FINAL REPORT

SPS-5 PROJECT 2805
ASPHALT REHABILITATION STUDY
IH-55, NORTHBOUND
YAZOO COUNTY, MISSISSIPPI

FHWA/LTPP

SOUTHERN REGION COORDINATION OFFICE

April 1993

BRENT RAUHUT ENGINEERING INC.

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TABLE OF CONTENTS

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INTRODUCTION

A Strategic Highway Research Program (SHRP) Specific Pavement Study 5 (SPS-5) project was constructed on Interstate Highway 55 approximately 30 miles north of Jackson, Mississippi, August 13-September 26, 1990. This SPS-5 project was one of the first SPS projects constructed in the United States. This report was prepared to discuss coordination and monitoring activities before, during, and after construction, and is provided as the final report for this project. It is not the intent of this document to report all of the various data collected for this project. The data will be entered into the Long Term Pavement Performance (LTPP) data base, and is stored on-file at the Southern Region Coordination Office (SRCO) in Austin, Texas.

SPS-5 General Experiment Design

The SPS-5 experiment addresses the rehabilitation of asphalt concrete pavements. The experiment design factorial for the SPS-5 experiment is shown on Table 1. This table shows the variation of primary design factors, including climate, overlay thickness, surface preparation, and existing pavement condition for the nationwide SPS-5 experiment. The Mississippi project meets the requirements for one of the two replicate projects in the wet-no freeze environmental zone, with poor existing pavement condition. In general, the experiment is intended to evaluate some of the more common asphalt rehabilitation techniques currently used by State Highway Agencies. More specifically, the objective of this study is to develop improved performance prediction models to be used for determining the additional pavement life that can be expected from application of a variety of asphalt concrete (AC) rehabilitation methods and strategies ranging from minimal to maximum investment in the rehabilitation treatment. Factors studied in this experiment include the condition of the pavement prior to overlay (both structurally and functionally), the loading conditions the section is exposed to (including both environmental and traffic) and finally the type and thickness of overlay material. The standard SPS-5 experiment design consists of nine 500′ test sections (as shown in Figure 1). The sections include four with milling prior to overlay versus four without, four utilizing recycled mix versus four with virgin mix, and thin overlays (approximately 2″) versus thick overlays (approximately 5″). The eight test sections representing the combinations of these three features are placed adjacent to one control section (to which no treatments are applied) for comparison purposes. Surface preparation referred to in Figure 1 denotes those sections where milling is to be conducted along with patching (intensive) and those sections where only patching will be performed (minimal).

TABLE 1

EXPERIMENTAL DESIGN FOR SPS-5: REHABILITATION OF ASPHALT CONCRETE PAVEMENTS

REHABILITATION PROCEDURES / FACTORS FOR MOISTURE, TEMPERATURE, AND PAVEMENT CONDITION			WET				DRY			
			FREEZE		NO FREEZE		FREEZE		NO FREEZE	
			FAIR	POOR	FAIR	POOR	FAIR	POOR	FAIR	POOR
Surface Prep.	Overlay Material	Overlay Thickness								
Routine Maint. (Control)		0	xx	xx	xx	xx	xx	xx	xx	xx
Minimum	Recycled	2″	xx	xx	xx	xx	xx	xx	xx	xx
	AC	5″	xx	xx	xx	xx	xx	xx	xx	xx
	Virgin	2″	xx	xx	xx	xx	xx	xx	xx	xx
	AC	5″	xx	xx	xx	xx	xx	xx	xx	xx
Intensive	Recycled	2″	xx	xx	xx	xx	xx	xx	xx	xx
	AC	5″	xx	xx	xx	xx	xx	xx	xx	xx
	Virgin	2″	xx	xx	xx	xx	xx	xx	xx	xx
	AC	5″	xx	xx	xx	xx	xx	xx	xx	xx

Each "x"designates a test section.

Subgrade Soil: Fine

Traffic: >85 KESAL/Year

FIGURE 1

SPS-5: ILLUSTRATIVE TEST SECTION LAYOUT FOR REHABILITATION OF ASPHALT CONCRETE PAVEMENTS (ONE OF 16 TEST SITES)

TRANSITIONS OF VARYING LENGTH

GPS 1 or 2 Test Section (Or Other Control Section)	SEC 1	SEC 2	SEC 3	SEC 4	SEC 5	SEC 6	SEC 7	SEC 8	SEC 9	—

ADDITIONAL SECTIONS AT AGENCY'S OPTION

SPS-5 SECTION	SURFACE PREPARATION	OVERLAY MATERIAL	OVERLAY THICKNESS	SECTION LENGTH
1	Routine Maintenance		0	500′
2	Minimum	Recycled AC	2″	500′
3	Minimum	Recycled AC	5″	500′
4	Minimum	Virgin AC	5″	500′
5	Minimum	Virgin AC	2″	500′
6	Intensive	Virgin AC	2″	500′
7	Intensive	Virgin AC	5″	500′
8	Intensive	Recycled AC	5″	500′
9	Intensive	Recycled AC	2″	500′

Note: Minimum surface preparation includes routine patching only, while intensive surface preparation includes milling and necessary patching.

As part of the experiment, it was designated that the recycled mixture contain 30% of the Recycled Asphalt Pavement (RAP) and that the RAP material shall be the millings from the intensive surface preparation sections.

For additional information on the general experiment design for SPS-5, please refer to "Specific Pavement Studies: Experimental Design and Participation Requirements" Operational Memorandum No. SHRP-LTPP-OM-005R.

Selection/Nomination of IH-55

The SPS-5 project on IH-55 in Yazoo County, Mississippi was nominated on May 18, 1989. Appendix A includes the project identification and description forms which were used to nominate the project. This section of IH-55 is a 4-lane, divided interstate constructed in 1973. The project considered was 12 miles long, and was to consist of milling and overlay of the existing asphalt concrete pavement. The proposed overlay thickness was 3". The subgrade soil beneath the entire project length fell into the fine subgrade category.

Review of the project in question found the project to be in a rural area north of Jackson, Mississippi, with rolling terrain. There were few interchanges, and access was completely controlled. Because of this, traffic flow was extremely uniform over the entire project length. Typical distresses existing in the pavement prior to rehabilitation included longitudinal and transverse cracking, and localized alligator cracking.

Acceptance of the project occurred quite quickly, after which a Coordination Meeting was scheduled for May 31, 1989. This meeting was held to discuss the candidate project which had been nominated, and to define tasks that must be accomplished prior to construction. The minutes of this meeting are provided as Appendix B, as it is felt that the success of this project depended primarily on the results of this meeting. As the bid date for this project was scheduled for July 25, 1989, many of the design considerations had to be expedited. In attendance at the meeting were representatives of the Mississippi Department of Transportation (Mississippi DOT) (R&D, Construction, Specifications, and Roadway Design Divisions), the Federal Highway Administration (FHWA) Regional and Divisional Offices, SHRP, and the SRCO. Primary points for discussion at the meeting included cost of the WIM data collection facility, HMAC specifications, personnel requirements to accomplish the plan revisions, and leaving the control section untreated. Regarding the WIM cost, after much discussion, a decision was reached between the Chief Engineer and the FHWA representative that Mississippi would support a continuous WIM installation for this project. This WIM installation would be eligible for reimbursement funding as a Regional WIM installation under SHRP.

After crossing this hurdle, everything else seemed relatively easy. Al Crawley indicated that the Research & Development Department would draft special provisions for the specifications, while the Roadway Design Division made the necessary plan changes. Regarding the control section, it was agreed that it would be left untreated for the time being, but that at any time the state felt that it was necessary to treat this section it could be done. Regarding the materials considerations, the Mississippi mix design was found to be acceptable to the FHWA, in conformance with the FHWA Technical Advisory. Finally,

the discussion turned to material sampling and field testing needs, where it was decided that SHRP would provide the material sampling and laboratory testing for this project. In order to plan for this testing, a material sampling and field testing layout was required immediately.

A tentative layout had been developed by the Mississippi DOT prior to the coordination meeting. This layout was reviewed, and found to be acceptable. The only critical item was relatively short transition sections between test sections, necessary to fit the test sections within the project constraints. Review of the test section layout found that the test sections had been grouped to minimize the effects of the short transitions, which were subsequently accepted.

Following this meeting, a small group traveled to the site location to review the layout of the test sections. It was found that the distresses at the site were consistent and that the preliminary layout provided by the Mississippi DOT did meet project criteria. These test sections were laid out using pavement marking tape on the pavement surface. Since PASCO was in the area, they provided a photographic distress survey of the SPS-5 project that night.

The rehabilitation project, including the SPS-5 experiment test sections, was bid in July 1989, and let to T.L. James & Company, Inc. in August 1989. The original contract was scheduled to begin with construction of the SPS-5 test sections in the fall of 1989. Unfortunately, one of the key subcontractors filed for bankruptcy protection prior to the beginning of the project, making it impossible to begin construction. Coordination and resolution of the problems associated with construction of the project continued until May 1990. In early May 1990, the dispute was resolved, and a Preconstruction Meeting was held on May 15, 1990. The primary purpose for the Preconstruction Meeting was to develop a construction schedule, review the specifications for the project, and review special provisions for the SPS-5 construction. Due to problems associated with setup of the asphalt plant at the project site, the actual construction did not begin until mid-August, 1990.

Specific Experiment Design for IH-55

The rehabilitation project selected for construction of the SPS-5 test sections met all of the desirable characteristics for traffic volume, planned rehabilitation, and existing pavement type. The Mississippi DOT reviewed a number of potential candidates, and found this interstate rehabilitation project to be the best alternative meeting the project selection criteria. The original construction plans for the selected project are provided in Attachment A. Test section location was complicated somewhat by the variation from cut to fill sections. In order to meet the stated criteria and avoid cut/fill transitions, the test section layout was revised to include relatively short transitions to meet space constraints. Transitions as short as 25′ were used. Once again, it should be noted that since this was one of the first SPS projects constructed, much of the guiding documentation now available from SHRP was not available. Many of the questions which surfaced during the planning and construction of this SPS-5 project were used in the preparation of the guiding documents now available.

The resulting layout is shown on the typical section sheets provided in Attachment A. Test sections were grouped to include sections of like materials (virgin AC and recycled AC), and then sections of similar cross-section to reduce the construction sequencing problems and abnormal variations in longitudinal profile, respectively. The short transition areas occurred between the sections separated only by minimal versus intensive surface preparation, where milling could be stopped in a short distance. Where transitions in layer thickness or material type were encountered, sufficient transition lengths were provided.

PRECONSTRUCTION MONITORING

Monitoring of the existing pavement in advance of construction included measurement of existing surface distress, profile and deflection testing with the SHRP FWD. A summary of the pre- and postconstruction timing requirements for SHRP SPS-5 projects is provided as Table 2.

Pavement Surface Distress

The first measurement of pavement surface distress was taken by PASCO on June 1, 1989. This occurred just after the Coordination Meeting, when the decision was made to accept the IH-55 project as an SPS-5 candidate. The PASCO unit was in the area conducting photographic distress surveys on GPS test sections, and was able to film the new SPS-5 project as well.

Because of the long delay between the acceptance of the project and the beginning of construction, it was necessary to conduct a second series of distress surveys prior to construction. PASCO filmed the Mississippi SPS-5 test section on June 11, 1990. This survey was conducted approximately two months prior to the beginning of construction.

Surface Profile

Profile data was measured with the SRCO Profilometer on May 12, 1990, or approximately three months prior to the commencement of construction. Measured IRI values varied significantly along the project. At the location of section 280501, the mean IRI value was 70.0. Moving north to sections 280507 and 280504, the mean measured IRI was 153.3. Through sections 280505 and 280506, the measured IRI prior to overlay was 119.6. The mean measured IRI value for the run encompassing sections 280509, 280502, and 280503 was 170.4, the highest along the project. Finally, at the north end of the project, the mean IRI for sections 280508 and 280510 was 142.7. It should be noted that multiple test sections were run in single passes because of short spacing between sections, and the inability of the photocell to register event markers at the beginning of the second or third test sections.

Structural Capacity

Preconstruction FWD data was measured on October 23-26, 1989. While it is recognized that this is approximately ten months prior to construction, it was not possible to reschedule FWD testing activities to accommodate the revised construction schedule.

Materials Sampling and Testing

Materials sampling activities at the SPS-5 project on IH-55 occurred on October 25, 1990. The SHRP Regional Contractor, conducting materials sampling activities on GPS test sections, was selected to sample the SPS-5 project as well. SHRP agreed to provide for this sampling and the materials testing activities during the coordination meeting discussed previously.

TABLE 2

SUMMARY OF TIMING GUIDELINES FOR BEFORE AND AFTER MONITORING MEASUREMENTS FOR THICK OVERLAYS (≥ 2″)

	Before	After
Deflection Measurements	< 3 mo.[1]	3 to 6 mo.[2,3]
Profile Measurements	< 3 mo.[4] (freeze) < 6 mo. (no-freeze)	< 2 mo. < 4 mo. (dry no-freeze)
Distress Surveys	< 6 mo.[5] (freeze) < 8 mo.[5] (no-freeze)	< 12 mo.[6]
Skid Measurements	< 12 mo.[7]	3 to 12 mo.

1. This can be extended to 6 months, if it is a dry no-freeze region where the moisture conditions of the pavement have not changed. For freeze regions, the average 24 hour air temperature should be above freezing for at least one week prior to testing; also, such testing should be after spring thaw recovery.

2. This should be shortened if winter freezing of the pavement structure is approaching.

3. If before measurements are made between 3 and 6 months, the after measurements should be 3 months.

4. This should be after spring thaw recovery.

5. For pavements with high severity of cracking, or exhibiting pumping, these times should be halved.

6. If the conditions of #5 apply, this time should be halved.

7. For pavements where low friction resistance is a consideration in placement of the overlay or surface treatment, this time should be halved.

Since this was one of the first SPS projects constructed in the United States, standard guidelines for development of materials sampling plans were not available. A Materials Sampling Plan was developed for this project by SHRP's Technical Assistance Contractor. A copy of the Materials Sampling and Testing Plan for this project is provided in Appendix C. Materials sampling activities in the field were conducted in accordance with this sampling plan.

The materials obtained in the field were shipped to the appropriate laboratories for materials testing. Law Engineering tested the unbound materials, while Southwestern Labs in Houston, Texas is testing the bound materials. Since the date of materials sampling occurred after the project had been constructed, preconstruction and postconstruction occurred at the same time, and the samples are to be tested in the laboratory accordingly.

CONSTRUCTION

Construction of SPS project 2805 on IH-55 in Yazoo County, Mississippi, began on August 13, 1990 and concluded on September 25, 1990. Construction occurred over such a long period of time primarily because of problems associated with the asphalt concrete production plant, which had numerous breakdowns and had trouble maintaining consistent mix production. In general, the construction sequence began with a 200-ton test strip to develop a rolling pattern, which generally found the mix being produced by the plant did not meet specifications. Until these mix problems were resolved, we were unable to pave on the actual test sections.

