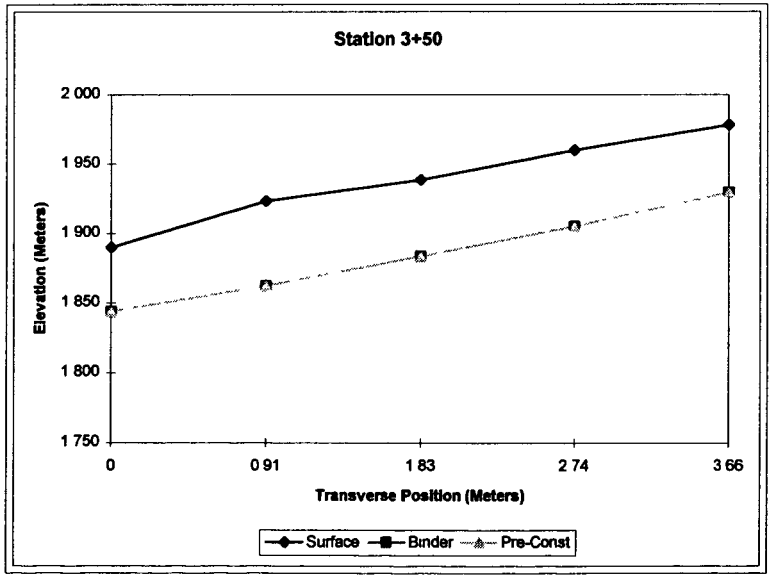

Station 1+00
Elevation (Meters)
1.700
1.650
1.600
1.550
1.500
1.450
0
0.91
1.83
2.74
3.66
Transverse Position (Meters)
Surface
Binder
Pre-Const

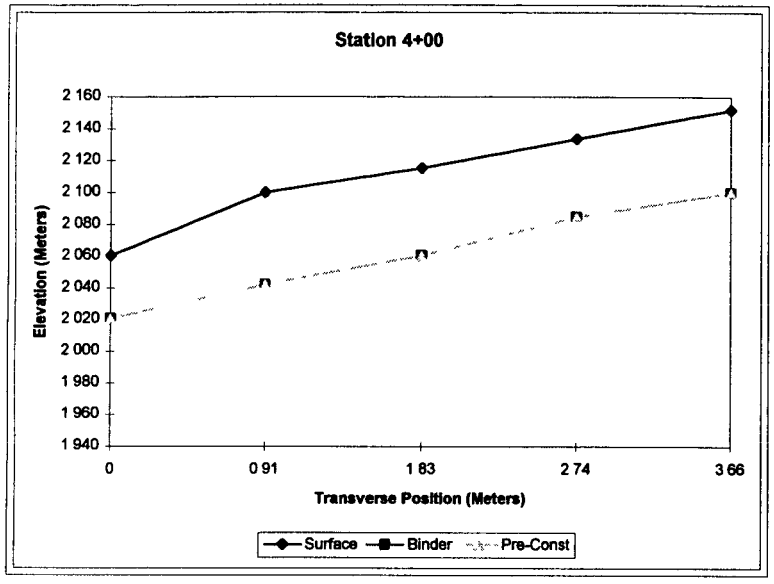

Station 1+50
Elevation (Meters)
1.680
1.660
1.640
1.620
1.600
1.580
1.560
1.540
1.520
1.500
1.480
1.460
0
0.91
1.83
2.74
3.66
Transverse Position (Meters)
Surface
Binder
Pre-Const

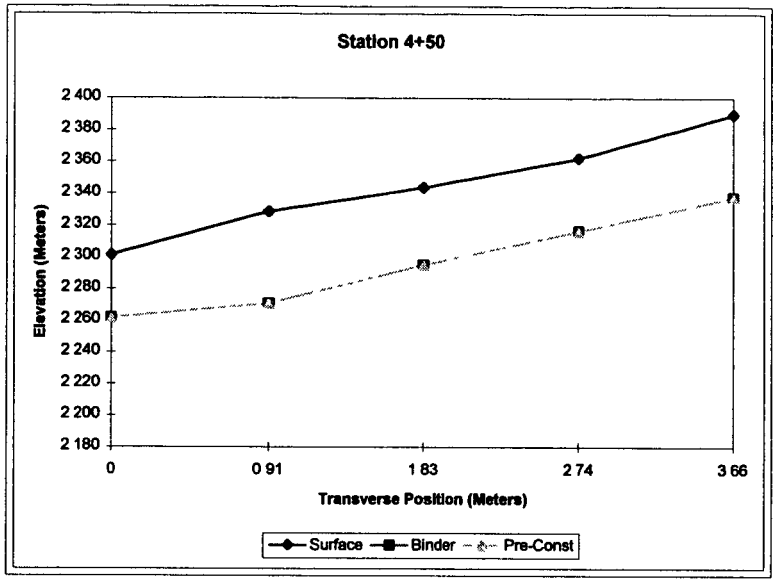

Station 2+00
1 700
1 650
1 600
1 550
1 500
1 450
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

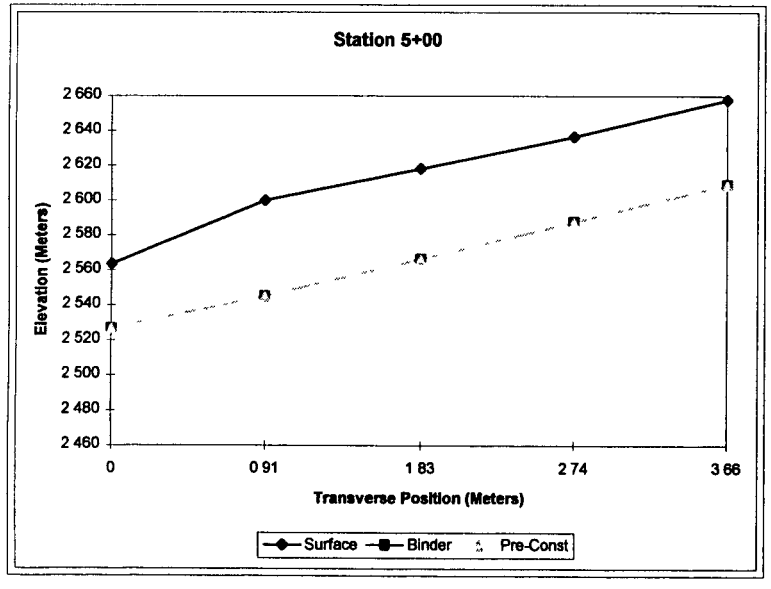

Station 2+50
1 780
1 760
1 740
1 720
1 700
1 680
1 660
1 640
1 620
1 600
1 580
1 560
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 3+00
1 860
1 840
1 820
1 800
1 780
1 760
1 740
1 720
1 700
1 680
1 660
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 3+50
2 000
1 950
1 900
1 850
1 800
1 750
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

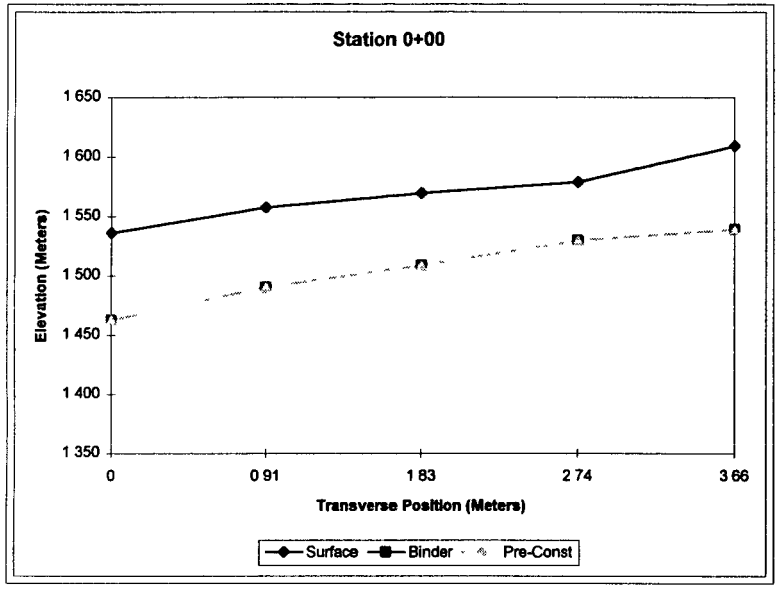

Station 4+00
Elevation (Meters)
2 160
2 140
2 120
2 100
2 080
2 060
2 040
2 020
2 000
1 980
1 960
1 940
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

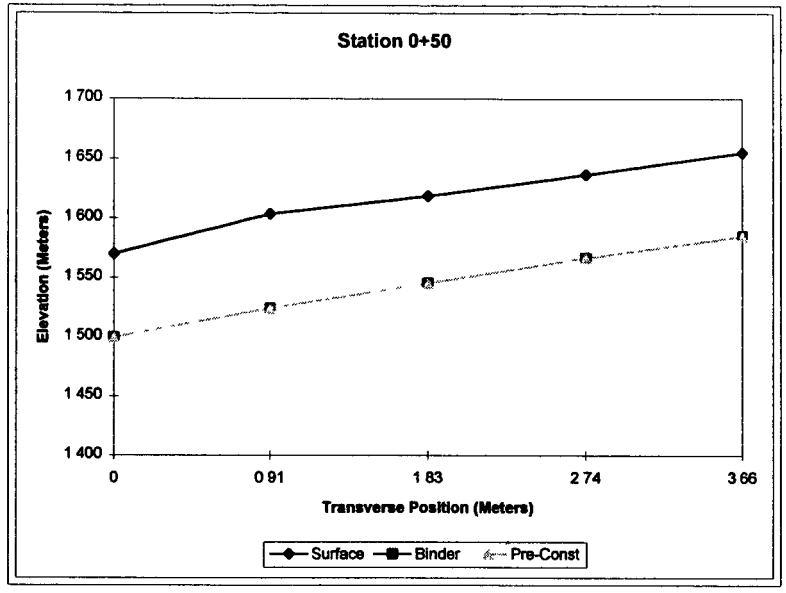

Station 4+50
Elevation (Meters)
2 400
2 380
2 360
2 340
2 320
2 300
2 280
2 260
2 240
2 220
2 200
2 180
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