Construction began with milling of the appropriate test sections on August 13, 1990. Each lane required two pulls of the milling machine, which was only capable of milling one-half lane width at a pass. The entire milling process went quite smoothly, and was completed by the afternoon of August 14. During the milling process, Dipstick® measurements were obtained to define the cross-profile after milling. Also, the Mississippi DOT obtained elevation measurements after each construction stage.

Placement of the virgin mix asphalt concrete was scheduled to begin on August 15, 1990. However, laboratory tests of the mix being produced found the material did not meet specification limits for asphalt content and gradation. Placement of the HMAC was delayed until August 21, when the first lift of virgin binder was placed on Sections 7 and 4. Problems at the plant prevented placement of any additional material until August 28, when the second and third lifts of HMAC binder were placed on Sections 7 and 4. On the following day, during the paving of the inside lane, the paver broke down. Special parts had to be ordered, which prevented further paving until September 11.

On August 31, while waiting for the laydown machine to be repaired, cores of the HMAC showed some areas were out of the specification limits (too high) on density. The worst locations were in the inside (non-test) lane, and after coordination with the contractor the materials were removed and replaced.

Paving resumed on September 11 and placement of all virgin binder layers were completed. Unfortunately, paving was again delayed because of rain and additional problems at the plant. It should be noted once again that the Mississippi DOT required a 200-ton test strip prior to placement of material each day, and diligently conducted QA testing at temporary laboratory facilities set up at the plant. Therefore, the occurrence of HMAC materials that did not meet specification requirements within the test sections should be minimal.

Paving operations resumed on September 18 with placement of recycled binder mix on Sections 9 and 8. Placement of recycled binder continued through September 19 and 20, when all of the recycled binder layers were complete.

Paving operations concluded with placement of the surfacing. Virgin HMAC surface layers were placed on September 24 and recycled surface mix was placed, completing all paving on the test sections on September 25.

Construction monitoring consisted primarily of observations of paving practice, recording mix temperatures, ensuring samples were obtained from the plant, and coordination with Mississippi DOT personnel regarding construction operations. We should note once again that as a pilot SPS project, most of the current data collection forms and guidelines were not available at the time of construction.

POSTCONSTRUCTION MONITORING

Monitoring of the SPS-5 project after construction included measurement of profile, deflection testing, and materials sampling (coring) of the new materials. The guidelines for timing of postconstruction monitoring were provided as Table 2.

Pavement Surface Distress

Observations of pavement surface distress were obtained for the Mississippi SPS-5 project on December 27, 1990, during a visit to the site. A manual distress survey was conducted in accordance with applicable guidelines at the time. A photographic distress survey was conducted in April 1992 by PASCO.

Surface Profile

Measurements of profile were obtained on November 14, 1990, to satisfy the postconstruction requirements for this project. The measured IRI for Section 280501 was 77.4. Since this is the control test section, no treatment or overlay was applied. As such, it was expected that the IRI value would increase in time, which is in fact the case.

As may also be expected, the postconstruction IRI values for the remaining test sections are significantly lower than the preconstruction values. For test sections 280507 and 280504, the mean IRI was 87.8. Mean IRI values for 280505 and 280506 were 103.2, while values for the combined run, including 280509, 280502, and 280503 were 119.8. Finally, the mean postconstruction IRI for Sections 280508 and 280510 were 90.0.

A second measurement of profile was obtained in August 1992 and plans are to conduct additional measurements on an annual basis.

Structural Capacity

The Southern Region FWD conducted deflection testing at this site November 28-30, 1990, to meet the stated postconstruction test requirements. Subsequent testing occurred in October 1991 and June 1992, and plans are to conduct additional measurements on an annual basis.

Materials Sampling and Testing

As stated previously, the materials sampling activities were conducted at this site on October 25, 1990. Since construction of the overlay was complete, requirements for the pre- and postconstruction materials sampling were satisfied at this time. Materials sampling and field testing followed the provisions of the sampling plan, as presented in Appendix C. The most disturbing aspect of the sampling and testing activities was the occurrence of stripping in the original HMAC materials. At some locations, cores would not remain intact and substitutes had to be cut.

SUMMARY

An SPS-5 project was constructed on IH-55, north of Jackson, Mississippi through the coordinated efforts of the Mississippi DOT, the Mississippi Division office of the FHWA, SHRP, the SRCO contractor to SHRP, and the construction contractor. Despite recurring problems with the asphalt mix plant and inclement weather, which delayed construction, the test sections for this SPS-5 project were completed on September 24, 1990. Throughout the construction process, representatives from the Mississippi DOT and the SRCO were on-site to observe and monitor progress.

Monitoring of project characteristics and construction activities was conducted in accordance with applicable SHRP guidelines at the time. As a pilot SPS construction project, very little guiding documentation was available. All pertinent data for before, during, and after construction monitoring activities are on-file at the SRCO, and will be input into the SHRP LTPP Information Management System (IMS) for future data analyses.

The only notable deviation from "desirable" construction circumstances would be the numerous problems with the asphalt plant. On many occasions mixes produced by the plant were rejected by the state for being out of specification limits on AC content or gradation, and the construction process was delayed while adjustments were made. Other indications of materials deficiencies included measurements of density for the newly placed AC binder, which fell below specification limits. It must be noted, however, that all prudent efforts were made to keep such occurrences from the test lanes.

The Mississippi DOT routinely required laydown of a 200-ton test strip prior to any paving on the test sections for each day of paving, and conducted QA testing on the test strip to ensure it was placed according to specifications. The deficiencies noted previously with the density test results were in the inside (non-test) lane. As a result, it is felt that this pilot SPS-5 construction project meets all reasonable expectations for this study.

APPENDIX A

SITE BACKGROUND DATA

MISSISSIPPI

Mississippi State Highway Department / P.O. Box 1850 / Jackson, Mississippi 39215-1850 / FAX (601) 359-2233

May 18, 1989

Mr. Amir N. Hanna
Strategic Highway Research Program
SPS Site Nominations
818 Connecticut Avenue, N.W.
Washington, D.C. 20008

Dear Mr. Hanna:

Enclosed are the completed data sheets for nomination of an SPS-5 candidate site as we discussed by telephone yesterday. This project is scheduled for July letting so we need a quick response if the project is acceptable.

Sincerely,

Alfred B. Crawley
Acting Research and Development Engineer

Project Identification and Description

Experiment Number: SPS-5
Environmental Zone: W-NF
Existing Pavement Condition: Poor X Fair ___

State: Mississippi District: 3 County: Yazoo/Holmes

Route Number: I-55
Number of Through Lanes: 2 (directional)
Year Constructed: 1973
Pavement age: 16 yrs
Edge Drains used: Yes ___ No X

Single Paving Contract: Yes X No ___
Single Paving Contractor: Yes X No ___
Single Pavement Design: Yes X No ___
Same Material Source: Yes X No ___
Previously Overlayed: Yes ___ No X

Proposed Project Length: 12 miles
Proposed Treatment: mill and overlay
Proposed Overlay Thickness: 3"
Proposed Pavement Prep: Minimal ___ Extensive X
Typical Rehab: Yes X No ___
Retrofit Edge Drains: Yes 0 No X
Primary Reason for Rehab: poor serviceability, high deflections

Soil Type: Fine X Course ___
Subbase Type: Stabilized X Unstabilized ___
Stabilizing Agent Type: lime

Layer	Material	Thickness	
Subgrade	56	___	clayey silt
Subbase	36	6"	lime-treated fine grained soil
Base	28	8.5"	hot mix asphalt
Pavement	1	4"	hot mix asphalt

Structural Number: 5.55
Shoulder Treatment: 12 hot mix asphalt with surface treatment

Bulk Specific Gravity of Aggregates: ___
In-Place Air Voids (%): ___

Prior Maintenance: Routine ___ Extensive X
If Heavy Maintenance: Percent Area Patched 100% chip seal in 1987, but distresses are highly visible

PSI Range: 2.5-2.8

Year of Traffic Data: 1989
AADT: 8400
Percent Trucks: 20 %
KESALS (Travel Lane): 204
Traffic Uniformity: Identical X Similar ___
Unusual Traffic Pattern: Yes ___ No X

Availability and Confidence in Historical Data:

As Built	Good ___	Fair X	Poor ___
Traffic	Good ___	Fair X	Poor ___
Maintenance	Good ___	Fair X	Poor ___

Test Section Layout:

Proposed Transition Length: 250'
Distance between First and Last Test Section: 2.6 miles
Number of Test Sections Entirely on: Cut 2 Fill 6
Test Section Layout Submitted: Yes ___ No X

GPS Relationship:

Project has GPS-6a/6b Test Section: Yes ___ No X
Project Part of GPS-1 or GPS-2 Test Section: Yes ___ No X
Distance to Nearest GPS Test Section: Miles 40

Supplemental Section:

Supplemental Test Sections Proposed: Yes ___ No X
Experimental Factors to be studied:
Anticipated Interest by Other Agencies: High ___ Low ___

Administrative:

Last Date for Candidate Acceptance: June 1, 1989
Last Date for Distress, FWD, Etc: August 1, 1989
Can Work be Delayed on Test Sections: Yes ___ No X
Testing and Sampling Plan Submitted: Yes ___ No X
Quality Assurance Plans Submitted: Yes ___ No X

GENERAL INDEX

FOR DETAILED INDEX OF PLANS SEE SHEET NO. 2

DESCRIPTION	NUMBER OF SHEETS
TITLE SHEET	1
DETAILED INDEX	1
GENERAL NOTES	1
TYPICAL SECTIONS	8
QUANTITIES	2
PLAN AND PROFILES	
SPECIAL DESIGN - ROADWAY ITEMS	14
BRIDGE DRAWINGS	
SPECIAL DESIGN - BRIDGES	
CROSS-SECTIONS	

TOTAL SHEETS 27

STATE OF MISSISSIPPI

STATE HIGHWAY DEPARTMENT

RECEIVED MAY 0 6 1991

PLAN AND PROFILE OF PROPOSED STATE HIGHWAY

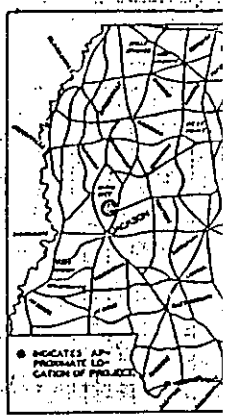
FEDERAL AID PROJ. NO. IR-55-2

(136)127 (YAZOO CO.) 54-0055-02-136-11 △
(136)138 (HOLMES CO.) 54-0055-02-136-12 △
(137)123 (MADISON CO.) 54-0055-02-137-10 △

INTERSTATE HWY. NO. 55 BETWEEN
MISS. HWY. NO. 16 & MISS. HWY. NO. 17
MADISON, YAZOO, AND HOLMES COUNTIES

SCALES
PLAN 1 IN.=100 FT.
PROFILE (HOR. 1 IN.=100 FT. / VERT. 1 IN.=10 FT.)
LAYOUT 1 IN.=3500 FT.

FED. ROAD REF. NO.	STATE	PROJECT NO.
3	MISS.	

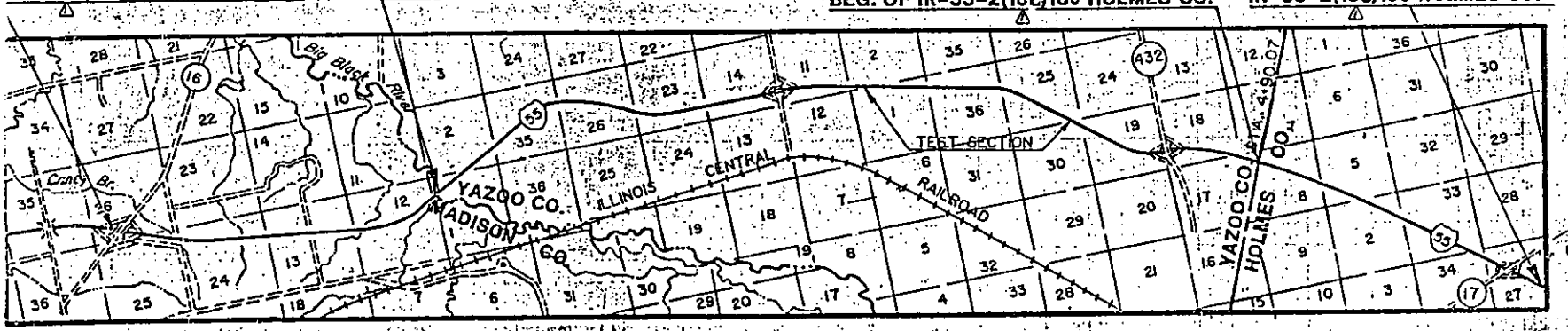


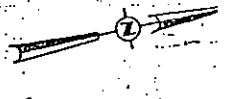
STA. 1112+25.00 BEG. OF PROJ.
IR-55-2(137)123 MADISON CO.

STA. 1317+79.00 END OF IR-55-2(136)123
BEG. OF IR-55-2(136)127 YAZOO CO.

STA. 4+90.04 END OF IR-55-2(136)127
BEG. OF IR-55-2(136)138 HOLMES CO.

STA. 230+00.00 END OF PROJ.
IR-55-2(136)138 HOLMES CO.





EQUATIONS

(MADISON COUNTY)

STA. 1182+69.03 BK. =	STA. 1182+50.58 AH.	+	18.45 FT.
STA. 1308+31.33 BK. =	STA. 1307+82.44 AH.	+	48.89 FT.
(YAZOO COUNTY)			
STA. 1387+96.60 BK. =	STA. 1373+10.00 AH.	+	1,486.60 FT.
STA. 1614+82.25 BK. =	STA. 1615+40.10 AH.	-	57.85 FT.
STA. 1781+02.69 BK. =	STA. 1781+00.00 AH.	+	02.69 FT.
STA. 1808+08.64 BK. =	STA. 1806+27.77 AH.	+	180.87 FT.
STA. 1912+73.16 BK. =	STA. 1912+72.58 AH.	+	0.58 FT.
STA. 1938+25.00 BK. =	STA. 0+00.00 AH.	+	193,825.00 FT.

EXCEPTIONS (BRIDGES)

MADISON COUNTY

STA. 1309+30	TO	STA. 1311+70	240.00 FT.
STA. 1316+04	TO	STA. 1317+79	175.00 FT.
		TOTAL	415.00 FT.

YAZOO COUNTY

STA. 1317+79	TO	STA. 1319+54	175.00 FT.
STA. 1329+00	TO	STA. 1331+80	280.00 FT.
STA. 1357+60	TO	STA. 1361+60	400.00 FT.
STA. 1382+60	TO	STA. 1386+60	400.00 FT.
STA. 1383+80	TO	STA. 1387+80	400.00 FT.
STA. 1580+87.27	TO	STA. 1582+79.52	192.00 FT.
STA. 1738+31	TO	STA. 1741+11	280.00 FT.
STA. 1770+40	TO	STA. 1774+00	360.00 FT.
		TOTAL	2,387.00 FT.

CONVENTIONAL SYMBOLS

COUNTY LINE
TOWN INCORPORATION LINE
SECTION LINE
ROAD OR TRAVELED WAY
RAILROAD
SURVEY LINE
BRIDGE

LENGTH

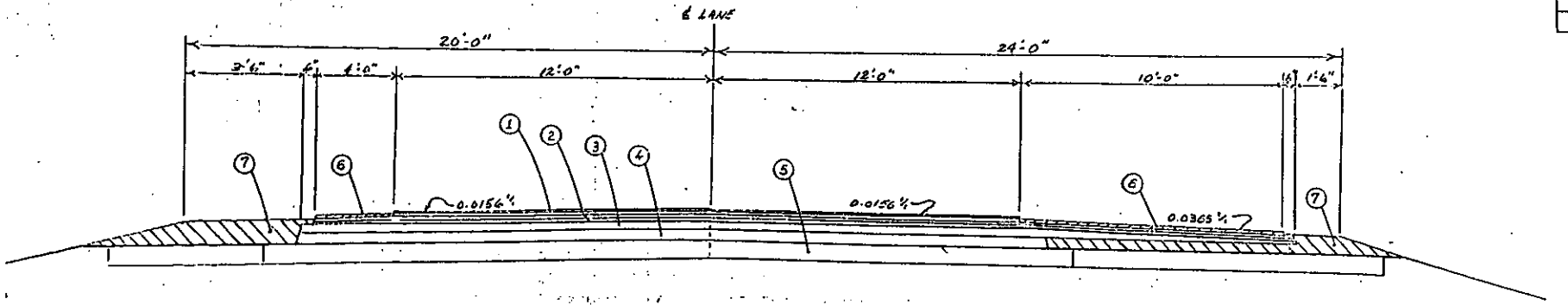
	MADISON CO.	YAZOO CO.	HOLMES CO.	TOTAL
LENGTH OF ROADWAY	20,206.34 FT. 3.827 MI.	61,661.71 FT. 11.678 MI.	22,504.42 FT. 4.262 MI.	104,372.47 FT. 19.767 MI.
LENGTH OF BRIDGES	0.00 FT. 0.000 MI.	0.00 FT. 0.000 MI.	0.00 FT. 0.000 MI.	0.00 FT. 0.000 MI.
LENGTH OF PROJECT (NET)	3.827 MI.	11.678 MI.	4.262 MI.	19.767 MI.
LENGTH OF EXCEPTIONS	415.00 FT. 0.079 MI.	2,387.00 FT. 0.452 MI.	0.00 FT. 0.000 MI.	2,802.00 FT. 0.531 MI.
LENGTH OF PROJECT (GROSS)	3.906 MI.	12.130 MI.	4.262 MI.	20.298 MI.

APPROVED: Orl R. Ozbirn
DIRECTOR
MISSISSIPPI STATE HIGHWAY DEPARTMENT

APPROVED:
DIVISION ENGINEER
FEDERAL HIGHWAY ADMINISTRATION
DEPARTMENT OF TRANSPORTATION

MADISON, YAZOO, AND HOLMES COS.

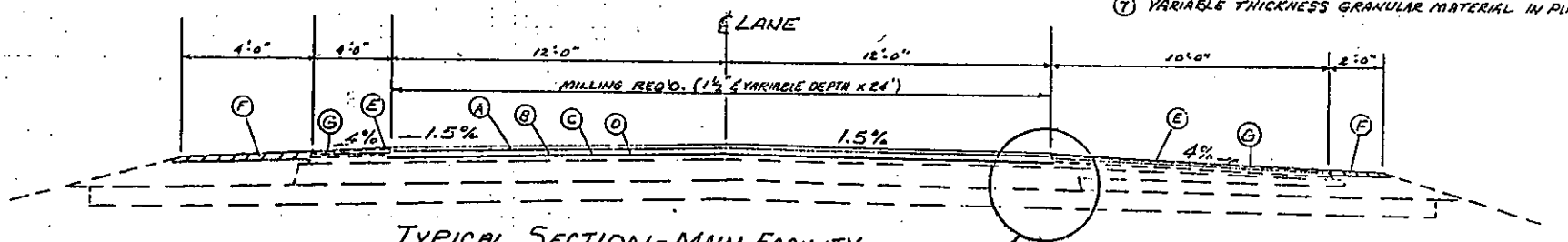
STATE	PROJECT NO.
MISS.	IR-55-2(1) IR-55-2(1)



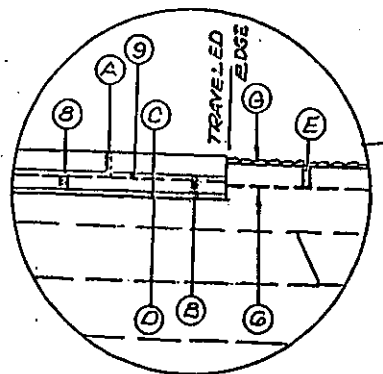
TYPICAL SECTION - MAIN FACILITY
EXISTING
(IN DIRECTION OF TRAFFIC)

(1) SEAL COURSE IN PLACE
(2) 4" AND VARIABLE DEPTH HOT BITUMINOUS PAVEMENT IN PLACE (2@1½" BINDER COURSE AND 1@1" SURFACE COURSE) (BINDER COURSES ONLY ON SHOULDERS)
(3) 4½" AND VARIABLE DEPTH PLANT MIX BITUMINOUS BASE COURSE IN PLACE
(4) 4" AND VARIABLE DEPTH PLANT MIX BITUMINOUS BASE COURSE IN PLACE
(5) LIME OR CEMENT TREATED DESIGN SOIL IN PLACE
(6) DOUBLE BITUMINOUS SURFACE TREATMENT IN PLACE
(7) VARIABLE THICKNESS GRANULAR MATERIAL IN PLACE

(8) 1" SURFACE CRSE. IN PLACE.
(9) ¼" SEAL IN PLACE



TYPICAL SECTION - MAIN FACILITY
(NORMAL) MILLING & OVERLAY
(IN DIRECTION OF TRAFFIC)

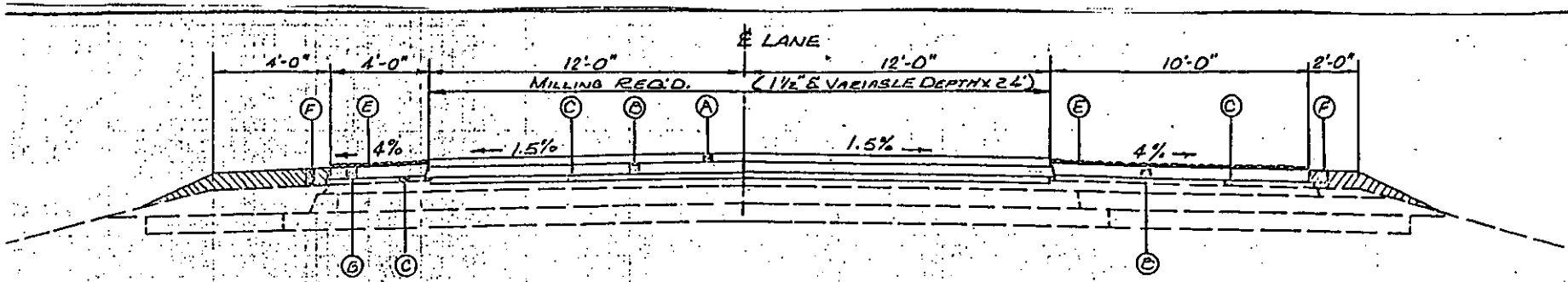


SHOULDER DETAIL

(A) 1½" HOT BITUMINOUS PAVEMENT SURFACE COURSE REQ'D.
*(B) 1½" AND VARIABLE DEPTH HOT BITUMINOUS PAVEMENT BINDER COURSE REQ'D.
(C) FABRIC UNDERSEAL REQ'D.
(D) ½" AND VARIABLE SLURRY SEAL REQ'D.
*(E) 1½" AND VARIABLE DEPTH HOT BITUMINOUS PAVEMENT BINDER COURSE REQ'D.
(F) 1½" AND VARIABLE DEPTH (PLANT MIX MAT'L.) P.E.R.D. (CLASS 5, GROUP C).
(G) S.B.S.T. REQ'D.

*PRELIMINARY LEVELING REQ'D. TO CORRECT GRADES, AS DIRECTED BY THE ENGINEER.

MISSISSIPPI STATE HIGHWAY DEPARTMENT
TYPICAL SECTIONS
MAIN FACILITY
PROJECT NO. IR-55-2(126)
IR-55-2(136)
IR-55-2(137)
MADISON, YAZOO & HOLMES CO'S.
WORKING NUMBER TS-1
SHEET NUMBER 4
DESIGNED ____ DETAILED ____ TRACED ____
CHECKED ____ DATE ____



TYPICAL SECTION – MAIN FACILITY
— TEST SECTION NO. 7 —
(STA. 1746+00 TO STA. 1751+00)

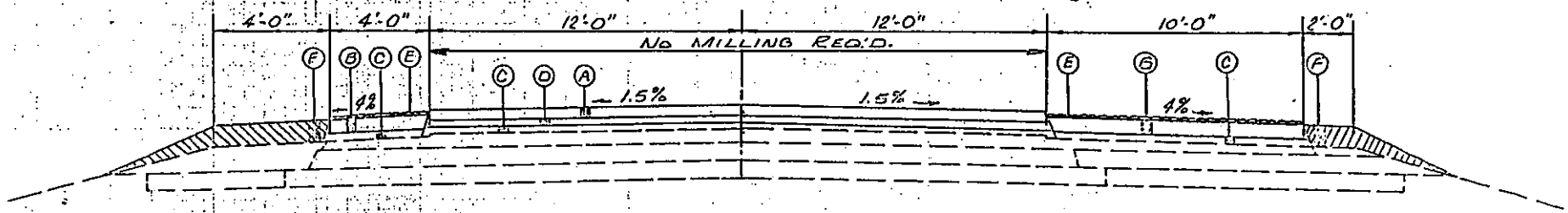
Ⓐ 2" HOT BITUMINOUS PAVEMENT (S-B MIX) SURFACE COURSE REQ'D.

Ⓑ 3" HOT BITUMINOUS PAVEMENT (2-B MIX) (2 @ 1½" BINDER) REQ'D.

Ⓒ 1½" & VARIABLE HOT BITUMINOUS PAVEMENT (2-B MIX) BINDER COURSE REQ'D.

Ⓓ 1½" HOT BITUMINOUS PAVEMENT (2-B MIX) BINDER COURSE REQ'D.

Ⓔ SINGLE BITUMINOUS SURFACE TREATMENT REQ'D.



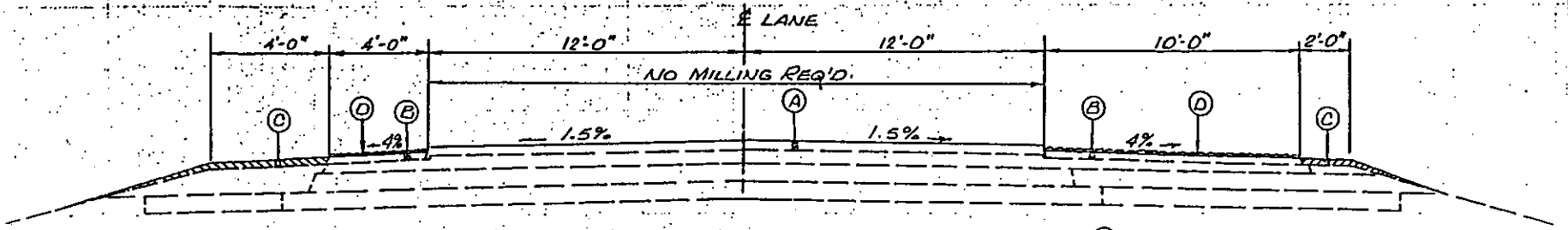
TYPICAL SECTION – MAIN FACILITY
— TEST SECTION NO. 4 —
(STA. 1751+25 TO STA. 1756+25)

Ⓕ 4½" & VARIABLE GRANULAR MATERIAL (CLASS 5, GROUP C) REQ'D.

NOTE: TYPICAL TEST SECTIONS APPLY TO NORTH-BOUND LANES ONLY.

MISSISSIPPI STATE HIGHWAY DEPARTMENT
TYPICAL SECTION-MAIN FACILITY
TEST SECTIONS NO. 7 & NO. 4
PROJECT NO. IR-55-2 (135) (136) (137)
MADISON, YAZOO & HOLMES CO'S.
TS-4
SHEET NUMBER 7

STATE	PROJECT NO.
MISS.	IR-55-2(136) IR-55-2(137)



TYPICAL SECTION - MAIN FACILITY
— TEST SECTION NO. 5 —
(STA. 1758 + 25 TO STA. 1763 + 25)

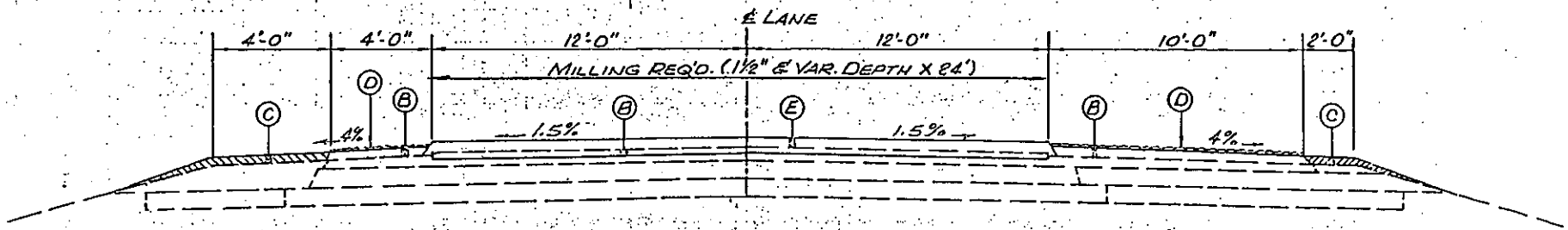
Ⓐ 2" ℄ VARIABLE DEPTH HOT BITUMINOUS PAVEMENT (3-B MIX) SURFACE COURSE REQ'D.

Ⓑ 1½" ℄ VARIABLE DEPTH HOT BITUMINOUS PAVEMENT (2-B MIX) BINDER COURSE REQ'D.

Ⓒ 1½" ℄ VARIABLE DEPTH GRANULAR MATERIAL (CLASS 5, GROUP C) REQ'D.

Ⓓ SINGLE BITUMINOUS SURFACE TREATMENT REQ'D.

Ⓔ 2" HOT BITUMINOUS PAVEMENT, (3-B MIX) SURFACE COURSE REQ'D.