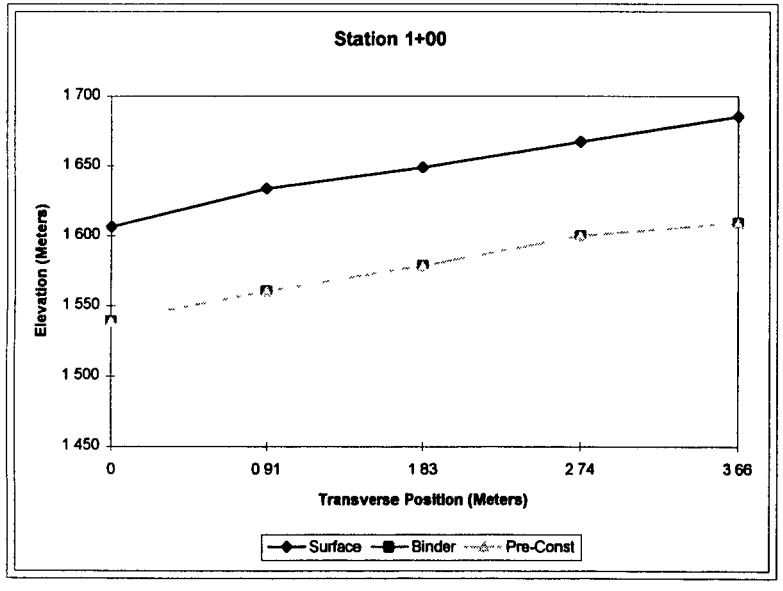

Station 5+00
Elevation (Meters)
2 660
2 640
2 620
2 600
2 580
2 560
2 540
2 520
2 500
2 480
2 460
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const

Mississippi, SPS-9, (280904)

Transverse Offset	3 LAYERS	ELEVATION 0 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 0.91 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 1.83 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 2.74 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters	ELEVATION 3.66 Meters	Surface THICKNESS Meters	Binder THICKNESS Meters
0+00	Surface	1 536	0 073	0 000	1 558	0 067	0 000	1 570	0 061	0 000	1 579	0 049	0 000	1 609	0 070	0 000
	Binder	1 463			1 490			1 509			1 530			1 539		
	Pre-Const	1 463			1 490			1 509			1 530			1 539		
0+50	Surface	1 570	0 070	0 000	1 603	0 079	0 000	1 618	0 073	0 000	1 637	0 070	0 000	1 655	0 070	0 000
	Binder	1 500			1 524			1 545			1 567			1 585		
	Pre-Const	1 500			1 524			1 545			1 567			1 585		
1+00	Surface	1 606	0 067	0 000	1 634	0 073	0 000	1 649	0 070	0 000	1 667	0 067	0 000	1 686	0 076	0 000
	Binder	1 539			1 561			1 579			1 600			1 609		
	Pre-Const	1 539			1 561			1 579			1 600			1 609		
1+50	Surface	1 637	0 064	0 000	1 664	0 070	0 000	1 679	0 070	0 000	1 698	0 067	0 000	1 716	0 076	0 000
	Binder	1 573			1 594			1 609			1 631			1 640		
	Pre-Const	1 573			1 594			1 609			1 631			1 640		
2+00	Surface	1 658	0 064	0 000	1 682	0 064	0 000	1 698	0 064	0 000	1 716	0 064	0 000	1 731	0 064	0 000
	Binder	1 594			1 618			1 634			1 652			1 667		
	Pre-Const	1 594			1 618			1 634			1 652			1 667		
2+50	Surface	1 686	0 064	0 000	1 710	0 067	0 000	1 725	0 070	0 000	1 743	0 064	0 000	1 762	0 067	0 000
	Binder	1 622			1 643			1 655			1 679			1 695		
	Pre-Const	1 622			1 643			1 655			1 679			1 695		
3+00	Surface	1 719	0 061	0 000	1 747	0 070	0 000	1 759	0 061	0 000	1 780	0 064	0 000	1 798	0 061	0 000
	Binder	1 658			1 676			1 698			1 716			1 737		
	Pre-Const	1 658			1 676			1 698			1 716			1 737		
3+50	Surface	1 786	0 055	0 000	1 811	0 061	0 000	1 829	0 061	0 000	1 850	0 064	0 000	1 865	0 058	0 000
	Binder	1 731			1 750			1 768			1 786			1 807		
	Pre-Const	1 731			1 750			1 768			1 786			1 807		
4+00	Surface	1 856	0 061	0 000	1 881	0 064	0 000	1 899	0 067	0 000	1 917	0 064	0 000	1 935	0 061	0 000
	Binder	1 795			1 817			1 832			1 853			1 875		
	Pre-Const	1 795			1 817			1 832			1 853			1 875		
4+50	Surface	1 926	0 067	0 000	1 948	0 070	0 000	1 966	0 061	0 000	1 981	0 058	0 000	2 003	0 061	0 000
	Binder	1 859			1 878			1 905			1 923			1 942		
	Pre-Const	1 859			1 878			1 905			1 923			1 942		
5+00	Surface	1 993	0 058	0 000	2 021	0 070	0 000	2 036	0 064	0 000	2 054	0 064	0 000	2 073	0 064	0 000
	Binder	1 935			1 951			1 972			1 990			2 009		
	Pre-Const	1 935			1 951			1 972			1 990			2 009		
	AVG		0.064	0.000		0 069	0.000		0.066	0.000		0.063	0 000		0.066	0.000
	MAX		0.073	0.000		0 079	0.000		0 073	0.000		0.070	0 000		0.076	0.000
	MIN		0.073	0.000		0 079	0.000		0.073	0.000		0 070	0 000		0.076	0.000
	STD		0.005	0.000		0 005	0.000		0.005	0.000		0.006	0 000		0.006	0.000