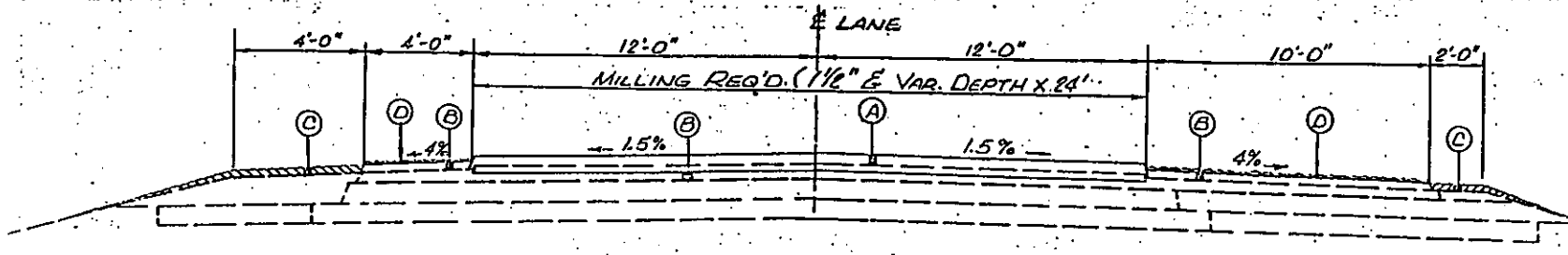
TYPICAL SECTION - MAIN FACILITY
— TEST SECTION NO. 6 —
(STA. 1763 + 50 TO STA. 1768 + 50

NOTE: TYPICAL TEST SECTIONS APPLY TO NORTH-BOUND LANES ONLY.

MISSISSIPPI STATE HIGHWAY DEPARTMENT
TYPICAL SECTION-MAIN FACILITY
TEST SECTIONS NO. 5 & NO. 6
IR-55-2(136)
PROJECT NO. IR-55-2(136).
IR-55-2(137)
MADISON, YAZOO & HOLMES CO'S.

WORKING DRAWING NO. TS-5
SHEET NUMBER

DESIGNED — DRAWN — TRACED — CHECKED



TYPICAL SECTION - MAIN FACILITY
— TEST SECTION NO. 9 —
(STA. 1777 +00 TO STA. 1782 +00)

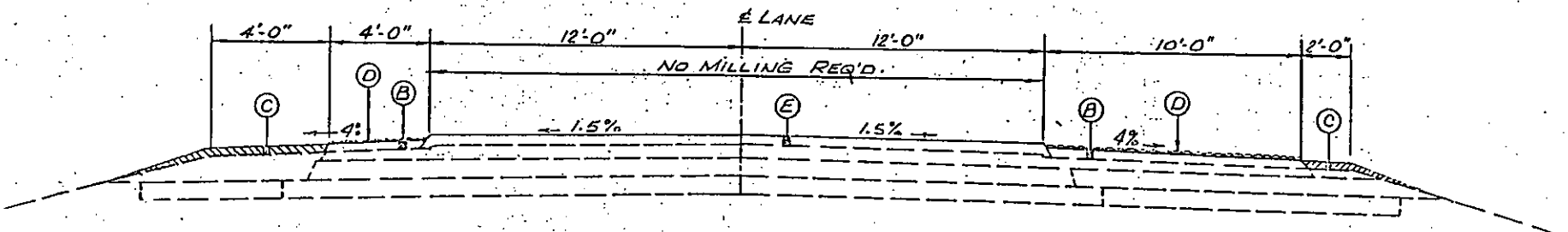
Ⓐ 2" HOT BITUMINOUS PAVEMENT (3 - A MIX.) SURFACE COURSE REQ'D.

Ⓑ 1½" & VARIABLE DEPTH HOT BITUMINOUS PAVEMENT (1/2 - A MIX) BINDER COURSE REQ'D.

Ⓒ 1½" & VARIABLE DEPTH GRANULAR MATERIAL (CLASS 5, GROUP C) REQ'D.

Ⓓ SINGLE BITUMINOUS SURFACE TREATMENT REQ'D.

Ⓔ 2" & VARIABLE DEPTH HOT BITUMINOUS PAVEMENT (3 - A MIX) SURFACE COURSE REQ'D.

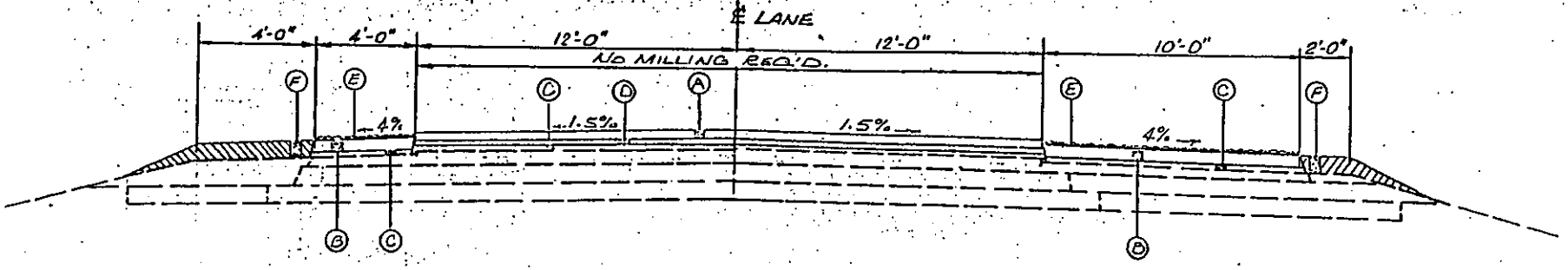


TYPICAL SECTION - MAIN FACILITY
— TEST SECTION NO. 2 —
(STA. 1782 +25 TO STA. 1787 +25

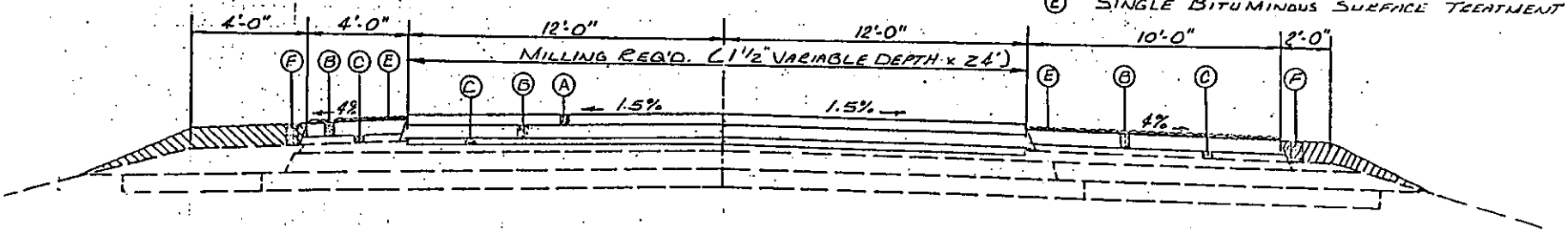
NOTE: TYPICAL TEST SECTIONS APPLY TO NORTH-BOUND LANES ONLY.

MISSISSIPPI STATE HIGHWAY DEPARTMENT
TYPICAL SECTION-MAIN FACILITY
TEST SECTIONS NO. 9 & NO. 2
IR-55-2(136)
PROJECT NO. IR-55-2(136)
IR-55-2(137)
MADISON & YAZOO
HOLMES CO'S.
TS-6

STATE	PROJECT NO.
MISS.	IR-55-2(136) IR-55-2(137)



TYPICAL SECTION – MAIN FACILITY
— TEST SECTION NO. 3 —
(STA. 1789+75 TO STA. 1794+75)



TYPICAL SECTION – MAIN FACILITY
— TEST SECTION NO. 8 —
(STA. 1798+00 TO STA. 1803+00)

Ⓐ 2" HOT BITUMINOUS PAVEMENT (S-A MIX) SURFACE COURSE REQ'D.

Ⓑ 3" HOT BITUMINOUS PAVEMENT (S-A MIX) (℄ 1 1/2" BINDER) REQ'D.

Ⓒ 1 1/2" & VARIABLE HOT BITUMINOUS PAVEMENT (S-A MIX) BINDER COURSE REQ'D.

Ⓓ 1 1/2" HOT BITUMINOUS PAVEMENT (S-A MIX) BINDER COURSE REQ'D.

Ⓔ SINGLE BITUMINOUS SURFACE TREATMENT REQ'D.

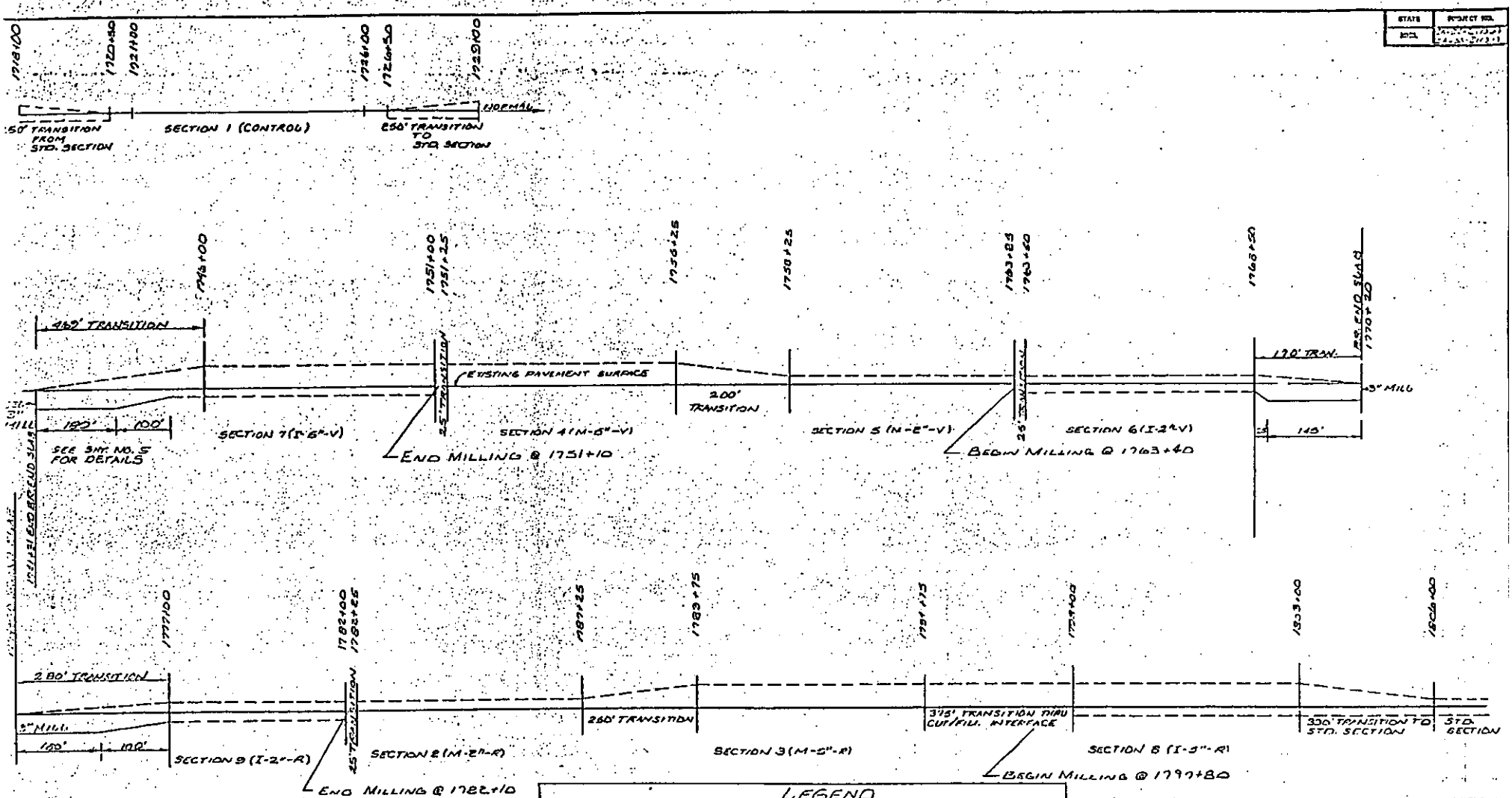
Ⓕ 4 1/2" & VARIABLE GRANULAR MATERIAL (CLASS 5, GROUP C) REQ'D.

NOTE: TYPICAL TEST SECTIONS APPLY TO NORTH-BOUND LANES ONLY

MISSISSIPPI STATE HIGHWAY DEPARTMENT

TYPICAL SECTION-MAIN FACILITY
TEST SECTIONS NO. 3 & NO. 8
IR-55-2(136)
PROJECT NO. IR-55-2(136)
12-55-2(137)
MADISON & HOLMES CO'S.

TS-7



LEGEND

I = INTENSIVE SURFACE PREPARATION (1½" MILLING)

M = MINIMUM SURFACE PREPARATION (PATCHING)

V = BITUMINOUS HOT MIX WITH NO RECYCLED ASPHALT PAVEMENT.

R = BITUMINOUS HOT MIX WITH 30% RECYCLED ASPHALT PAVEMENT.

MISSISSIPPI STATE HIGHWAY DEPARTMENT

TYPICAL SECTIONS (PROFILE OF TEST SECTIONS)

MAIN FACILITY - NORTH BOUND LANES -

PROJECT NO. IR-55-2(150)
IR-55-2(136)
IR-55-2(137)

MADISON, HINDS & RANKIN COS.

SHEET NO. 11

SUMMARY OF QUANTITIES (ROADWAY)