Station 0+00
1 650
1 600
1 550
1 500
1 450
1 400
1 350
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 0+50
1 700
1 650
1 600
1 550
1 500
1 450
1 400
Elevation (Meters)
0
0 91
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const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1 650
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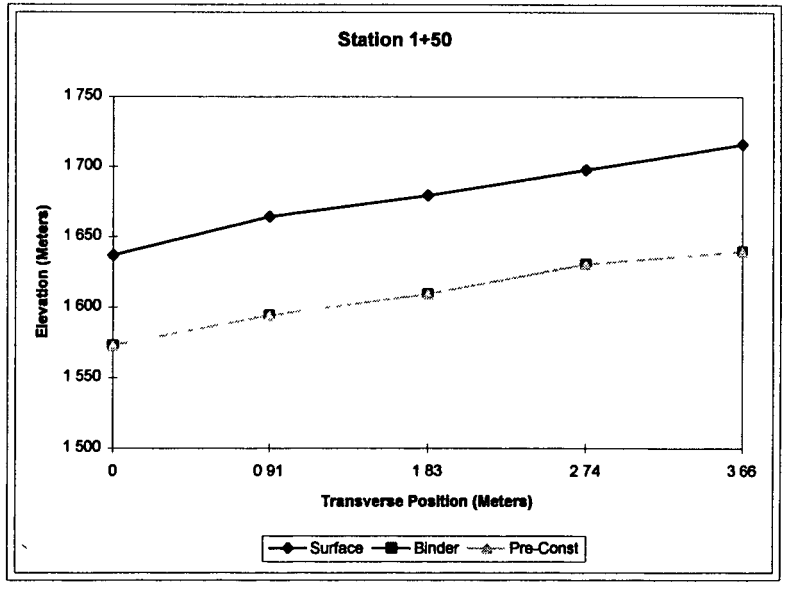
1 83
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const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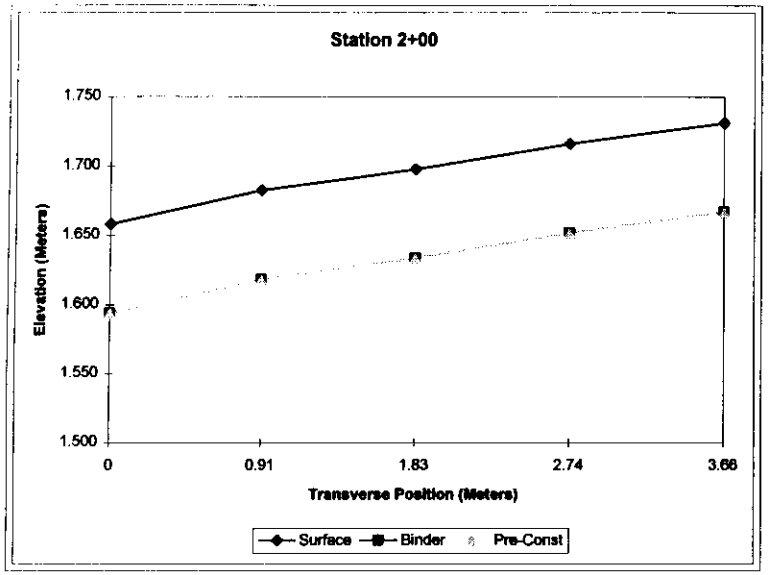
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const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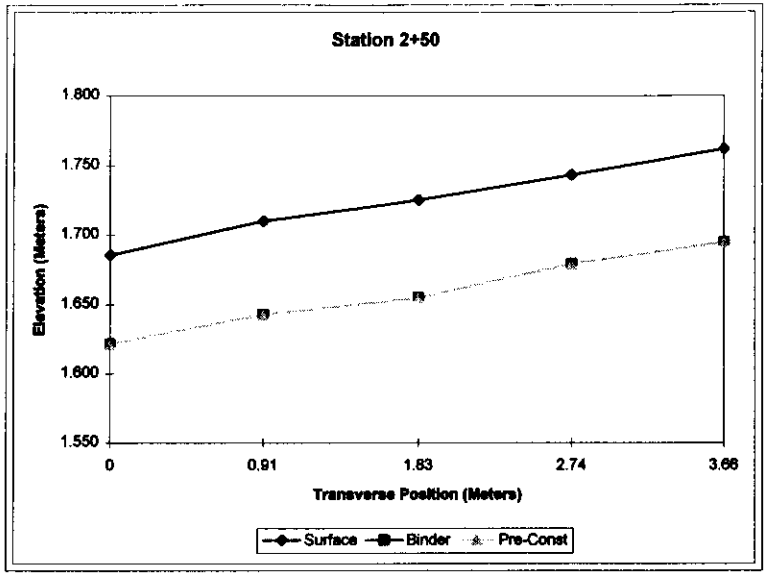
Transverse Position (Meters)
Surface
Binder
Pre-Const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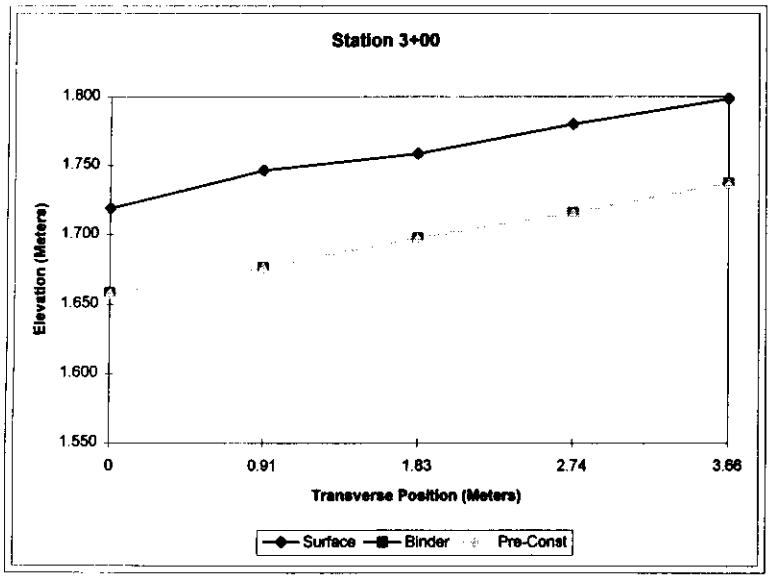
Transverse Position (Meters)
Surface
Binder
Pre-Const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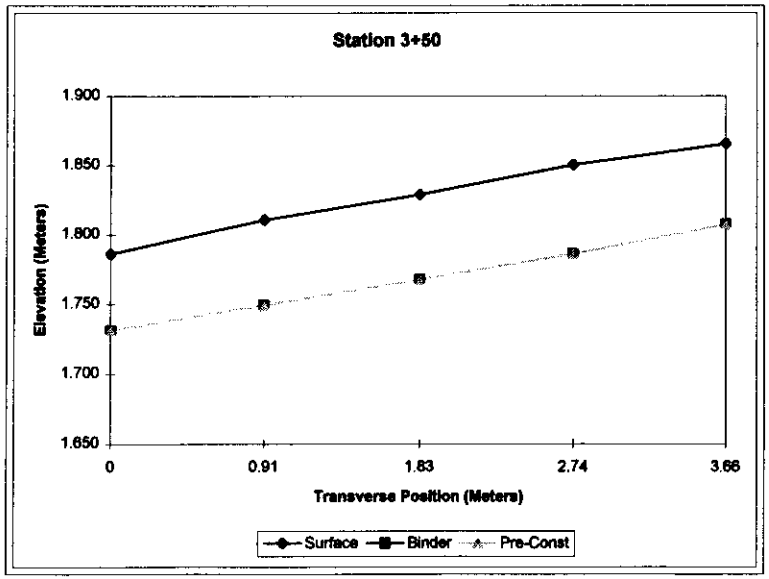
3.66
Transverse Position (Meters)
Surface
Binder
Pre-Const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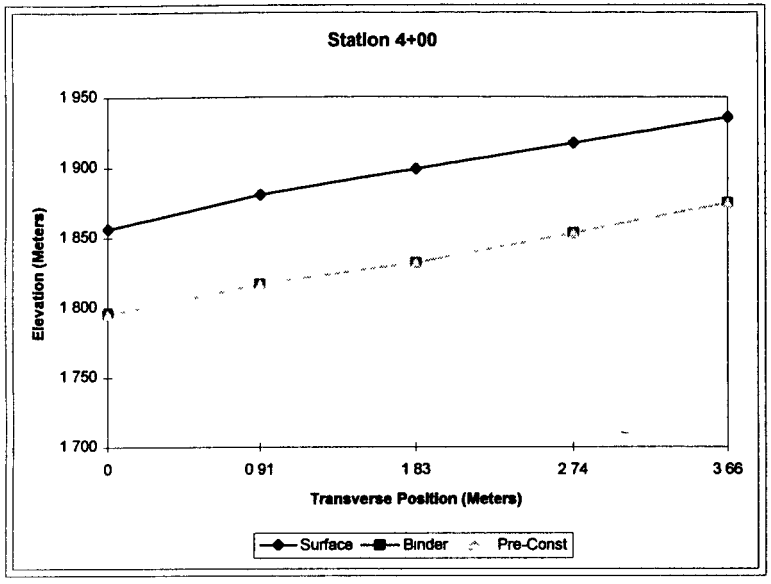
Transverse Position (Meters)
Surface
Binder
Pre-Const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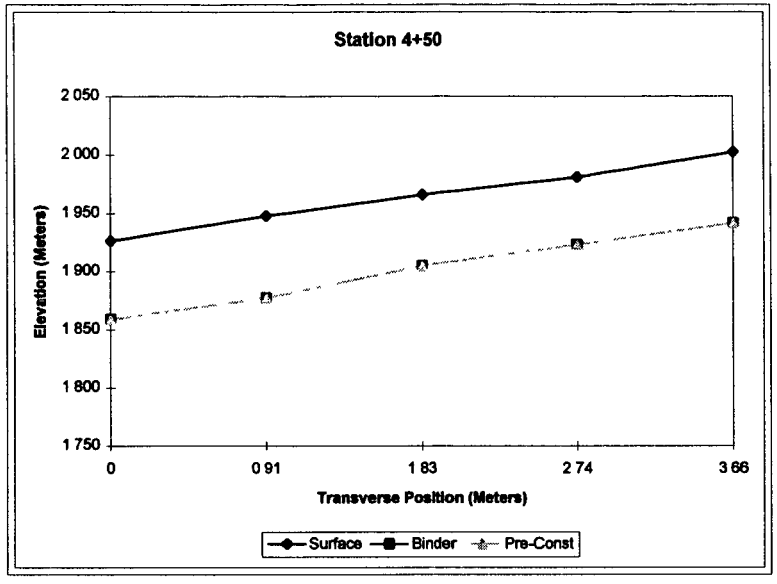
2 74
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 4+50
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Elevation (Meters)
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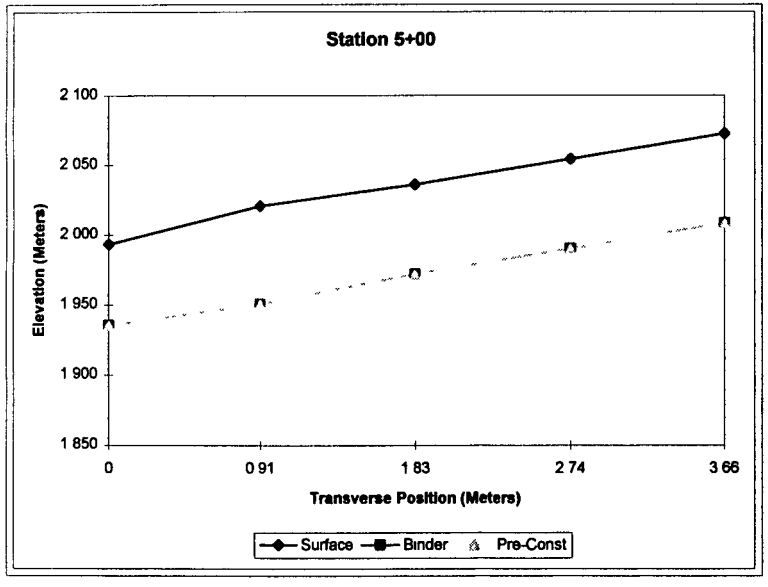
3 66
Transverse Position (Meters)
Surface
Binder
Pre-Const


Station 5+00
2 100
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Elevation (Meters)
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0 91
1 83
2 74
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Transverse Position (Meters)
Surface
Binder
Pre-Const

APPENDIX D

MATERIALS SAMPLING AND TESTING PLAN

Brent Rauhut Engineering Inc.

26 June 1995

Mr. Alfred B. Crawley
Research & Development Engineer
Mississippi Department of Transportation
P.O. Box 1850
Jackson, Mississippi 39215-1850

Subject: Mississippi SPS-9A Project (280900) Materials Sampling and Testing Plan

Dear Mr. Crawley:

Enclosed is the plan for materials sampling and testing activities for the Mississippi SPS-9A project, located in the southbound lanes of IH-55 near Como, Mississippi. This plan has been prepared to identify details of the materials sampling, field testing, and laboratory materials testing to occur as part of the SPS-9A project construction.

If you have any questions or comments regarding the information provided in this plan, please do not hesitate to contact me. A copy of this document is also being provided to Mr. Monte Symons of the FHWA, for review and approval.

Sincerely,

Mark P. Gardner
Project Engineer, SRCO

MPG:dmj

Enclosure: As stated.

c.w/Enc: Monte Symons, FHWA/LTPP-DC
John Avent, MS-DOT
Gonzalo Rada, PCS/LAW

c.w/o Enc: Morris Reinhardt, RE-SRCO

8240 Mopac, Suite 220 • Austin, Texas 78759 • (512) 346-0870 • FAX (512) 346-8750

MATERIAL SAMPLING
AND
TESTING PLAN

MISSISSIPPI SPS-9A PROJECT 280900
PANOLA COUNTY, MISSISSIPPI
IH-55, SOUTHBOUND

PREPARED BY:

BRENT RAUHUT ENGINEERING INC.
FHWA/LTPP SOUTHERN REGION COORDINATION OFFICE
8240 MOPAC, SUITE 220
AUSTIN, TEXAS 78759

JUNE 1995

MATERIAL SAMPLING AND TESTING PLAN
MISSISSIPPI SPS-9A PROJECT (280900), IH-55 SOUTHBOUND
PANOLA COUNTY, MISSISSIPPI

INTRODUCTION

As part of their participation in the FHWA/LTPP studies, the State of Mississippi will construct an SPS-9A project to validate the SHRP asphalt specification and mix design. This project will consist of four test sections with similar details and materials on IH-55, in the Southbound lane, in Panola County, Mississippi. It is the intent of this document to provide a complete plan for the material sampling, testing, and laboratory material testing that will occur as a part of this project.