PAY ITEM NO.	PAY ITEMS	UNITS	MADISON CO. PRELIM.	MADISON CO. FINAL	YAZOO CO. PRELIM.	YAZOO CO. FINAL	HOLMES CO. PRELIM.	HOLMES CO. FINAL	TOTALS PRELIM.	TOTALS FINAL
	EARTHWORK ITEMS									
202-A	REMOVAL OF ASPHALT PAVEMENT	S.Y.	175		750		350		1275 ①	
202-B	REMOVAL OF CONCRETE ISLANDS & CURB	L.S.	L.S.		L.S.		L.S.		L.S. ②	
203-A	UNCLASSIFIED EXCAVATION (F.M.)	C.Y.	60		250		120		430 ①	
	SUBBASE & BASE ITEMS									
304-E	GRANULAR MATERIAL (CL.S GO) (CONTRACTOR FURNISHED)	TON	2,499		9,179		3,493		15171	
	BITUMINOUS PAVING ITEMS									
907-403-2	HOT BITUMINOUS PAVEMENT BINDER COURSE (PROJECT)	TON	18,733		48,804		21,329		88866	
907-403-2A	HOT BITUMINOUS PAVEMENT BINDER COURSE (WITH 30% RAP)	TON	—		1,906		—		1,906	
907-403-2B	HOT BITUMINOUS PAVEMENT BINDER COURSE (NO RAP)	TON	—		1,683		—		1,683	
907-403-3	HOT BITUMINOUS PAVEMENT SURFACE COURSE (PROJECT)	TON	9,616		30,608		14,081		54305	
907-403-3A	HOT BITUMINOUS PAVEMENT SURFACE COURSE (SC-1, WITH 30% RAP)	TON	—		948		—		948	
907-403-3B	HOT BITUMINOUS PAVEMENT SURFACE COURSE (SC-1, NO RAP)	TON	—		939		—		939	
907-405-C	SLURRY SEAL (TYPE 3)	S.Y.	53831		309,016		120,027		482874	
907-406-A	COLD MILLING OF PAVEMENT	TON	6643		34,780		13,778		55201	
410-B	ASPHALT CEMENT, GRADE AC-10 FOR SURFACE TREATMENT	GAL.	17,586		53,714		19,609		90909	
410-C	SEAL AGGREGATE COVER MATERIAL, SIZE 7, SLAG OR STONE	C.Y.	651		1,989		726		3,366	
	INCIDENTAL ITEMS									
907-406-A	GEOTEXTILE FABRIC UNDERSEAL	S.Y.	53,831		309,016		123,294		486191	
907-406-B	ASPHALT CEMENT FOR FABRIC UNDERSEAL	GAL.	16,149		92,705		36,988		145,842	
907-618	MAINTENANCE OF TRAFFIC	L.S.	L.S.		L.S.		L.S.		L.S. ③	
619-F	DETAIL TRAFFIC STRIPE	L.F.	637		2666		1360		4663	
619-L	TRAFFIC STRIPE (CONTINUOUS WHITE) (CODE TW OR FOTW)	MI.	9.06		26.748		9.763		45.571	
619-S	TRAFFIC STRIPE (CONTINUOUS YELLOW) (CODE TY OR FOTY)	MI.	8.33		25.621		9.210		43.161	
619-P	TRAFFIC STRIPE (SKIP YELLOW) (CODE TY OR FOTY)	MI.	0.436		0.228		0.284		0.948	
619-M	TRAFFIC STRIPE (CONTINUOUS YELLOW) (CODE TY OR FOTY)	L.F.	2,600		2,300		1,500		6,400	
907-619-1A or	4" HOT SPRAYED THERMOPLASTIC TRAFFIC STRIPE (SKIP									
907-619-4A	WHITE) (60 MIL. MIN.) OR 4" COLD PLASTIC STRIPE (SKIP WHITE)	MI.	7.81		24.26		8.52		40.59	
907-619-1G or	4" HOT SPRAYED THERMOPLASTIC DETAIL STRIPE (WHITE) (60									
907-619-4G	MIL. MIN.) OR 4" COLD PLASTIC STRIPE (WHITE)	L.F.	1260		2485		1130		4875	
907-619-1L or	HOT SPRAYED THERMOPLASTIC LEGEND (WHITE) (90 MIL.									
907-619-4L	MIN.) OR COLD PLASTIC LEGEND (WHITE)	S.F.	73.89		246		147.10		467.99	
907-619-2C	RED-CLEAR REFLECTIVE RAISED MARKERS	EACH	960		2502		869		4331	
907-620-A	MOBILIZATION	L.S.	L.S.		L.S.		L.S.		L.S.	
	TRAFFIC CONTROL ITEMS									
907-675-A3	TRAFFIC STRIPE (SKIP WHITE) (PAINT)	MILE	22.96		70.07		25.58		118.61	
907-675-A5	TRAFFIC STRIPE (DETAIL PAINT)	L.F.	4341		17,364		8682		30,387	
907-675-01	STANDARD ROADSIDE CONSTRUCTION SIGNS (LESS THAN 10 SQ. FT.)	S.F.	4		4		4		12	
907-675-02	STANDARD ROADSIDE CONSTRUCTION SIGNS (10 SQ. FT. OR MORE)	S.F.	218		242		233		693	
907-675-G4	BARRICADES (TYPE III) (SINGLE FACED)	L.F.	6		—		6		12	
907-675-G4	BARRICADES (TYPE III) (DOUBLE FACED)	L.F.	12		12		12		36	
907-675-G5	FREE STANDING PLASTIC DRUMS	EACH	58		58		58		174 ④	

① FAILED AREAS IN EXISTING PAVEMENT TO BE REMOVED IN WIDTHS & DEPTHS AS DIRECTED BY THE ENGINEER. REMOVAL OF MATERIAL BELOW PAVEMENT TO BE MEASURED AS UNCLASSIFIED EXCAVATION (F.M.) & DISPOSED OF BY THE CONTRACTOR. BACKFILL TO BE OF HOT BITUMINOUS PAVEMENT AS DIRECTED BY THE ENGINEER.

② EXISTING ISLAND PAVEMENT & SURROUNDING CURB AT INTERCHANGE GORES TO BE REMOVED AND SITES BACKFILLED WITH HOT BITUMINOUS PAVEMENT TO MEET APPROPRIATE GRADE.

③ INCLUDES TEMPORARY PAVEMENT MARKINGS REQUIRED ON LOCAL ROADS.

④ TOTAL QUANTITY ESTIMATED TO BE MOST USED AT ANY ONE TIME. MOVEMENT FOR DIFFERENT TRAFFIC PHASES TO BE PAID FOR UNDER 907-618 MAINT. OF TRAFFIC.

MISSISSIPPI STATE HIGHWAY DEPARTMENT

SUMMARY OF QUANTITIES

PROJECT NO. IR-55-2(134) ... MADISON, YAZOO & HOLMES CO'S

APPENDIX B

COORDINATION MEETING MINUTES

Brent Rauhut Engineering Inc.

June 6, 1989

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

Subject: Commitments Made During the SPS-5 Design Meeting, May 31, 1989.

Dear Al,

As we discussed during our meetings of May 31-June 1, 1989, I have prepared this letter to serve as minutes to our design meeting for the proposed SPS-5 test section in Mississippi. The primary objective for this letter is to document all of the commitments made by the various parties involved to ensure that this SPS-5 test section gets constructed as planned. For reference purposes, I have attached the agenda which you handed out, and a list of the meeting attendees of May 31. Before you receive this letter, it will have been reviewed by Homer Wheeler and Jim Walls, who were also in attendance at the meeting. Should you have any comments as to the wording of this letter, or the commitments made as documented herein, please contact me so that we can revise the letter accordingly and resubmit it to the involved persons.

Al Crawley convened the meeting at 1:00 p.m. on May 31, with the objective of discussing all the details involved with the implementation of an SPS-5 test section on IH-55, northbound lanes, approximately 35 miles north of Jackson, Mississippi. He discussed the agenda items and made the statement that this particular roadway section planned for rehabilitation is by far the best SPS-5 candidate which Mississippi may have to offer. After review of the other interstate highways in the state, he found that most are nonusable for various reasons. Al also stated that we must develop answers in this meeting to meet the confined time frame with which we have to work. For the benefit of those personnel who were not aware of the specifics of the SPS experiment design, Al briefly reviewed the SPS-5 experiment design.

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

Since the planned bid date for this project is July 25, it is imperative that all of the design details, necessary specification revisions, special provisions, and SHRP requirements for the test section be clearly stated and resolved in a two week time frame. The given time deadlines which must be strictly met are as follows:

June 15 - Plan completion/submittal to FHWA.

June 28 - Project advertisement.

July 25 - Open bids and probable award.

July 26-Sept. 1 - Notice to proceed and start of construction.

Estimated completion is about 1 year after start of construction.

One of the biggest hurdles set before the participants of the meeting was the SHRP requirement for continuous WIM data collection at the SPS site. Jim Walls stressed the importance of WIM data and indicated that because of the project's location, a major north-south corridor, SHRP would likely be willing to fund 50% of the WIM cost up to a maximum of $10,000. After some discussion and input by Mr. Sullivan of the FHWA and Mr. Quin of the MSHD, an agreement was reached that for this one section, a continuous WIM system would be installed by the Mississippi State Highway Department. It was stated that this should not be considered as a precedent for other SPS sections in Mississippi. Jim Walls then obtained verbal concurrence from Mr. Neil Hawks at SHRP to participate in WIM funding.

The point was made that the specifications for hot mix asphalt concrete materials to be used on the project would have to remain as is. Currently, Mississippi uses HMAC materials accepted by the FHWA Division, and they believe that this should be suitable for SHRP purposes. Jim Walls indicated that the FHWA Technical Advisory is a guideline for the mix design, and SHRP would be satisfied with whatever agreement the FHWA and Mississippi SHD had reached on implementing the Technical Advisory.

A concern was expressed about leaving the control section untreated, as this roadway is currently in relatively poor condition. The purpose for an untreated control section was discussed briefly, and Jim Walls indicated that the state may decide when the control section reaches a terminal condition, and repair it at that time. It will be necessary for SHRP to be notified so that any data collection activities necessary could be considered prior to the overlay placement. Al Crawley indicated that he felt confident the control section could be left for a period of approximately one year, although he was doubtful that the section would remain in a safe condition for more than two winter seasons. This seemed acceptable to all.

We moved into a discussion of the design layout as proposed by MSHD-R&D personnel. Al presented a proposed layout along the roadway section. This layout includes clustering of the virgin asphalt concrete material sections and the recycled asphalt concrete test sections. Within these clusters, MSHD elected to place the two-inch overlay test sections and five-inch overlay test sections side by side to minimize the number of thickness transitions. Gary Elkins reviewed the proposed layout and indicated that this was acceptable. One key point in this layout is the use of 25-foot transition sections between the minimal and intensive surface preparation sections, caused by very limited roadway lengths to work with. After some discussion, the use of 25-foot transitions was approved. Input from Mr. Walter Jordan of the MSHD indicated that while the SPS test sections would require additional HMAC mix designs, he did not feel that this would be a problem.

While discussing materials, a question concerning the use of binder materials was brought up. The use of a binder layer in the five-inch overlay sections posed no problems and was therefore accepted. However, as stated on page 12 of the SPS-5 experiment design plan, "The surface course of the thick overlay will be of the same mix and thickness as the thin overlay". Therefore, it appears the binder may be used to fill the milled thickness and for three inches of the five-inch overlay, but the two-inch surface layer should be consistent across the test sections.

The considerations of materials sampling and field testing plans were brought up by Gary Elkins. After some discussion, Jim Walls clarified by saying SHRP plans included the use of any data which MSHD could provide on the materials at the site, and supplemental tests would be performed as needed. Al Crawley indicated that MSHD standard practice does not include extensive sampling of the test section materials or acceptance coring. To ensure access to the SPS-5 project after the contract is let, it will be necessary to advise in the contract that materials sampling and field testing work will occur within the limits of the SPS-5 project, and that access and coordination will be required. For this reason, Mississippi SHD personnel requested that a materials sampling and field testing plan be provided. Gary Elkins committed to providing this materials sampling and field testing plan for the SPS-5 test section. This sampling plan should be provided to MSHD personnel within the next week.

Discussions then moved into how the contractor may accomplish the actual construction sequence, since plans for the roadway include leaving one lane of traffic open at all times. It appeared that there are a number of alternative methods by which the contractor may accomplish the construction; all will require considerable thought and coordination to minimize the plant setup changes. The requirement that all SPS-5 test sections must be constructed within one construction season was also discussed. While it was originally hoped that construction of the test sections would occur in 1989, MSHD personnel felt that it would be impossible to guarantee

completion of test section construction prior to a winter shutdown. Therefore, all agreed the best alternative was to restrict test section construction prior to March of 1990, when the entire construction sequence would occur within one construction season. Special provisions will be included in the contract documents stating that no construction would occur on the SPS-5 test sections (between set station boundaries) until early in the 1990 construction season.

After these discussions, Al Crawley summarized the meeting with the following points:

1. It appears we can build the section, with necessary attention to details and construction sequence.

2. It appears we can accomplish the design of the section, if all personnel work together to provide the necessary special provisions and specifications, and plan preparation within the necessary time deadline.

3. Mississippi SHD will provide the required traffic data collection, including continuous WIM data collection, for this section.

4. SHRP will provide the required materials sampling and field testing layout within the next week. This will include the number of cores, any test pits, sampling layout, and necessary during-construction sampling to occur.

5. SHRP will provide WIM specifications for use by MSHD in their documents. Jim Walls indicated that his discussion with Neil Hawks revealed that there is already something of this nature in the works, only needing revision for use by Mississippi.

Since there were no objections to Al's summary comments, the meeting was adjourned at approximately 3:00 p.m. After a short break, a smaller group of the meeting attendees reconvened around the conference table to further refine details which would have to be resolved prior to the construction of this section. During this time, arrangements were made with PASCO to provide the distress photography of this section while they were in Mississippi. This distress photography occurred during the night of June 1.

The question was raised about the materials needed to fill the proposed milled area. It was stated that wherever milling occurred, the milled depth would be replaced by whatever material was used above, with virgin asphalt being used on test sections designated for virgin asphalt concrete overlays, and recycled asphalt concrete used on test sections designated for recycled asphalt concrete overlays. The material used to fill the milled thickness is not to be considered as part of the overlay thickness.

We continued discussion on the necessary construction sequence, and further discussed the need for postponing construction of the SPS-5 section until after March of 1990. This would allow the entire section to be constructed within the construction season of 1990. All agreed that this seemed to be the best alternative, and therefore special provisions will be provided in the contract documents to facilitate this.

As the project currently includes a chip seal on the surface, there was some question as to whether this chip seal should be milled off test sections designated for minimal surface treatment. Currently, the minimal surface treatment sections include only localized pothole patching and crack sealing, with no milling. After some discussion, Gary Elkins indicated that leaving the chip seal on the surface would be acceptable for the minimal surface preparation areas.

Jim Lyon indicated that Mississippi currently uses AC-30 for both their virgin and recycled HMAC mixes. Depending on how the material characteristics are determined, the recycled mix may or may not meet SHRP's defined criteria. The question came down to one of whether in-service or design characteristics are to be used to characterize the materials. After some discussion, it was agreed that in-service materials characteristics would be appropriate, and Mr. Lyon felt that with this clarification, the materials should meet all the necessary criteria.

At this point, a number of items were discussed in quick succession. I will attempt to summarize their content in the following points.

1. It was noted that it is critical that the distresses apparent at the sections are consistent throughout the length of the SPS project. During review of the section the following day, we all agreed that distress types and severities were relatively uniform and would therefore not negate the use of this section of highway as an SPS-5 project.

2. Distress monitoring was briefly discussed to find out what would be required over the coming months and years. SHRP will have PASCO film the section while they are in Mississippi in the next couple of days, and will likely include FWD testing in conjunction with the MS&FT testing. Jim Walls indicated that pre-overlay skid data is not required for the experiment.

3. When asked about the inclusion of supplemental test sections by the MSHD, Al Crawley indicated there would be no supplemental test sections. Previous discussions indicated that MSHD-R&D personnel may do additional monitoring to correlate their data collection techniques with SHRP's. This appeared to pose no problems.

4. SHRP inventory data is needed for this section, much the same as for the GPS test sections. Al indicated that the same type of data that had been provided for the GPS sections could be provided for this roadway.

5. The possibility of locating a GPS-6B test section adjoining this SPS-5 project will be explored. During the events of the following day, as sections were marked on the roadway, we did lay out a GPS-6B test section, numbered as test section 10. This will have to be coordinated further with TRDF personnel, but if it is at all possible we will include a GPS-6B section in line with the SPS-5 sections.

6. Mr. Lyon indicated the need for a pre-bid conference so that interested contractors may ask questions prior to their bid submittals. This would likely include discussion of the proposed construction for the SPS-5 test section. An agreement was reached that if MSHD desired, SHRP and/or RCOC staff would be made available for technical assistance during any pre-bid conference.

This pretty much concluded the discussions of May 31.

At 7:00 a.m. on June 1, Al Crawley, John Avent, Mark Gardner, Gary Elkins, and Jim Walls traveled to the site location to review and lay out the test section. We first drove slowly down the section looking at the consistency of the distresses apparent at the site. After review, all agreed that the distresses at the site were consistent enough to be considered for the SPS-5 location. Preliminary work done by Al Crawley and other R&D personnel made our selection process much more efficient, and this was greatly appreciated.