This document has been prepared in accordance with **draft** guidelines provided by the Federal Highway Administration entitled "Specific Pavement Studies Material Sampling and Testing Requirements for Experiment SPS-9A, SUPERPAVE™ Asphalt Binder Study, February 1995". Recognizing the apparent variability in the construction of roadway projects, the goal of this effort is to develop a sampling and testing plan for the project materials that will be consistent with other projects in this experiment, and therefore make the information obtained suitable for analysis.

The SPS-9A experiment is the first part of a multi-stage approach to the SPS-9 experiment, "Validation of SHRP Asphalt Specification and Mix Design". The experiment is designed for immediate implementation to provide agencies with hands-on experience with methods and requirements developed under the SHRP program. The primary objectives of SPS-9A are to validate the SHRP binder specifications, to allow direct comparison of asphalt mixtures designed using Agency procedures and the newly developed SUPERPAVE™ procedures, and to provide initial data for use in refining the mixture performance models also developed as part of the SHRP research. In order to accomplish these objectives, three basic test sections are included within each project; one using the Agency's current mix design, one using the SUPERPAVE™ mix design system, and one using a SUPERPAVE™ Alternate binder. In addition, Mississippi has elected to construct a fourth section as a supplement, to evaluate a wider array of the PG graded binders. The SPS-9A experiment requires the construction of test sections at a given project with similar details, materials, and construction quality. It is anticipated that some variation between sections will exist. The purpose of the sampling and testing plan is to provide the information necessary to evaluate such variations and their effect on performance.

This sampling and testing plan has been developed by Brent Rauhut Engineering, Inc. the Southern Region Coordination Office under contract to the Federal Highway Administration. If, during the construction activities, any questions arise regarding the sampling and/or testing to be conducted, one should first coordinate these questions with the Mississippi Department of Transportation, who may refer them to the Southern Region Coordination Office.

This document has been prepared in four distinct parts, each covering a particular area of this rather formidable exercise. The sections are:

A. General Layout Information

B. Materials Sampling and Testing - Preconstruction

C. Materials Sampling and Testing - During Construction

D. Materials Sampling and Testing - Postconstruction

"Preconstruction" sampling activities are defined as those occurring for the purpose of defining existing conditions and material properties prior to placement of the overlay. "During construction" activities begin once material production and placement activities are underway, and continue through the coring activities at time t = 0 (to be explained in Section C). "Postconstruction" sampling and testing activities include sampling of the overlay materials over time (cores) to document changes in material properties. Specific samples to be obtained, and laboratory testing needs for each sample, are defined for each of these time periods in Sections B, C and D.

SECTION A

GENERAL LAYOUT INFORMATION

SECTION A

GENERAL LAYOUT INFORMATION

This section of the plan provides a description of the SPS-9A project in terms of the location of the test sections along the roadway. Note that since the sections are in the southbound lane, stations decrease from the beginning of the project to the end. Table A-1 lists the test sections in order of project stationing, providing an indication of the overlay mix to be used.

Figure A-1 depicts the layout of the test sections along the roadway and shows the placement of each material type and the location of each test section within the material placement.

The referenced project stationing was provided by the Mississippi DOT in the form of preliminary project sketches. If there are significant changes in alignment or stationing, this plan should be reviewed closely to determine if revisions are warranted.

TABLE A-1. TEST SECTION LAYOUT

Section (Cell ID)	Overlay Material	Begin Station	End Station
280901	Agency Mix (PG64-22 HTSC)	1428 + 50	1423 + 50
280902	SUPERPAVE™ Mix (PG64-22)	1407 + 50	1402 + 50
280903	Alternate SUPERPAVE™ Binder (PG58-22)	1379 + 50	1374 + 50
280904	Supplemental Binder Mix (PG76-22)	1331 + 50	1326 + 50

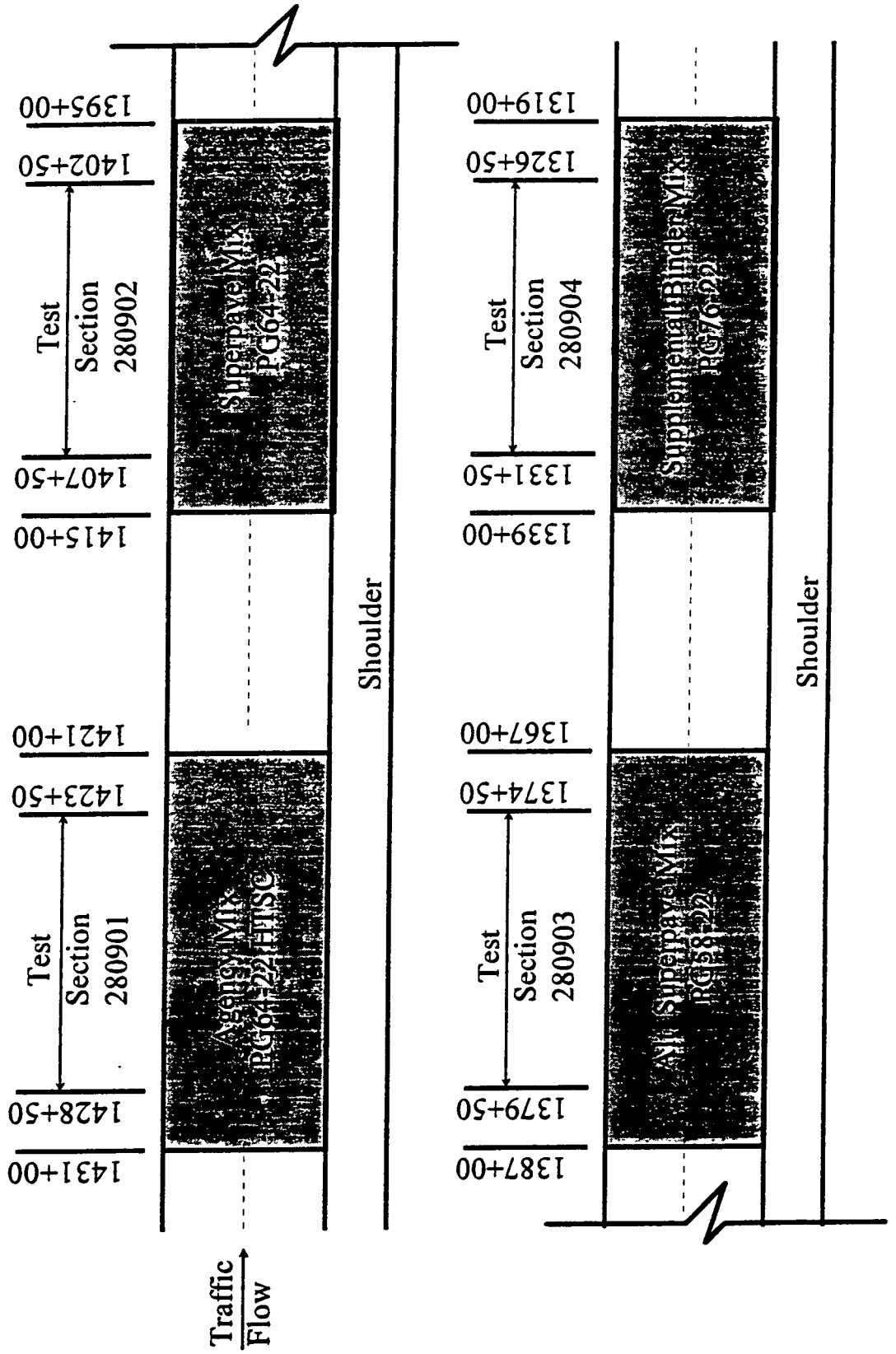


FIGURE A-1. LAYOUT OF TEST SECTIONS MISSISSIPPI SPS-9A (280900)

SECTION B

MATERIAL SAMPLING AND TESTING

PRECONSTRUCTION

SECTION B

MATERIAL SAMPLING AND TESTING
PRECONSTRUCTION

This section of the plan provides for the material sampling and testing activities that occur prior to construction. As the Mississippi SPS-9A project will be an overlay, the objective of this sampling will be to confirm the type and thickness of existing pavement materials and obtain samples of the subgrade for classification testing.

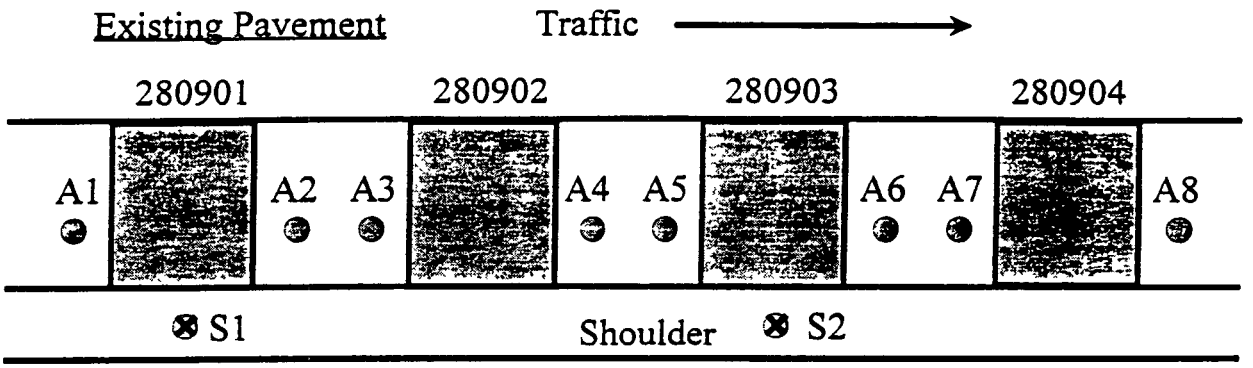
Table B-1 provides the scope of preconstruction material sampling. As may be seen, only minimal sampling is proposed, consisting of cores of the existing asphalt concrete, visual observation of the existing base materials and sampling of the subgrade. There are a total of 8 sampling locations, numbered A1 through A8. The sampling locations are shown in Figure B-1.

Samples that are obtained should be labeled accordingly and wrapped in protective wrapping to prevent damage in transit. Sample labels will be provided by the Southern Region Coordination Office, who will have a representative on site to assist with the sampling and data collection activities. Plastic, resealable bags should be used for subgrade samples, to retain the moisture content for testing. Bubble-wrap or similar material should be used to protect the core samples.

All laboratory testing for the preconstruction samples will occur at the Mississippi DOT laboratory. Table B-2 provides an indication of the laboratory tests to be performed on the preconstruction samples.

TABLE B-1. SCOPE OF PRECONSTRUCTION MATERIAL SAMPLING

Material And Sample Description	Nº. Of Samples	Sample Location	Sample Number
Asphalt Concrete Coring - 4" Diam. Cores	8	A1-A8	CA01-CA08
Unbound Granular Base - Lime-Treated	8	A1-A8	BG01, 03, 05, 07, 09, 11, 13, 15
Unbound Granular Subbase	8	A1-A8	BG02, 04, 06, 08, 10, 12, 14, 16
Subgrade Bulk Sampling Moisture Content Samples	 8 8	 A1-A8 A1-A8	 BS01-BS08 MS01-MS08



A-type core locations - 152 mm OD core of bound layers, auger to 1.2 m below top of subgrade

Shoulder auger probe to 6 m below surface

FIGURE B-1. PRECONSTRUCTION SAMPLING LAYOUT MISSISSIPPI SPS-9A (280900)

TABLE B-2. PRECONSTRUCTION MATERIALS TESTING

Test Type	LTPP Designation	LTPP Protocol	Min. Nº. of Tests	Sample Designation
Surface Bound Layers:				
Core Examination/Thickness	AC01	P01	8	A1-A8
Base:				
Classification (Visual)	UG08	Note 1	3	A2,A4,A6
Subbase:				
Classification (Visual)	UG08	Note 1	3	A2,A4,A6
Subgrade:				
Sieve Analysis	SS01	P51	3	A1,A3,A5
Atterberg Limits	SS03	P43	3	A1,A3,A5
Classification	SS04	P52	3	A1,A3,A5
Natural Moisture Content	SS09	P49	3	A1,A3,A5
Depth to Rigid Layer		Note 2	3	S1,S2

Notes:

1. Visually classify materials in accordance with Appendix C of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

2. Follow procedures contained in Appendix C of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

SECTION C

MATERIAL SAMPLING AND TESTING

DURING CONSTRUCTION

SECTION C

MATERIAL SAMPLING AND TESTING DURING CONSTRUCTION

This portion of the sampling and testing plan deals with field material sampling and laboratory testing during overlay construction. Most of the "during-construction" sampling involves collection of bulk samples from the plant during mix production. Other sampling and testing activities include elevation measurements for documentation of layer thickness and coring just subsequent to construction to evaluate as-placed properties. It is important to note that only the HMAC surface materials are to be sampled and tested. HMAC binder and/or base layers will not be tested and are not included in the following discussions. Samples will be used to evaluate the properties of the paving mixtures produced and will be compared to properties measured from core samples after material placement.

The goal of this phase of the sampling effort is to investigate differences in material properties from mix design, production and placement. As such, the scope of the sampling activities requires collection of bulk samples at various times in the process, for preparation as test specimens. Samples of the constituent materials and the resulting HMAC mixtures are to be collected. These samples are to be compacted in the SHRP Gyratory Compactor (SGC) for volumetric and performance testing. It is anticipated that performance testing will be conducted at SUPERPAVE™ Regional Test Centers, once they are "on-line". At this time, there is no mechanism in place for conducting the performance testing. As such, samples should be stored in a safe environment awaiting testing. If the SHA does not have suitable storage available, then the samples may be transported to the Materials Reference Library (MRL) for storage.

A summary of the bulk sampling activities by test section is provided in Table C-1. For discussion purposes, bulk sampling activities are divided into five general areas. These are:

1. Laboratory Testing - For the SUPERPAVE™ mix to be used on Section 280902, once the final mix design is complete, a bulk sample should be blended in the laboratory to final mix design proportions and compacted in the SHRP Gyratory Compactor (SGC) to N_{design} gyrations into 34, 152 mm diameter by 115 mm height cylindrical specimens. These specimens will be used for volumetric and performance testing, as shown in Table C-2.

2. Quality Control Tests - For each of the four surface mixtures, a 60 kg sample of the mix should be obtained from the haul vehicle on site. These samples will be reheated and compacted in the SGC to N_{max} gyrations to form 6 test specimens of each mix. Testing on these samples is shown on Table C-3.

3. Field Performance Tests - For the SUPERPAVE™ mix placed at Section 280902, 360 kg of mix should be sampled from the haul vehicles. These samples will be compacted in the SGC to N_{design} gyrations into 34 test specimens for volumetric and performance testing, as shown on Table C-2.

4. Mix Design Verification - For each of the four test sections, samples of the constituent materials should be sampled at the plant and shipped to the laboratory to be mixed and tested. One 10-liter sample of the asphalt cement and ten 25 kg samples of the combined aggregate will be required for each surface mix. Testing to be performed on these samples is shown on Table C-4.

5. MRL Sampling - Sampling and information related to the handling of bulk samples for the LTPP Materials Reference Library (MRL) is itemized on Table C-5.

In addition to the bulk samples, cores of the HMAC materials are needed just after placement for volumetric and/or performance testing, to quantify as-placed properties. Table C-6 provides an indication of the number of cores and time intervals for each of the test sections. Figure C-1 provides an indication of the general coring area for each section at an SPS-9A project. Each coring area is further subdivided into six coring "intervals", as depicted in Figure C-2. Each interval corresponds to a time period, with Interval A corresponding to the immediate postconstruction cores. Intervals B-F correspond to time periods of 6 months, 12 months, 18 months, 24 months and 48 months, respectively. The sampling for these intervals (B-F) will be discussed in Section D of this document.

The coring layout within each interval for Sections 01, 03 and 04 is also shown on Figure C-2. The coring layout within each interval for Section 02 (the SUPERPAVE™ section) is shown in Figure C-3. The thirty-four cores scheduled in Interval A will be used for volumetric and performance testing.

In summary, 8 cores will be obtained from each of Section 01, 03 and 04 during Interval A, immediately following construction. Testing to be performed on these cores is shown in Table C-7. Thirty-four cores shall be obtained from Test Section 02 during Interval A, immediately following construction. Testing to be performed on these cores is shown in Table C-8.

The final "during-construction" field testing activities include elevation and Dipstick® cross-profile measurements before and after overlay placement. Elevation measurements should be performed at 15 m intervals, across the pavement surface at intervals of 0, 0.9, 1.8, 2.7 and 3.6 m from the outside lane edge. Care should be taken to measure the elevation at the same location before and after overlay placement, to ensure accurate calculation of the overlay thickness. Dipstick® cross-profile measurements were obtained prior to construction. A second set of measurements will be taken just prior to the placement of the surfacing layers. A third and final set of measurements will be taken after completion of the surfacing placement. Collection of elevation and Dipstick® cross-profile data will be conducted by the Regional Coordination Office representative on site and as such are not itemized in the following tables or figures.

TABLE C-1. SUMMARY OF BULK SAMPLING BY TEST SECTION

Test Section	Material Type	Testing	Bulk Sampling	Testing Lab	Ref. Table
280901	Agency Mix (PG64-22 HTSC)	Quality Control (Volumetric)	60 kg Mix	SHA	C-3
		Mix Design Verification (Volumetric)	10 liter Asphalt 250 kg Aggregate	SHA	C-4
		Materials Ref. Library	20 liter Asphalt 250 kg Aggregate	MRL	C-5
280902	SUPERPAVE™ (PG64-22)	Lab. Mix Design (Volumetric & Performance)	300 kg Mix	SHA	C-2
		Quality Control (Volumetric)	60 kg Mix	SHA	C-3
		Performance Testing (Volumetric & Performance)	360 kg Mix	SHA, LTPP Contract, SUPERPAVE™ Reg. Test Center	C-2
		Mix Design Verification (Volumetric)	10 liter Asphalt 250 kg Aggregate	SHA	C-4
		Materials Ref. Library	20 liter Asphalt 250 kg Aggregate	MRL	C-5
280903	Alt. SUPERPAVE™ Binder (PG58-22)	Quality Control (Volumetric)	60 kg Mix	SHA	C-3
		Mix Design Verification (Volumetric)	10 liter Asphalt 250 kg Aggregate	SHA	C-4
		Materials Ref. Library	20 liter Asphalt 250 kg Aggregate	MRL	C-5
280904	Supplemental Binder (PG76-22)	Quality Control (Volumetric)	60 kg Mix	SHA	C-3
		Mix Design Verification (Volumetric)	10 liter Asphalt 250 kg Aggregate	SHA	C-4
		Materials Ref. Library	20 liter Asphalt 250 kg Aggregate	MRL	C-5