After general review of the site, we then proceeded to mark each individual SPS test section with STA-MARK pavement marking tape. A solid white line was placed across the pavement at the beginning of the maintenance control zone, and 2-foot long tape marks were placed at the beginning and end of each of the 500-foot long test sections. STA-MARK numbers were placed at the beginning of each of the 500-foot sections to identify each of the SPS-5 sections. These numbers were not placed in sequential order from 1 to 10, but varied with the design details. A STA-MARK line was placed across the pavement at the end of the maintenance control zone. In all, approximately 1.8 miles of pavement are included in the entire maintenance control zone. MSHD agreed to establish permanent reference markers over the next several weeks.

Finally, we videotaped the overall maintenance control zone area by driving along the shoulder, with Mark Gardner filming out the driver's side rear window. While this would be insufficient for detailed review of the pavement surface, it is useful in previewing the existing conditions of the test section.

The specific test section location and layout was coordinated by telephone with PASCO personnel, who were approximately 2 hours north of us on I-55 in Mississippi. We faxed them a sketched lay-out of the test sections, so that they could film the section that evening. (On Friday morning, June 2, I determined that PASCO did indeed film the SPS-5 test section on the previous night.) For reference purposes, a tentative SHRP ID number was assigned to the section. It's number is 280501, indicating that it is in Mississippi (28), and SPS-5 section (05), the first SPS-5 in Mississippi (01). This number is unique and should temporarily pose no problems.

This pretty much concluded the activities performed during this SPS set-up meeting. Since the primary purpose of this letter is to document all commitments and details of the discussions for the involved parties, should you find that my representation of the events or decisions made are inaccurate, please notify me so that we may revise this letter and resubmit it. It is critically important that the decisions reached be accurately understood, so that this effort may be accomplished within the very limited time frame.

I appreciate all your hard work and support in this effort, and look forward to working with you again soon.

Respectfully submitted,

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

Attachments: As stated.

cc: Homer G. Wheeler
Jim Walls, SHRP-DC
Amir Hanna, SHRP-DC
Neil Hawks, SHRP-DC
Gary E. Elkins, TRDF-MD

MPG:dmj

AGENDA - SPS-5 DESIGN MEETING

I. INTRODUCTORY REMARKS
   - A. Review of proposed project
   - B. Experiment design
   - C. Decision deadline

II. MSHD CONSIDERATIONS FOR THIS PROJECT-NON NEGOTIABLE
   - A. Traffic data acquisition-same as for GPS
   - B. HMAC specifications - except inclusion of RAP in SC
   - C. Letting date-July 1989

III. MSHD R&D DIVISION INPUT
   - A. Draftsman for plan modifications
   - B. Computations for quantities
   - C. Special Provisions for contract
   - D. HPR study

IV. FHWA CONSIDERATIONS
   - A. Immediate approval of plan/specification changes
   - B. Need for use of "experimental feature"
   - C. Repair of control section and thin overlay sections

V. EXPERIMENTAL DETAILS
   - A. QA/QC plan
   - B. Study life
   - C. Experimental section and transition location

SHRP/LTPP SPS-5 DESIGN MEETING
MISSISSIPPI STATE HIGHWAY DEPARTMENT

May 31, 1989

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APPENDIX C

MATERIALS SAMPLING AND TESTING PLAN

Unreviewed Draft
from Amir Hanna

Copies to:
Brent
Jerry
Mark
Gary

STRATEGIC HIGHWAY RESEARCH PROGRAM

SAMPLING, TESTING, AND MONITORING ACTIVITIES

SPECIFIC PAVEMENT STUDIES - EXPERIMENT 5
REHABILITATION OF ASPHALTIC CONCRETE PAVEMENTS

PLAN FOR TEST SECTIONS
LOCATED ON INTERSTATE HWY 55 NORTH BOUND
BETWEEN VAUGHAN AND JUNC. MISS. HWY 432
YAZOO COUNTY, MISSISSIPPI

REVISED JULY 1989

INTRODUCTION

The Strategic Highway Research Program's (SHRP) Specific Pavement Studies (SPS) portion of the Long Term Pavement Performance (LTPP) consists of a series of designed pavement performance experiments which start from new construction. These experiments are targeted at high priority pavement research needs and are being conducted across the United States and Canada. The SPS-5 experiment is for rehabilitation techniques for asphalt concrete pavements. This introduction provides some summary background information on the objectives and character of the SPS-5 experiment.

Objective

The objective of this study is to develop improved performance prediction models to be used for determining the additional pavement life that can be expected from application of a variety of asphalt concrete (AC) rehabilitation methods and strategies ranging from minimal to maximum investment in the rehabilitation treatment. The treatments being studied include combinations of surface preparations, overlay thicknesses, and virgin and recycled AC overlay materials. The study objective includes a determination of the influence of environmental regions and initial pavement condition on the predicted performance of rehabilitation methods. Accomplishment of the objective will provide substantially improved "tools" for use in pavement management and life-cycle cost analyses activities for cost effective decision making in extending the life of existing pavements.

Experimental Design

The experimental design is shown in Table 1. It identifies the primary experimental factors and their relationships with each other. The site related factors are shown across the top of the table and rehabilitation treatments down the sides. Each column in this arrangement represents two project locations while each row represents a test section with specific features to be constructed at each project location. In addition to the test sections shown

Table 1. Experimental design for SPS-5, rehabilitation of asphalt concrete pavements.

FACTORS FOR MOISTURE, TEMPERATURE, AND PAVEMENT CONDITION / REHABILITATION PROCEDURES			WET				DRY			
			FREEZE		NO FREEZE		FREEZE		NO FREEZE	
			FAIR	POOR	FAIR	POOR	FAIR	POOR	FAIR	POOR
Surface Prep.	Overlay Material	Overlay Thickness								
Routine Maint. (Control)		0	xx	xx	xx	xx	xx	xx	xx	xx
Minimum	Recycled AC	2-inch	xx	xx	xx	xx	xx	xx	xx	xx
		5-inch	xx	xx	xx	xx	xx	xx	xx	xx
	Virgin AC	2-inch	xx	xx	xx	xx	xx	xx	xx	xx
		5-inch	xx	xx	xx	xx	xx	xx	xx	xx
Intensive	Recycled AC	2-inch	xx	xx	xx	xx	xx	xx	xx	xx
		5-inch	xx	xx	xx	xx	xx	xx	xx	xx
	Virgin AC	2-inch	xx	xx	xx	xx	xx	xx	xx	xx
		5-inch	xx	xx	xx	xx	xx	xx	xx	xx

Each "x" designates a test section

Subgrade Soil: Fine

Traffic: >85 KESAL/Year

in the experiment design, data and information from any additional test sections desired by the highway agency plus the rehabilitation procedures applied to the remaining portions of the project will be also be evaluated.

Wet climatic regions are considered to have a high potential for moisture presence in the entire pavement structure throughout most of the year. Dry climatic regions are considered to have a very little or seasonal variability of moisture in the pavement structure. Freeze regions include locations with severe winters resulting in frost penetration to appreciable depths and locations likely to have periodic frozen subgrade soils. No-freeze climatic regions are considered to have no long-term freezing of subgrade.

The classification of existing pavement condition as fair or poor will be used to screen candidate projects to provide a range of existing distress conditions. Distress condition surveys of all test sections will be made prior to rehabilitation to quantify the actual distresses present on each test section.

The numbering system used to identify the test sections in the field and which designate the rehabilitation treatments is shown in Table 2. Note that the test sections in the field are not laid out in sequential order by test section number.

Rehabilitation treatment factors include two levels of surface preparation, two types of overlay material, and two overlay thicknesses. In addition, each project includes a control test section which will only receive routine maintenance (i.e., routine pot hole filling and crack repair and sealing). This control test section will not receive rehabilitation treatment until it reaches a terminal condition and is removed from the experiment.

The minimum level of surface preparation consists of limited patching (filling pot holes), crack repair and sealing. The intensive level consists of cold milling 1 to 2 inches of the surface layer plus any necessary crack repairs and sealing. The intensive level represents a premium level of surface preparation addressing geometry, rut removal, and removal of aged asphalt concrete along with providing a high degree of bonding. Care should be exercised

Table 2. SPS-5 test section numbering scheme.

SPS-5 SECTION	SURFACE PREPARATION	OVERLAY MATERIAL	OVERLAY THICKNESS
1	Routine Maintenance	No overlay	----
2	Minimum	Recycled AC	2-inch
3	Minimum	Recycled AC	5-inch
4	Minimum	Virgin AC	5-inch
5	Minimum	Virgin AC	2-inch
6	Intensive	Virgin AC	2-inch
7	Intensive	Virgin AC	5-inch
8	Intensive	Recycled AC	5-inch
9	Intensive	Recycled AC	2-inch
10	State Standard	State Standard	State Standard

that the depth of milling does not coincide with a layer interface. The thickness of milling shall be replaced with the same material being used for the overlay prior to placement of the overlay but not considered part of the overlay thickness. Removal of an open graded friction course shall not be considered part of the milling for intensive surface preparation.

To produce reasonably consistent mixes for the AC overlays using local materials and design procedures, the FHWA Technical Advisory T5040.27, "Asphalt Concrete Mix Design and Field Control" (March 10, 1988) shall be used as a guide by the state and provincial highway agencies. This advisory contains recommendations for material selection, mix design, plant operation, and compaction.

The recycled asphalt concrete overlay material type will be further constrained to insure a reasonable level of consistency as follows:

1. The content of reclaimed asphalt pavement (RAP) in the recycled mix is fixed at 30%. This reflects a widespread practice and construction-contractor capability, avoids potential problems associated with high RAP ratio mixes, and reflects current judgement that a high RAP ratio could be restrictive and not likely to add much information on the comparative effect or benefits of using recycled materials.

2. Only a soft asphalt cement, selected to provide the required consistency of the combined binders, will be used. This reflects the widespread practice and avoids problems associated with choosing a representative softening agent from numerous proprietary formulations. However, participating highway agencies may wish to consider the use of proprietary softening agents for additional test sections.

3. All RAP for the test sections of a project should be from the same source, but not necessarily from the project that the test sections are located.

4. The recycled mixture should be designed to meet the same mixture specifications as the virgin asphalt concrete mix.

The study design has thin (2") and thick (5") overlay design thicknesses. The surface course on the thick and thin sections should be the same thickness. On milled sections, the material used to replaced the milled layer shall be the same as the overlay. The thickness of the newly placed material for the overlay shall be increased by the depth of the milling. Thus, on a test section with a 5" design overlay thickness, if 1.5" is milled from the original pavement surface, then a total of 6.5" of new material should be placed.

Construction Considerations

Construction problems and variations, as well as environmental conditions during construction could influence the performance of test sections to a greater extent than the design factors. Because construction procedures and control will be the responsibility of the participating highway agency, accurate records of actual construction procedures must be obtained (references to construction specifications will not be adequate). In addition, records must be maintained of weather conditions and events such as equipment breakdowns and material contamination during the test section construction.

Although the test sections to be monitored are limited to the outside lane in one direction, all rehabilitation preparation activities and overlays should extend the full width of the pavement.

PRE-CONSTRUCTION ACTIVITIES

Activities that need to be completed prior to the start of construction on the test section sites include:

Pavement Evaluation Measurements
Materials Sampling and Testing
Laboratory Mix Design
Layout and Marking of Test Sections

Pavement Evaluation Measurements

Pavement evaluation measurements refer to the following types of non-destructive measurements:

Deflection
Condition survey
Profile/roughness
Skid

The purposes of these measurements are to document the change in these measurements caused by the rehabilitation treatments applied to the test section. Ideally, the measurements performed prior to construction of the overlays should be performed as close too placement of the overlay as practical (2 months prior). This is to minimize any changes occurring within the pavement structure during the time period from when the measurement was made and the performance of the rehabilitation work. Due to practical considerations, performance of these tests within a two month period is not always possible. Table 3 presents a summary of guidelines for timing consideration for these measurements. In many instances, engineering considerations may override these guidelines. Operational and administrative constraints make it impossible to establish a strict set of guidelines that are appropriate for all situations. The considerations presented in this document are intended to aid in the decision process. All measurements should be performed following SHRP standard test procedures and guidelines, except as noted in the following sections. It is preferred that all measurements be performed with SHRP equipment, with the exception of skid testing which is performed with state owned equipment.

Deflection Measurements

Deflection measurements are needed to quantify the structural condition of the pavement prior to placement of the overlay layer. An evaluation of the added structural capacity provided by the new layer can be performed by comparing

Table 3. Summary of timing guidelines for pavement evaluation measurements prior to pavement rehabilitation.

Measurement Type	Timing Guidelines
Deflection Measurement	< 3 mo.[1]
Profile Measurement	< 3 mo.[2] (freeze) < 6 mo. (no freeze)
Distress Survey	< 6 mo.[3] (freeze) < 8 mo.[3] (no freeze)
Skid Measurement	< 12 mo.[4]

1. This can be extended to 6 months if it is a dry, no-freeze region where the moisture conditions of the pavement have not changed. For freeze regions, the average 24 hour air temperature should be above freezing for at least 1 week prior to testing; also, such testing should be after spring thaw recovery.

2. This should be after spring thaw recovery.

3. For pavements with high severity of cracking, or exhibiting pumping, these times should be halved.

4. For pavements where low friction resistance is a consideration in placement of the overlay or surface treatment, this time should be halved.

the before and after deflection measurements. For this reason it is important that these measurements be performed as close together as possible to minimize the influence of changes in the other layers of the pavement structure on the surface deflections.

In general, deflection measurements should be conducted within 3 months prior to placement of the overlay. Measurements performed within 6 months of placement of the overlay can be considered acceptable under the following conditions:

1. Water within the layers of the pavement structure have not frozen in the intervening period. Since this is difficult to determine, as a rule of thumb, subfreezing air temperature over a continuous seven day period should not have occurred in the intervening period.

2. In freeze regions, if the deflection measurements were last conducted in the fall and the overlay is planned for spring, then the before measurements should be repeated in the spring after the thaw period.

3. If the moisture condition of the pavement layers at the time of the deflection testing has not changed prior to placement of the overlay, such as in dry regions in which no appreciable precipitation has occurred in the intervening period.

The intent of these considerations are to minimize the influence of environmental variables on the before and after measurements. In all cases it is desireable that the before and after measurements be conducted as close together as possible since the influence of these types of environmental responses are largely unknown and could potentially overshadow the effect of the overlay.

The deflection measurements on each section should be conducted following the current SHRP guidelines for flexible pavements. Each 500 foot SPS test section should be treated and tested the same as a 500 foot GPS test section.

Care should be exercised in performing deflection tests at the 12 inch core/bore hole and the test pit locations since they may change from section to section.

Profile Measurements

Before and after profile measurements allow the improvement in ride quality to be quantified. As a general rule, the before overlay profile measurements should be conducted within 6 months prior to the placement of the overlay. On test sections situated on expansive subgrades, in wet zones, or in freeze zones, shorter time intervals on the order of 4 months are desired. The intent is to minimize changes in the profile due to either development of distresses or volume changes in the underlying materials.