TABLE C-2. TESTS ON COMPACTED BULK SAMPLES OF MATERIALS FROM TEST SECTION 02

Test Name	Test Desig.	Protocol	Nº. of Tests	Material Source/ Material Sample
HMA Specimen Compaction by Participating Highway Agency				
Gyratory Compaction @ N_{Design} (Lab samples)		AASHTO M002	34	BA01-BA34[a]
Gyratory Compaction @ N_{Max} (Field samples)		AASHTO M002	6	BA35-BA40[a]
Gyratory Compaction @ N_{Design} (Field samples)		AASHTO M002	34	BA41-BA74[a]
Volumetric Tests by Participating Highway Agency				
Bulk Specific Gravity	AC02	LTPP P02	12	DA01,DA18,DA34, DA35-DA41, DA58,DA74
Asphalt Content (Extraction) (Performed on uncompacted material from bulk sample)	AC04	LTPP P04	9	BA01,BA18,BA34, BA35,BA37,BA40, BA41,BA58,BA74
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	3	BA18,BA37,BA58
Maximum Specific Gravity	AC03	LTPP P03	3	BA18,BA37,BA58
Volumetric Calculations by Participating Highway Agency				
Volume Percent of Air Voids		AASHTO PP19	74	All Compacted Specimens
Percent Voids in Mineral Aggregate		AASHTO PP19	74	
Voids Filled with Asphalt		AASHTO PP19	74	
LTPP Performance Tests by LTPP Contract Laboratory				
Creep Compliance	AC06	LTPP P06	16	DA01-DA04, DA31-DA34, DA41-DA44, DA71-DA74
Indirect Tensile Strength	AC07	LTPP P07	4	DA05,DA30,DA45,DA70
Resilient Modulus	AC07	LTPP P07	4	DA06,DA29,DA46,DA69
SUPERPAVE™ Shear Tester Performance Tests by SUPERPAVE™ Regional Test Center				
Frequency Sweep at Constant Height		AASHTO M003, P005	4	DA11,DA24,DA51,DA64
Simple Shear at Constant Height		AASHTO M003, P005	4	DA10,DA25,DA50,DA65
Uniaxial Strain		AASHTO M003, P005	4	DA08,DA27,DA48,DA67
Volumetric Test		AASHTO M003, P005	4	DA07,DA28,DA47,DA68
Repeated Shear at Constant Stress Ratio		AASHTO M003, P005	4	DA09,DA26,DA49,DA66
SUPERPAVE™ Indirect Tensile Tests by SUPERPAVE™ Regional Test Center				
Indirect Tensile Creep Compliance		AASHTO M005	12	DA12-DA14, DA21-DA23, DA52-DA54, DA61-DA63
Indirect Tensile Strength		AASHTO M005	12	DA15-DA20, DA55-DA60

Notes:

a. For purposes or this table, a single specimen is compacted from each bulk sample. Test specimen DA01 is produced from BA01, etc. Up to three specimens can be produced from the sample, depending on its size.

TABLE C-3. QUALITY CONTROL RELATED TESTS ON COMPACTED SPECIMENS FROM TEST SECTION 01, 03 (To Be Performed by the Participating Highway Agency)

Test Name	Test Desig.	Protocol	Nº. of Tests	Material Source/ Material Sample
HMA Specimen Compaction				
Gyratory Compaction @ N_{max} (Field samples)		AASHTO M002	6	BA01-BA06[a]
Volumetric Tests				
Bulk Specific Gravity	AC02	LTPP P02	6	DA01-DA06
Asphalt Content (Extraction)	AC04	LTPP P04	2	BA02, BA04
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	2	BA02, BA04
Maximum Specific Gravity	AC03	LTPP P03	2	BA02, BA04
Volumetric Calculations				
Volume Percent of Air Voids		AASHTO PP19	6	DA01-DA06
Percent Voids in Mineral Aggregate		AASHTO PP19	6	
Voids Filled with Asphalt		AASHTO PP19	6	

Notes:

a. A single test specimen is produced from each bulk HMA mix sample. Test specimen DA01 is produced from sample BA01, etc.

TABLE C-4. SUPERPAVE™ AGGREGATE, BINDER AND MIXTURE DESIGN TESTS ON HMA SURFACE LAYER MATERIALS FROM ALL TEST SECTIONS (To Be Performed by Participating Highway Agency)

Test Name	Test Desig.	Protocol	No. Tests	Material Source
Aggregate Tests[a]				
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	1	BU01
Specific Gravity of Coarse Aggregate	AG01	LTPP P11	1	
Specific Gravity of Fine Aggregate	AG02	LTPP P12	1	
Specific Gravity of -200 Material		AASHTO T100	1	
Coarse Aggregate Angularity		Penn DOT TM 621	1	
Fine Aggregate Angularity		ASTM C1252	1	
Toughness		AASHTO T96	1	
Soundness		AASHTO T104	1	
Deleterious Materials		AASHTO 112	1	
Clay Content		AASHTO T176	1	
Thin, Elongated Particles		ASTM D4791	1	
Asphalt Cement				
Penetration @ 5°C		AASHTO T49	3	BC01
Penetration @ 25°C & 46°C	AE02	LTPP P22	3	
Viscosity @ 60°C & 135°C	AE05	LTPP P25	2	
Specific Gravity @ 16°C	AE03	LTPP P23	2	
Dynamic Shear @ 3 Temperatures		AASHTO TP5	2	
Creep Stiffness		AASHTO TP1	2	
Brookfield Viscosity @ 135°C & 165°C		ASTM D4402	1	
Rolling Thin Film Oven (RTFOT)		AASHTO T240	b	
Dynamic Shear on RTFOT Residue @ 3 Temperatures		AASHTO TP5	3	
Pressure Aging (PAV) of RTFOT Residue		AASHTO PP1	b	
Creep Stiffness of RTFOT-PAV Residue @ 2 Temperatures		AASHTO TP1	2	
Dynamic Shear on RTFOT-PAV Residue @ 3 Temperatures		AASHTO TP5	2	
Direct Tension on RTFOT-PAV Residue @ 2 Temperatures		AASHTO TP3	2	
Mixed and Compacted HMA				
Gyratory Compaction @ Design Asphalt Content @ N_{Design}		AASHTO M002	3	BC01,BU01-BU03
Gyratory Compaction @ 7% Air Voids		AASHTO M002	6	BC01,BU04-BU09
Moisture Susceptibility	AC05	AASHTO T283	1	DA04-DA09
Bulk Specific Gravity	AC02	LTPP P02	3	DA01,DA03
Maximum Specific Gravity	AC03	LTPP P03	1	BC01,BU10
Volumetric Calculations				
Volumetric Percent of Air Voids		AASHTO PP19	3	DA01,DA02,DA03
Percent Voids in Mineral Aggregate		AASHTO PP19	3	
Voids Filled With Asphalt		AASHTO PP19	3	

Notes:

a. Only one set of aggregate tests required for each unique aggregate combination used on the project.

b. Sufficient material should be conditioned for the required tests.

TABLE C-5. BULK MATERIAL SAMPLES TO BE SHIPPED TO THE LTPP MATERIAL REFERENCE LIBRARY

Material	Number
Asphalt Cement Collected from the Plant in 20-Liter Pails (Surface Mix Only)	1 for Each Type of Binder
Combined Coarse and Fine Aggregate Obtained from the Plan and Stored in 20-Liter Pails (Surface Mix Only)	10 for Each Aggregate Combination

Notes:

The MRL will provide containers and will pay for shipping costs.

Contact the MRL at (702) 358-7574 prior to construction to make arrangements for sample containers and to receive specific shipping instructions.

Only one sample of each unique asphalt binder used in the SPS-9A mixes is needed. If the same binder is used in more than one mix, then only one sample of that binder should be obtained.

A copy of LTPP Field Operations Information Form 1 should be completed and attached to all MRL shipments. Another copy of the form should be mailed separately to the MRL.

TABLE C-6. NUMBER OF CORES AND CORING TIME INTERVALS FROM SPS-9A STUDY TEST SECTION

Project Type	Test Section Nº.	Time After Paving, Months - Interval Identifier -					
		0 -A-	6 -B-	12 -C-	18 -D-	24 -E-	48 -F-
Main Study	Section 280901 Agency Binder (PG64-22-HTSC)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
	Section 280902 SUPERPAVE™ Binder (PG64-22)	34 (S*)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
	Section 280903 Alternate SUPERPAVE™ Binder (PG58-22)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
	Section 280904 Supplemental Binder (PG76-22)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)

Note: The numbers in the cells represent the number of 152 mm diameter cores needed to perform the required tests.

V = Volumetric and binder stiffness tests on cores

S* = Performance testing at t=0 months will be performed on 3 sets of specimens;

- compacted specimen from design mixtures produced in the laboratory
- compacted specimen from bulk samples obtained during construction
- cores obtained immediately following construction.

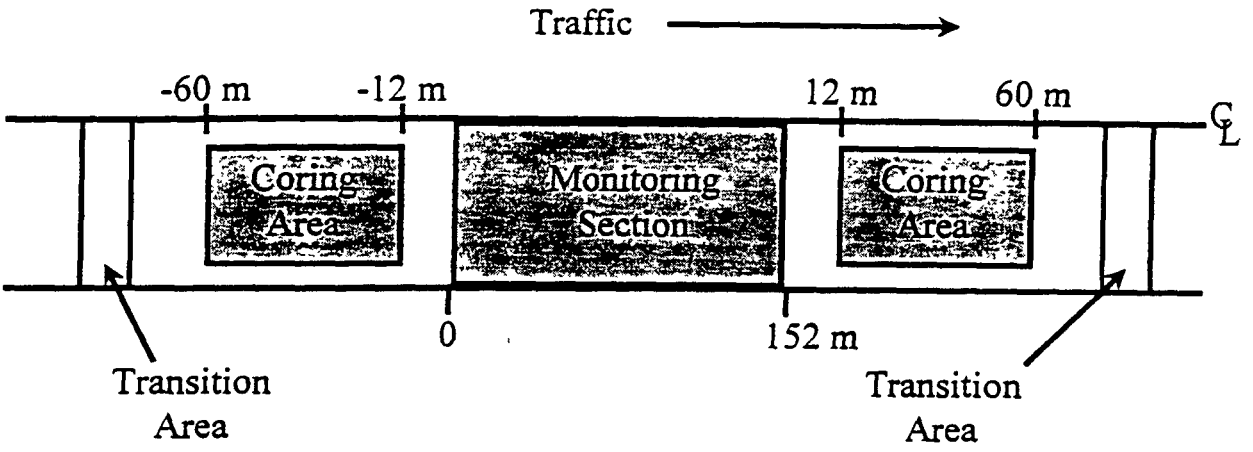


FIGURE C-1. CORING AREAS FOR SPS-9A TEST SECTIONS MISSISSIPPI SPS-9A (280900)

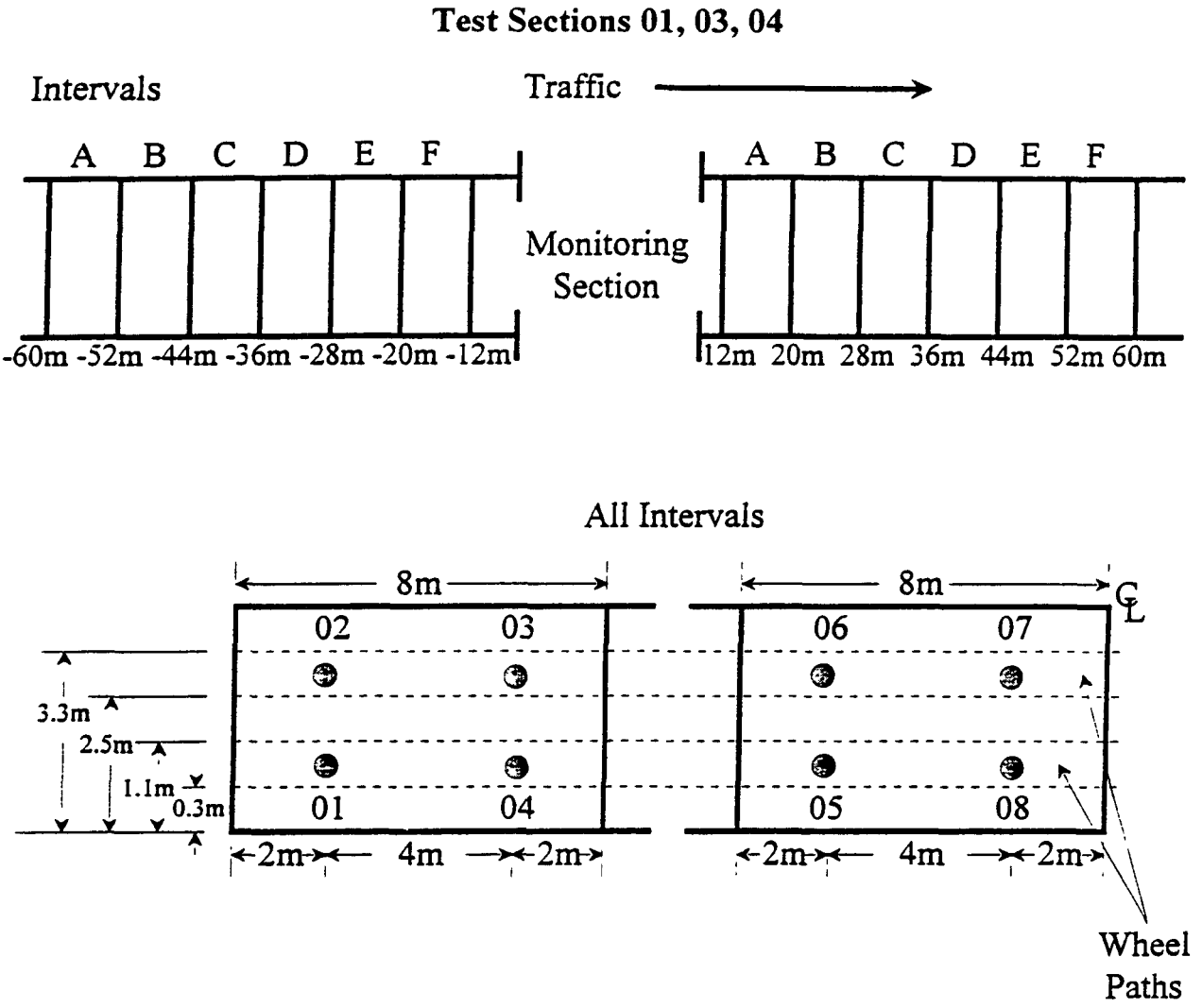


FIGURE C-2. CORING PLAN FOR MAIN STUDY TEST SECTIONS 01, 03 AND 04 MISSISSIPPI SPS-9A (280900)

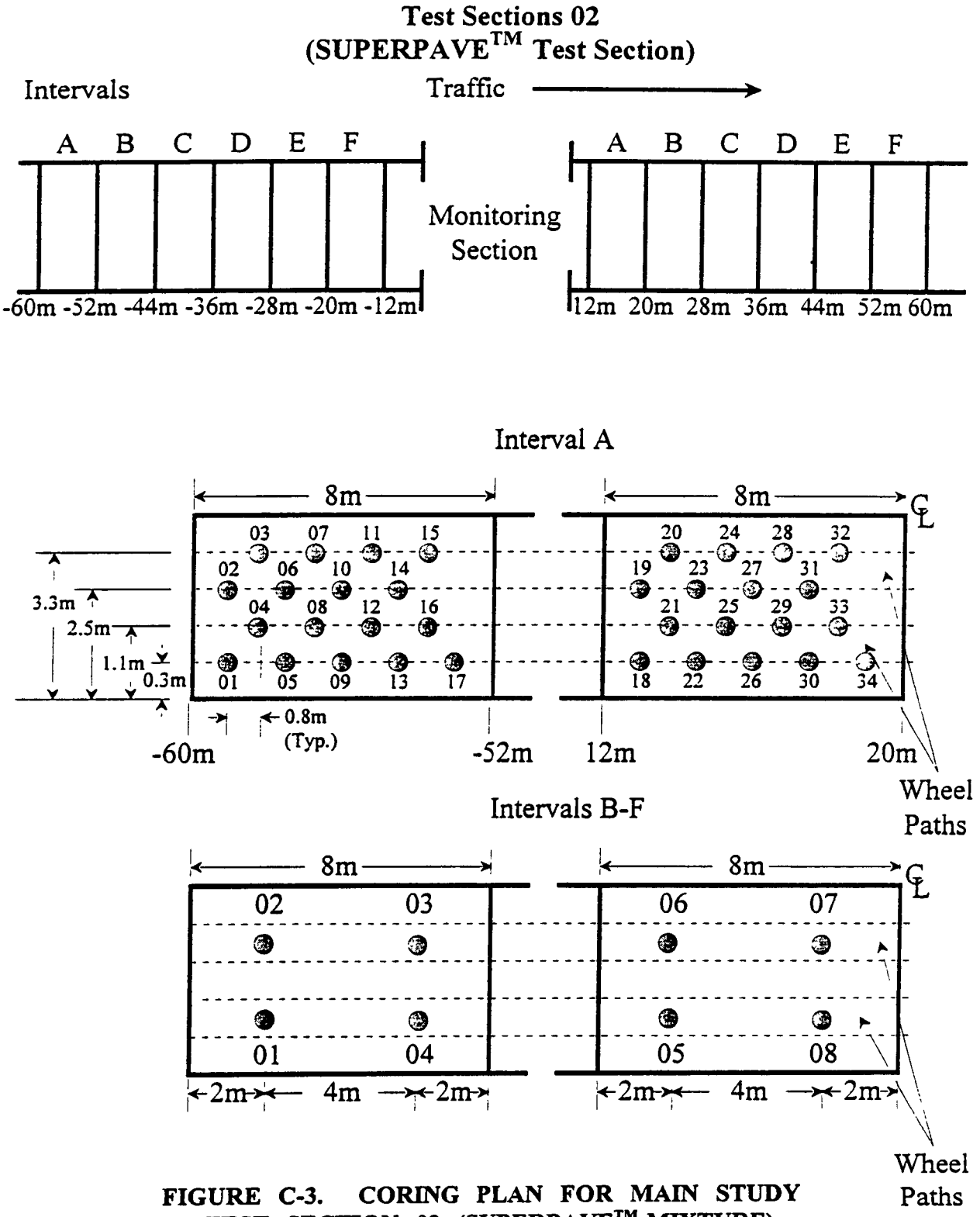


FIGURE C-3. CORING PLAN FOR MAIN STUDY TEST SECTION 02 (SUPERPAVE™ MIXTURE) MISSISSIPPI SPS-9A (280900)

TABLE C-7. LABORATORY MATERIAL TESTS TO BE PERFORMED ON CORES FROM TEST SECTIONS 01, 03 AND 04 IMMEDIATELY AFTER CONSTRUCTION (To Be Performed by the Participating Highway Agency)

Test Name	Test Desig.	Protocol	Nº. of Tests	Material Source[b]
Core Examination/Thickness	AC01	LTPP P01	8	All Cores
Volumetric Analysis				
Bulk Specific Gravity	AC02	LTPP P02	8	All Cores
Asphalt Content (Extraction)	AC04	LTPP P04	8	All Cores
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	1	C01*t*
Volumetric Calculations[a]				
Volume Percent of Air Voids		AASHTO PP19	8	C01*t*-C08*t*
Percent Voids in Mineral Aggregate		AASHTO PP19	8	
Voids Filled with Asphalt		AASHTO PP19	8	
Recovered Asphalt Cement				
Abson Recovery	AE01	LTPP P21	8	C01*t*-C08*t*
Penetration @ 5°C		AASHTO T49	3	
Penetration @ 25°C & 46°C	AE02	LTPP P22	3	
Viscosity @ 60°C & 135°C	AE05	LTPP P25	2	
Specific Gravity @ 16°C	AE03	LTPP P23	2	
Dynamic Shear @ 3 Temperatures[c]		AASHTO TP5	2	
Creep Stiffness @ 2 Temperatures[c]		AASHTO TP1	2	
Direct Tension @ 2 Temperatures[c]		AASHTO TP3	2	

Notes:

a. Use the maximum theoretical specific gravity determined from tests on bulk uncompacted samples obtained during construction. Use specific gravity of aggregate components from tests on unmixed aggregates.

b. The cores shown in this table are for each test section to be tested at each designated testing time interval *t*, where *t* represents the sampling time interval after construction as follows:

t = A at time 0 immediately following construction
t = B at 6 months after construction
t = C at 12 months after construction
t = D at 18 months after construction
t = E at 24 months after construction
t = F at 48 months after construction

For example, core C01E is obtained and tested 24 months after construction.

c. The test temperatures should be the same as those used for the tests on the RTFOT-PAV conditioned samples performed during the initial binder grading.