On sections which have been milled or in which some other treatment has been applied which significantly influences the profile of the surface of the pavement prior to placement of the overlay, a profile measurement after completion of the treatment and prior to placement of the overlay should be considered. This is not a mandatory measurement. Due to operational considerations a manual profile measurement, using a device such as a Dipstick profiler or rod and level, may be necessary. Due to traffic control considerations, it may be best to schedule this at the time the treatment is being applied since traffic control will be necessary to perform these treatments.

It is desired that these measurements be performed with one of the SHRP Profilometers. If this is not possible, then the next best device would be a profile measurement device which measures and records the relative surface elevations of the pavement surface in both wheel paths every 6 inches. If this is not possible, then a response type road meter, calibrated to a profile based standard, capable of reporting roughness in International Roughness Index (IRI) units can be used. If this type of response meter is used, the same unit should also be used for the after overlay measurements. All other non-SHRP profile or roughness devices used should be evaluated against the one of the SHRP Profilometers when they visit the section in the future.

Distress Surveys

Before and after distress surveys allow evaluation of the propagation or reflection of distresses through the overlay layer. The intent of the time limitation on distress surveys conducted prior to the placement of the overlay is to minimize missing the development of new distresses or the progression of existing distress prior to placement of the overlay. As a general rule, distress surveys should be performed within 8 months prior to placement of the overlay. On sections in areas of expansive subgrades or active environmental zones where the last survey was conducted prior to a significant climatic event, the survey should be performed within 6 months. For pavements which exhibit distresses such as pumping or high severity fatigue cracking, these times should be halved.

It is desirable to obtain distress photographs and rut depth measurements from the instrumented vehicle used by SHRP. If scheduling consideration makes it impossible for the automated distress photographs and rut depth measurements to be performed within the specified period above, these measurements should be performed prior to placement of the overlay as the schedule permits. In this case, a follow up distress survey following SHRP manual distress survey procedures should be performed within the above time frames.

Skid Measurements

Before and after skid resistance testing provides a measure of the change in the skid number provided by the overlay. On pavements in which a skid problem is a major consideration in placement of the overlay, skid measurements performed within 6 months prior to placement of the overlay are desired. On other sections, skid tests within a 12 month period prior to placement of the overlay are satisfactory.

Skid tests should be performed on all of the SHRP test sections following the SHRP guidelines. Skid tests are performed with agency equipment following ASTM E-17.

Materials Sampling and Testing

Two types of pre-construction materials information are needed for this research study. The first is information and characterization of the in-place pavement and subgrade materials at the test sites. The other is information obtained during the laboratory mix design testing.

In-Place Material Sampling and Testing

To understand performance differences between test sections and to provide sufficient information into the national pavement research data base on the material characteristics of the test section pavement structure, sampling and testing of the in-place pavement and subgrade materials is necessary. Each individual test section is 500 feet in length. This length was chosen to purposefully limit the variations in material properties along the test sections. Since the material sampling and testing methods in this category are destructive, they need to be performed close too, but not on, the test sections. The sampling and test location need to be close enough so that the materials tested are representative of the materials and conditions within the test sections, but far enough away so that they do not influence the development of distress on the test sections.

The in-place material sampling and testing of the existing pavement structure for SHRP consists of a combination of the following:

4" OD cores of asphaltic concrete surface and binder courses only.

4" OD cores of asphalt concrete surface and binder courses, bound base layers, and treated subbase layers.

6" OD cores of asphaltic concrete surface and binder courses, bound base layers, and treated subbase layers; Augering of unstabilized base and subbase layers; splitspoon sampling and/or Shelby tube sampling of subgrade layers to 5' below top of untreated subgrade.

12" OD Core of asphaltic concrete surface and binder courses, bound base layers, and treated subbase layers; augering of unstabilized base, subbase, and subgrade to 12" below top of untreated subgrade for bulk sample retrieval.

6' x 4' test pits to a depth of 12" below top of untreated subgrade for collection of pavement slabs; nuclear density and moisture measurements on unstabilized pavement layers and subgrade material; bulk sampling of unstabilized layers and subgrade.

For the SPS-5 experiments it is desired that the bulk of these samples and tests be performed prior to the start of the rehabilitation construction on the SHRP test sections. This is to allow the core holes and test pits to be patched and repaired prior to placement of the overlays. This sequence will allow all patches of the cores and test pits to be beneath the overlay material. This should help minimize intrusion of surface water through the pavement structure at these locations. This should help minimize the propagation of any distresses associated with test locations into the 500 foot monitoring test sections.

The details of the materials sampling plan are presented in Appendix A.

Table 4 presents a list of the laboratory tests to be performed on the materials sampled from the test sections. SHRP has developed testing protocols and directives for performing these tests on materials sampled from the field since the existing AASHTO and ASTM procedures are primarily for laboratory prepared specimen. In some cases SHRP has developed test procedures for those tests which have not yet been standardized, such as creep compliance on asphalt concrete.

The field material sampling and testing activities should be performed in accordance with guidelines contained in the latest version of the "SHRP-LTPP Guide for Field Material Sampling Testing and Handling."

Table 4. List of laboratory material tests to be performed on material samples from SHRP SPS-5 test sections.

MATERIAL TYPE, SHRP TEST DESIGNATIONS AND PROPERTIES	TEST METHOD
I. ASPHALT CONCRETE	
a. Asphaltic Concrete	
AC01. Core Examination and Thickness	SHRP-LTPP Method
AC02. Bulk Specific Gravity	AASHTO T166-88I
AC03. Maximum Specific Gravity	AASHTO T209-82
AC04. Asphalt Content (Extraction)	AASHTO T164-86
AC05. Moisture Susceptibility (6 cores per test)	AASHTO T283-87I
AC06. Creep Compliance (77°F) (3 cores per test)	SHRP-LTPP Method
AC07. Resilient Modulus for Selected Temperature (3 cores per test)	ASTM D4123-82
AC07. Tensile Strength for Selected Temperature	ASTM D4123-82
b. Extracted Aggregate	
AG01. Bulk Specific Gravity of Coarse Aggregate	AASHTO T85-88I
AG02. Bulk Specific Gravity of Fine Aggregate/ Mineral Filler	AASHTO T84-88I
AG03. Type and Classification of Coarse Aggregate	ASTM D2488-84
AG03. Type and Classification of Fine Aggregate	ASTM D2488-84
AG04. Gradation of Aggregate	AASHTO T30-87I
c. Asphalt Cement	
AE01. Recovery of Asphalt by Abson Method	AASHTO T170-84
AE02. Penetration at 77°F	AASHTO T49-87I
AE03. Ductility at 77°F	AASHTO T51-87I
AE04. Specific Gravity (60°F)	AASHTO T228-87I
AE05. Ring and Ball Softening Point	AASHTO T53-87I
AE06. Viscosity of Asphalt at 77°	AASHTO T202-84
AE06. Viscosity of Asphalt at 140°	AASHTO T202-84
II. BOUND (TREATED) BASE AND SUBBASE	
TB01. Type and Classification of Material and Type of Treatment	ASTM D2488-84
TB02. Compressive Strength	ASTM D2166-66(79)/ ASTM C39-83
TB03. Dynamic Modulus (77°F) (3 cores per test)	ASTM D3497-78(85)
III. UNBOUND GRANULAR BASE AND SUBBASE	
UG01. Particle Size Analysis	AASHTO T27-88I
UG02. Sieve Analysis (Washed)	T11-85
UG03. Hydrometer to 0.001mm	AASHTO T88-86
UG04. Atterberg Limits	AASHTO T89-87I T90-87I
UG05. Moisture-Density Relations	AASHTO T180-86
UG06. Laboratory California Bearing Ratio (at in situ density, moisture)	AASHTO T193-81 (Soaked and Unsoaked)

Table 4. List of laboratory material tests to be performed on material samples from SHRP SPS-5 test sections, (continued).

MATERIAL TYPE, SHRP TEST DESIGNATIONS AND PROPERTIES	TEST METHOD
III. UNBOUND GRANULAR BASE AND SUBBASE (Continued)	
UG07. Resilient Modulus (at in situ density moisture)	AASHTO T274-82
UG08. Classification	ASTM D2488-84
UG09. Permeability	ASTM D2434-68(79)
UG10. Natural Moisture Content	AASHTO T265-86
IV. SUBGRADE	
SS01. Sieve Analysis	AASHTO T27-88I
SS02. Hydrometer to 0.001mm	AASHTO T88-86
SS03. Atterberg Limits	AASHTO T89-87I T90-87I
SS04. Classification/Type of Subgrade Soils	AASHTO M145-82 ASTM D2488-84
IV. SUBGRADE	
SS05. Moisture-Density Relations	AASHTO T99-86 T180-86
SS06. Laboratory California Bearing Ratio (at in situ density, moisture)	AASHTO T193-81 (Soaked and Unsoaked)
SS07. Resilient Modulus (at in situ density, moisture)	AASHTO T274-82
SS08. Unit Weight	SHRP-LTPP Method
SS09. Natural Moisture Content	AASHTO T265-86
SS10. Unconfined Compressive Strength	AASHTO T208-70(84)

Laboratory Mix Design Information

The laboratory mix design will be performed in accordance with standard practices of the participating Highway Department, except as noted in the introduction for those items constrained for experimental purposes (i.e. all virgin and 30% recycled asphalt concrete mixes). To produce reasonably consistent AC mixes from local materials and design procedures, the mixes should be designed and manufactured using the guidelines contained in the FHWA Technical Advisory T5040.27, "Asphalt Concrete Mix Design and Field Control," March 10, 1988. The highway agency's specified laboratory will perform all tests. The intent of the mix design is to design the virgin and recycled mixes to the same equivalent standards. This information will be reported to SHRP on standard SHRP data collection forms.

Layout and Marking of Test Sections

The overall layout and marking of test sections is illustrated in Figure 1. It is desireable to lay out all of the test sections so that they can all be located within one continuous research control zone. The research control zone is designated with white stripes across the outside lane 500' in advance of the first test section and 250' after the end of the last test section. If site location constraints prevent the grouping of all test sections within one conveniently short zone, then groups of test sections should be laid out in multiple zones, each marked by a beginning and end stripe placed the appropriate distance from the first and last test section within each group.

Figure 2 illustrates the markings of an individual test section after completion of the construction. Prior to the start of construction, the beginning and end of each test section will be marked with either reflective road tape or paint. A spike, nail or suitable monument should be placed in the shoulder adjacent to the beginning of each test section. Consideration should also be given to placing delineator posts or other similar posts in the right of way at the edge of the pavement to mark the beginning of the test sections since the markings on the shoulder will most likely be covered during the construction process. Test section 1, the control test section which will not receive any

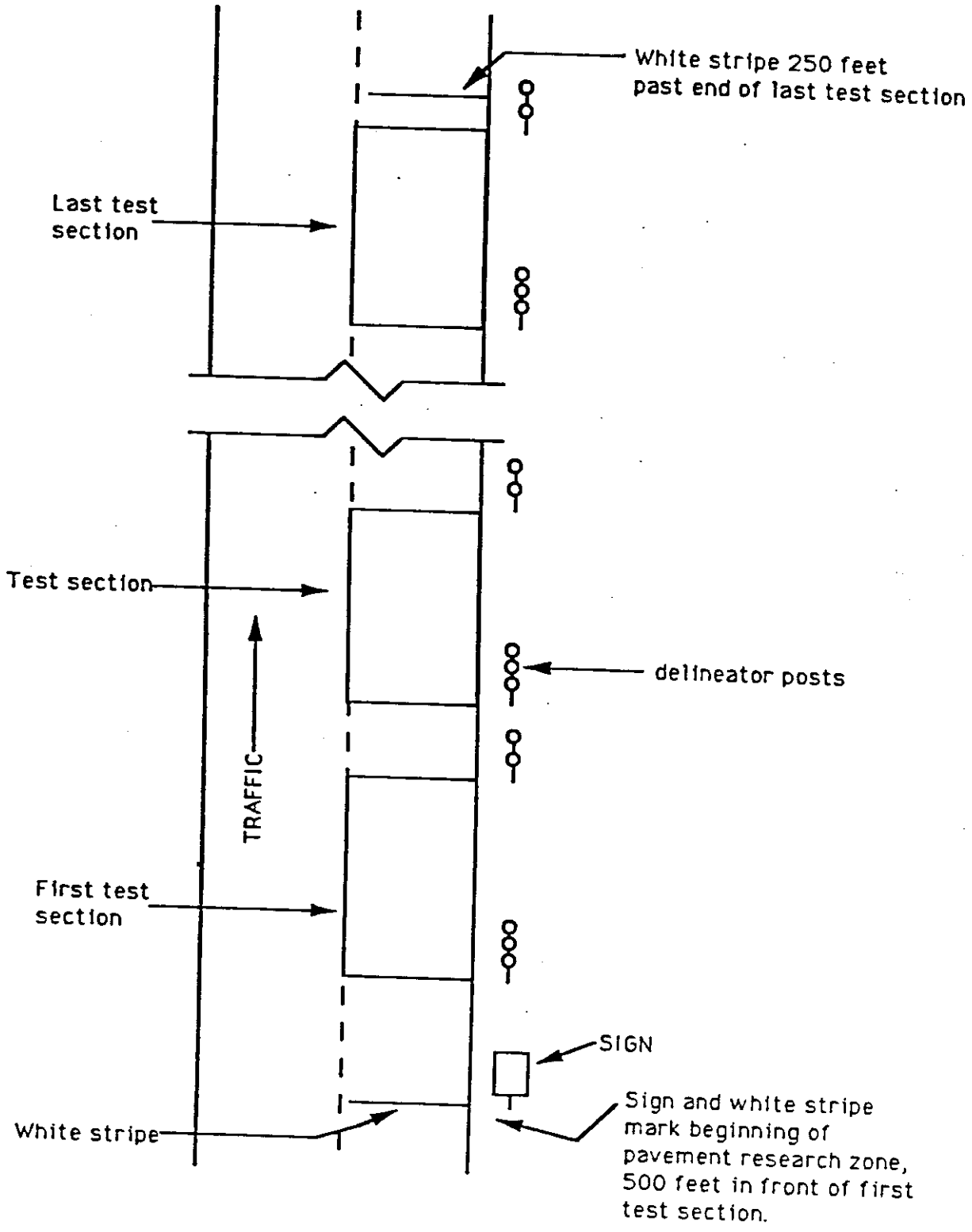


Figure 1. Illustrations of overall layout, marking and signing of SPS test projects.