TABLE C-8. TESTS TO BE RUN ON CORE SAMPLES FROM TEST SECTION 02 IMMEDIATELY AFTER CONSTRUCTION

Test Name	Test Desig.	Protocol	Nº. of Tests	Material Source/ Material Sample[b]
Volumetric Tests by Participating Highway Agency				
Core Examination and Thickness	AC01	LTPP P01	34	All Cores
Bulk Specific Gravity	AC02	LTPP P02	34	All Cores
Asphalt Content (Extraction)[a]	AC04	LTPP P04	8	C01*t*-C04*t*, C31*t*-C34*t*
Aggregate Gradation (Extracted Aggregate)[a]	AG04	LTPP P14	2	C02*t*, C33*t*
Volumetric Calculations by Participating Highway Agency				
Volume Percent of Air Voids		AASHTO PP19	34	All Cores
Percent Voids in Mineral Aggregate		AASHTO PP19	34	
Voids Filled with Asphalt		AASHTO PP19	34	
Recovered Asphalt Cement Tests by Participating Highway Agency				
Abson Recovery	AE01	LTPP P21	8	C01*t*-C04*t*, C31*t*-C34*t*
Penetration @ 5°C		AASHTO T49	3	
Penetration @ 25°C & 46°C	AE02	LTPP P22	3	
Viscosity @ 60°C & 135°C	AE05	LTPP P25	2	
Dynamic Shear @ 3 Temperatures		AASHTO TP5	2	
Creep Suffness @ 2 Temperatures		AASHTO TP1	2	
Direct Tension @ 2 Temperatures		AASHTO TP3	2	
LTPP Performance Tests by LTPP Contract Laboratory				
Creep Compliance	AC06	LTPP P06	8	C01*t*-C04*t*, C31*t*-C34*t*
Indirect Tensile Strength	AC07	LTPP P07	2	C05*t*, C30*t*
Resilient Modulus	AC07	LTPP P07	2	C06*t*, C29*t*
SUPERPAVE™ Shear Tester Performance Tests by SUPERPAVE™ Regional Test Center				
Frequency Sweep at Constant Height		AASHTO M003, P005	2	C11*t*, C24*t*
Simple Shear at Constant Height		AASHTO M003, P005	2	C10*t*, C25*t*
Uniaxial Strain		AASHTO M003, P005	2	C08*t*, C27*t*
Volumetric Test		AASHTO M003, P005	2	C07*t*, C28*t*
Repeated Shear at Constant Stress Ratio		AASHTO M003, P005	2	C09*t*, C26*t*
SUPERPAVE™ Indirect Tensile Tests by SUPERPAVE™ Regional Test Center				
Indirect Tensile Creep Compliance		AASHTO M005	4	C12*t*-C14*t*, C21*t*-C23*t*
Indirect Tensile Strength		AASHTO M005	4	C15*t*-C17*t*, C18*t*-C20*t*

Notes:

a. These tests to run on cores after completion of the LTPP performance tests performed by the LTPP contract laboratory.

b. These are cores from each test section at time intervals t = A (0 months), t = C (12 months), t = E (24 months) and t = F (48 months) after construction.

SECTION D

MATERIAL SAMPLING AND TESTING

POSTCONSTRUCTION

SECTION D

MATERIAL SAMPLING AND TESTING POSTCONSTRUCTION

Materials sampling after construction consists solely of coring at time intervals of 6 months, 12 months, 18 months, 24 months and 48 months. These time periods correspond to intervals B-F, as discussed in Section C of this document and presented in Figures C-2 and C-3. These core samples will be tested to determine volumetric and binder stiffness properties, to evaluate their change with time. The testing to be performed on these core samples is shown in Table D-1.

TABLE D-1. LABORATORY MATERIAL TESTS TO BE PERFORMED ON CORES FROM ALL TEST SECTIONS AT TIME INTERVALS B-F AFTER CONSTRUCTION

(To Be Performed by the Participating Highway Agency)

Test Name	Test Desig.	Protocol	Nº. of Tests	Material Source[b]
Core Examination/Thickness	AC01	LTPP P01	8	All Cores
Volumetric Analysis				
Bulk Specific Gravity	AC02	LTPP P02	8	All Cores
Asphalt Content (Extraction)	AC04	LTPP P04	8	All Cores
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	1	C01*t*
Volumetric Calculations[a]				
Volume Percent of Air Voids		AASHTO PP19	8	C01*t*-C08*t*
Percent Voids in Mineral Aggregate		AASHTO PP19	8	
Voids Filled with Asphalt		AASHTO PP19	8	
Recovered Asphalt Cement				
Abson Recovery	AE01	LTPP P21	8	C01*t*-C08*t*
Penetration @ 5°C		AASHTO T49	3	
Penetration @ 25°C & 46°C	AE02	LTPP P22	3	
Viscosity @ 60°C & 135°C	AE05	LTPP P25	2	
Specific Gravity @ 16°C	AE03	LTPP P23	2	
Dynamic Shear @ 3 Temperatures[c]		AASHTO TP5	2	
Creep Stiffness @ 2 Temperatures[c]		AASHTO TP1	2	
Direct Tension @ 2 Temperatures[c]		AASHTO TP3	2	

Notes:

a. Use the maximum theoretical specific gravity determined from tests on bulk uncompacted samples obtained during construction. Use specific gravity of aggregate components from tests on unmixed aggregates.

b. The cores shown in this table are for each test section to be tested at each designated testing time interval *t*, where *t* represents the sampling time interval after construction as follows:

t = A at time 0 immediately following construction
t = B at 6 months after construction
t = C at 12 months after construction
t = D at 18 months after construction
t = E at 24 months after construction
t = F at 48 months after construction

For example, core C01E is obtained and tested 24 months after construction.

c. The test temperatures should be the same as those used for the tests on the RTFOT-PAV conditioned samples performed during the initial binder grading.

APPENDIX E

PHOTOGRAPHS

Photo 1. Shuttlebuggy Loading Paver with Asphalt

Photo 2. Truck Loading Shuttlebuggy with Asphalt

Photo 3. Shuttlebuggy Loading Paver with Asphalt

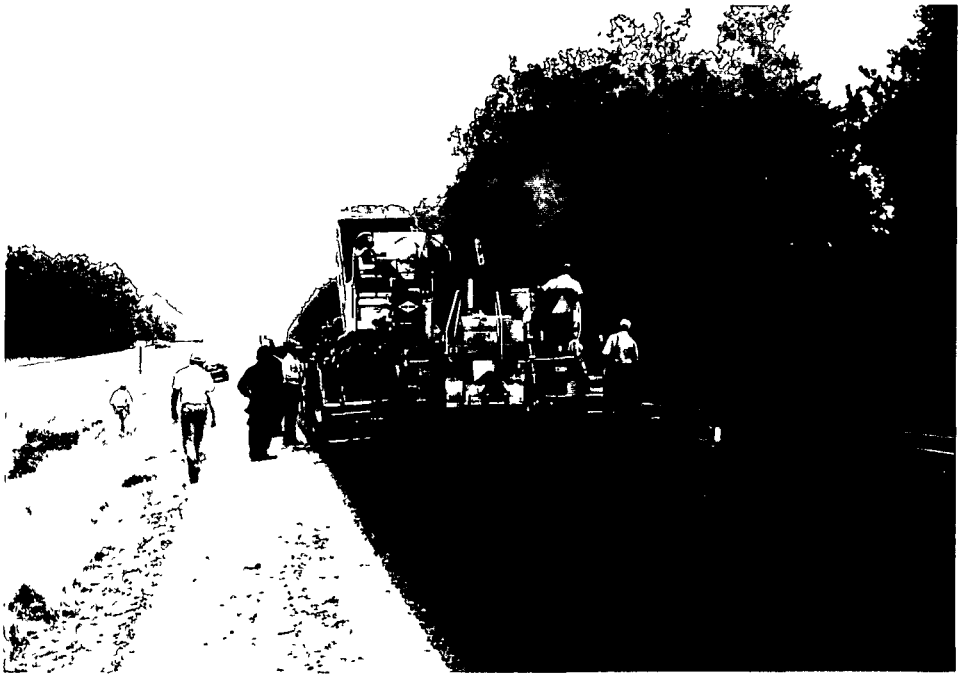


Photo 4. Asphalt Placement, 23 August 1995

Photo 5. Compaction with Vibratory Roller, 23 August 1995

Photo 6. Dresser VOS2-66B Gyratory Roller

Photo 7. BOMAG BW10RS Steel-Wheeled Roller

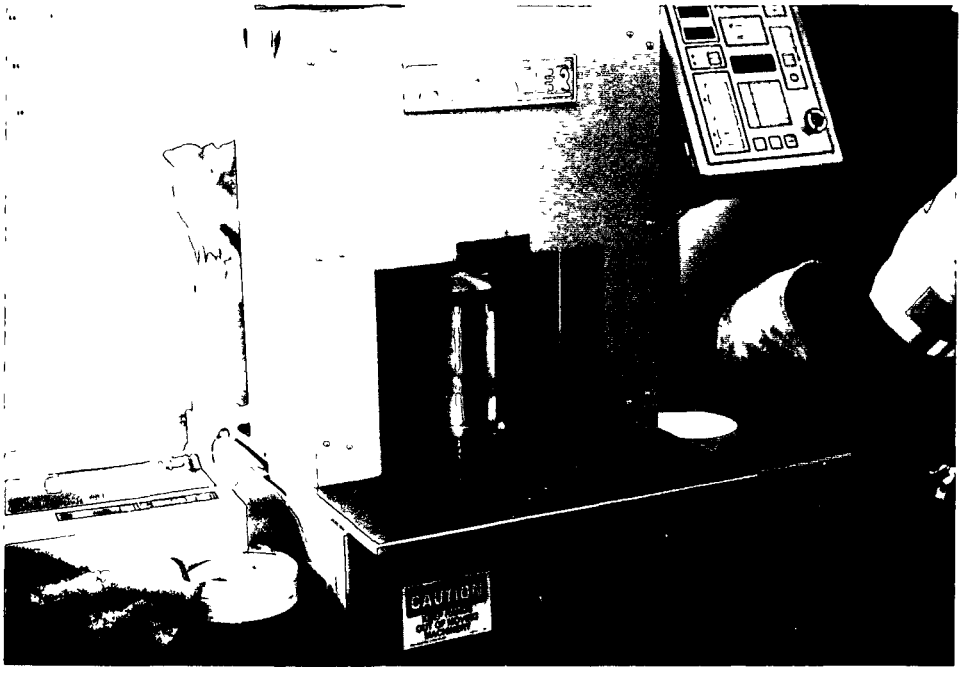


Photo 8. Troxler Gyratory Compactor at Plant