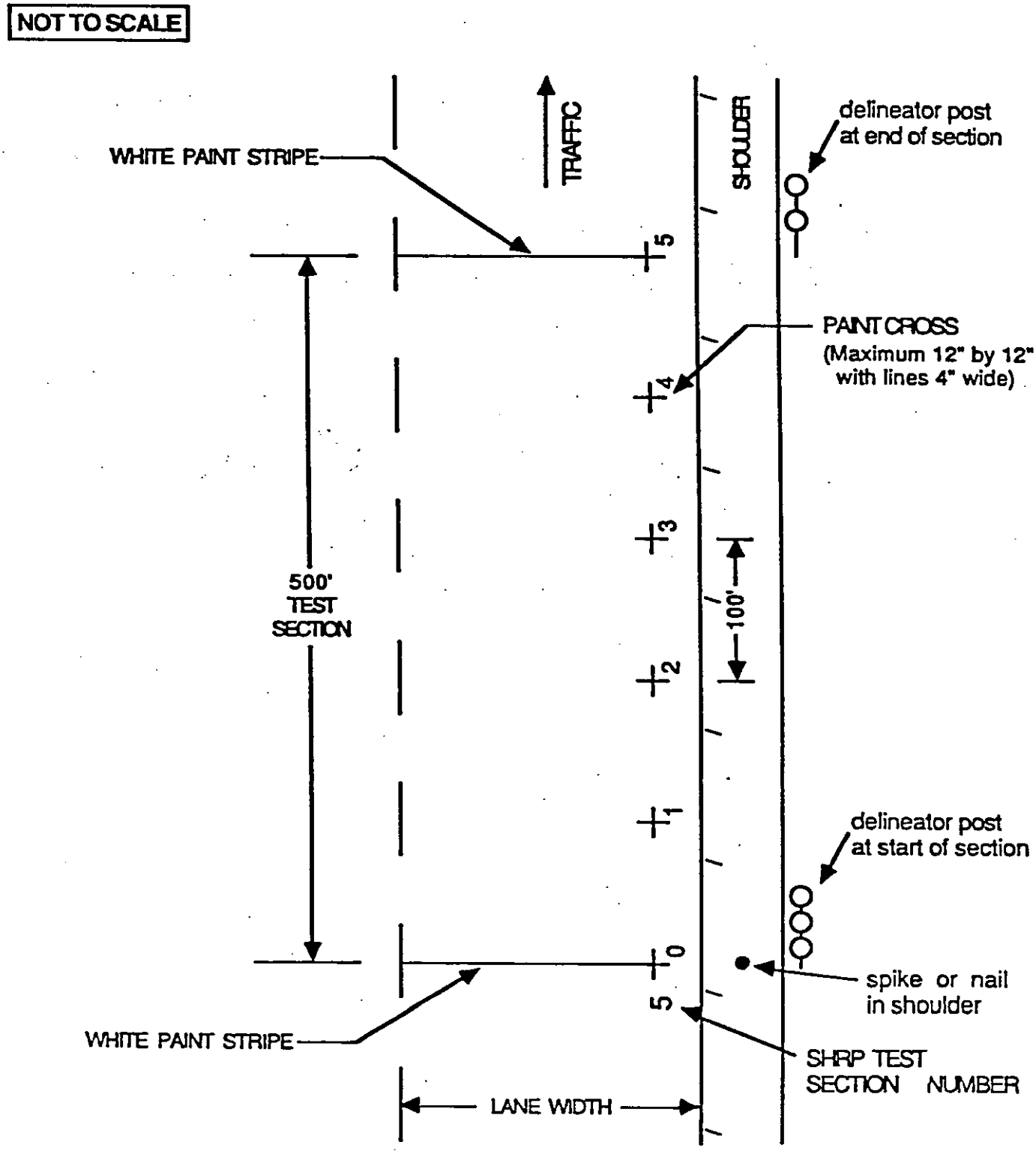


Figure 2. Details of individual SPS test section marking and layout.

rehabilitation treatments, should be marked in accordance with Figure 2 during the initial section lay out and marking. The internal stations markings for the test sections to be overlaid do not need to be marked on the pavement surface prior to construction of the overlay. The purpose of these markings is to serve as reference points during the pre-construction testing and sampling and also to enable the test sections to be located after completion of construction.

The following test section numbering scheme should be used for the planned LTPP SPS test sections.

State Code	SPS Experiment Number	Section Number

The two-digit state code is the SHRP adopted code for states and provinces. The two-digit SPS experiment number corresponds to the number assigned to the particular experiment. A test section on SPS-5, rehabilitation of asphaltic concrete pavement, would be coded as 05. The last two digits correspond to each individual test section within the experiment. Test section numbers are designated in the experiment plan document. The test section number indicates the combination of pavement experimental factors on each section, such as thickness, surface preparation, etc.

If a state or province constructs more than one SPS test site of the same experiment in its jurisdiction, at the second site, the test section numbers should start at 51 for the first test section and follow sequentially in order. For example, if Texas constructed two SPS-5 test sites, the test sections should be numbered as follows:

First Site Constructed

480501 - Test Section 1
480502 - Test Section 2
480503 - Test Section 3
. .
. .
480510 - Test Section 10

Second Test Site Constructed

480551 - Test Section 1
480552 - Test Section 2
480553 - Test Section 3
. .
. .
480560 - Test Section 10

During the initial post-construction section marking, the full test section number should be indicated on Section 1. The rest of the test sections can be marked with the test section number since they will be covered with the overlay.

All section marking will be performed by either state or SHRP personnel working in cooperation.

ACTIVITIES DURING CONSTRUCTION

Activities during construction will concentrate on collection of construction activity information and materials from the mix plant.

Construction Information

During the construction of the test sections information will be collected on details of the actual construction. This information will be collected by a SHRP designated data collector. This person may be either a member of the state DOT or a SHRP research contractor. Construction details to be collected will include items such as:

Date, start and stop time of construction activities.
Climatic events such as rain, air temperature, and humidity.
Location of construction activities.
Model and manufacture of milling equipment.
Depth of milling.
Type of patching and crack sealing materials.
Location of pre-overlay maintenance activities.
Asphalt concrete haul distance, haul time, and wait time.
Type of asphalt concrete haul trucks.

Tack coat material and application rate.
Time between application of tack coat and placement of overlay.
Model and manufacture of laydown machine.
Laydown temperature.
Equipment type, load, and number of roller applications.
Curing period.
Time to opening to traffic.
Other significant events.

The purpose of this data collection is for informational purposes only. All construction supervision will be under the control of the responsible state DOT through their standard construction supervision and quality control procedures. The intent of the SHRP data collector is to be a spectator and not a participant in the construction of the test sections.

Materials Sampling

During construction of the test sections, asphaltic concrete materials used in construction of the test section will be sampled and collected. All sampling and collection of materials during construction will occur at the mix plant to avoid any interruptions in the on-site construction activities. These samples will be for research purposes only and will not be a part of any contractual quality control programs by the responsible state agency. The following materials will be collected:

1. 55 gallons of asphalt cement used in virgin asphalt concrete mix. This material will be collected in containers provided by SHRP from the asphalt concrete mix plant after the asphalt has been heated for mixing. SHRP will provide details of the sampling procedures.

2. 55 gallons of asphalt cement used in the recycled asphalt concrete mix. This material will be collected in containers provided by SHRP from the asphalt plant after the asphalt has been heated for mixing. SHRP will provide details of the sampling procedures.

3. 1,000 lbs of the finished aggregate product to be used in the virgin asphalt concrete mix. This material shall be sampled in conformance with applicable portions of AASHTO Designation T 2-84. SHRP will provide containers and directives on any special procedures to be followed.

4. 1,500 lbs of the finished recycled asphalt concrete product prior to mixing with the new asphalt cement. This material shall be sampled following procedures similar to those used for aggregates. SHRP will provide containers and directives on any special procedures to be followed.

5. 1,000 lbs of the finished aggregate product to be mixed with the recycled asphalt concrete material. This material shall be sampled in conformance with applicable portions of AASHTO Designation T 2-84. SHRP will provide containers and directives on any special procedures to be followed.

6. 50 lbs of each batch of the finished virgin and recycled asphaltic concrete mix used in the construction of the SHRP test sections. These materials shall be sampled in conformance with applicable sections of AASHTO Designation T168-82. SHRP will provide containers and directives on any special procedures to be followed.

SHRP will bear the cost of shipping all materials collected for the SHRP research purposes.

POST-CONSTRUCTION ACTIVITIES

After construction of the test sections is completed the following sequence of activities will occur:

1. Marking and signing of the test sections.
2. Sampling of the overlay material.
3. Initial pavement evaluation measurements.
4. Performance monitoring of test sections over time.

Marking and Signing of Test Sections

Marking and signing of the location of each test section is important so that over time the location of the test section can be found. Depending on how the test sections were marked prior to construction, the location of the test sections needs to be marked immediately after construction. If the location of the test sections were marked on the shoulder prior to construction and if the shoulder was also overlaid during construction, temporary marking of the beginning and end of the test sections may need to be made during the construction process. This may be done with paint or pavement marking tape. In some instances, the beginning and end of test sections may be marked with delineator posts located off of the shoulder. In this instance, the marking of the section can wait until after completion of all construction activities provided that the delineator posts have not been disturbed during construction.

Figure 2 illustrates the typical marking and signing guidelines for each test section. The full six-digit section should be marked on each section. Details of the marking and signing are subject to local practices and law. A sign is encouraged at the start of the test sections to inform the public and also to serve as a notice to maintenance crews on the special nature of the test sections.

Sampling of the Overlay Material

Cores of the in-place and compacted overlay materials are needed to quantify the as-constructed thicknesses and to provide specimen for tests on the in-place compacted material. These cores should be 4" OD cores that perferably extend approximately 1" into the prior pavement surface. It is desired that these cores not extend full depth through the pavement structure, however due to the difficulty in extraction of a partial depth core, it may be necessary to extend these cores full depth through the bound pavement layers. It is preferred that these cores be taken outside the limits of the 500 foot monitoring section. The actual locations should be close enough to the section to be representative of the as-constructed conditions. For example, the cores should be not be made in the areas where overlay is changing from thin to thick or non-milled to milled. If construction constraints make it necessary, post construction

sampling, may have to performed within the 500 foot test sections. Construction should be performed so that the specific treatment extends past the ends of the 500 foot test section to avoid any destructive sampling within the test section.

The recommended post-construction sampling plan for this site is presented in Appendix A.

Initial Pavement Evaluation Measurements

The pavement evaluation measurements performed on the pavement prior to the overlay need to be repeated after completion of construction to establish an as-constructed reference point against which prior measurements and all future measurements can be compared. These measurements include deflection, distress, profile, and skid. Ideally, these measurements should be conducted as soon after completion of construction as possible. Since practical operational and administrative constraints may preclude this, the guidelines presented in Table 5 summarize the guidelines on timing of these measurements. Equipment and procedural guidelines, as discussed for pre-construction measurements, should be followed for these initial post construction measurements.

Deflection Measurements

In general, the after overlay placement deflection measurements should be made within a three month period after placement of the overlay. This might be extended in less active environment zones to 6 months, depending on the timing of the before overlay measurements relative to the placement of the overlay.

Profile Measurements

It is important that the after overlay profile measurements be conducted as soon after placement of the overlay as possible to characterize the immediate improvement in ride quality provided by the overlay and to minimize reflection distresses and volume changes in the underlying layer through the overlay. If possible, these measurements should be conducted within 2 months after placement of the overlay, particularly if the condition of the section was

Table 5. Summary of timing guidelines for pavement evaluation measurement after pavement rehabilitation.

Measurement Type	Timing Guidelines
Deflection Measurement	< 3 mo.[1] (freeze)
	< 6 mo.[2] (no freeze)
Profile Measurement	< 2 mo.
	< 4 mo. (dry, no freeze)
Distress Survey	< 12 mo.[3]
Skid Measurement	< 12 mo.

1. This should be shortened if winter freezing of the pavement structure is approaching.

2. If before measurements are made between 3 and 6 months, the after measurements should be performed within 3 months.

3. For pavements with high severity of cracking, or exhibiting pumping, these times should be halved.

in the poor distress condition category prior to the overlay or if the section is in an environmentally active zone (wet and/or freeze zones). For pavements in fair to good distress condition prior to the overlay and in zones with minimal environmental influence on the profile, time intervals up to four months after placement of the overlay may be considered for conduct of the after overlay profile measurements.

Distress Survey

The importance of the distress survey conducted immediately after placement of the overlay is not as critical as some of the other measurements. If properly constructed, no major distresses are expected to occur within one year after completion of construction. The initial distress survey after placement of the overlay should be performed within 12 months after placement of the overlay. In environmentally active zones or on pavements in the poor distress condition prior to the overlay it may be desireable to conduct the initial distress survey within 6 months after placement of the overlay or prior to the next winter.

Skid Measurements

Skid measurements should be performed within a twelve month period after placement of the overlay.

Pavement Monitoring Tests over Time

After the initial round of pavement evaluation tests described above, the test sections will be monitored over time for deflection, profile, distress and skid. The general schedule of these measurements are:

1. Deflection: annually. (Some sections may be monitored at closer time intervals to quantify environmental influences on these measurements.)

2. Distress: maximum 2 year intervals.

3. Profile: maximum 2 year intervals.

4. Skid: maximum 2 year intervals.

As the test sections age, it may be necessary to increase the above time intervals between testing. These test sections will be monitored over their performance life until they reach an out-of-test condition and require subsequent rehabilitation. It is currently expected that the SHRP monitoring program for these test sections will extend over a 20 year time period. Depending on future conditions, it is possible that some of this test sections will continue to be monitored after subsequent rehabilitation.

OTHER DATA COLLECTION ACTIVITIES

Other data collection activities associated with the research for the Specific Pavement Studies experiments includes historical information on the existing roadway and traffic monitoring data.

Historical Information

Historical information in this context refers to information on the original constructed pavement section prior to the rehabilitation for this experiment. This information will include information on original construction, materials, maintenance and rehabilitation treatments applied to the section, any historical monitoring information such as skid tests or deflection measurements, and traffic information. This information will be reported to SHRP using the forms and guidelines for the General Pavement Studies portion of LTPP in the SHRP LTPP Data Collection Guide.

Continuous Weigh-In-Motion Station

In order to balance the effort expended on the construction and materials sampling of these test sections, continuously operating weigh in motion station is prescribed for collection of detailed information on the traffic loadings carried by the rehabilitated pavement test sections. This station needs

to be located on a smooth level (zero grade) site which measures the same traffic stream which passes over the test sections. It is preferred that these stations be constructed and placed in operation at the same time that the test sections are opened to traffic. However, these stations can be placed in operation up to one year after the test sections are opened to traffic. In this case, sampling of the traffic stream with other types of portable equipment should be performed until the continuous station is placed in operation. All traffic data collected should be reported to SHRP following the FHWA reporting guidelines and format as specified in the FHWA Traffic Monitoring Guide. The other details regarding editing and reporting of this type of traffic data developed for the LTPP GPS test sections should be followed for SPS traffic data.

APPENDIX A. MATERIAL SAMPLING PLAN FOR SPS-5 MISSISSIPPI PROJECT

The following tables and figures present the recommended material sampling plan for the SPS-5 site in Mississippi. Adjustments may be necessary in the field based on site specific considerations. This plan contains what is considered the minimum to meet the materials characterization needs for the SPS-5 experiment.

The schematic layout of the location of the test sections and sampling areas is shown in Figure A.1. Table A.1 presents a summary of test section locations, sampling area locations and overlay details and Table A.2 presents a summary of the materials sampling and testing to be performed in each sampling area. Figures A.2 through A.16 present details of the recommended sampling and testing to be performed prior to construction of the test sections. Figures A.17 through A.31 present details of post-construction sampling.

SPS-5 LAYOUT, NORTH BOUND HIGHWAY 55, MISSISSIPPI (before overlay)

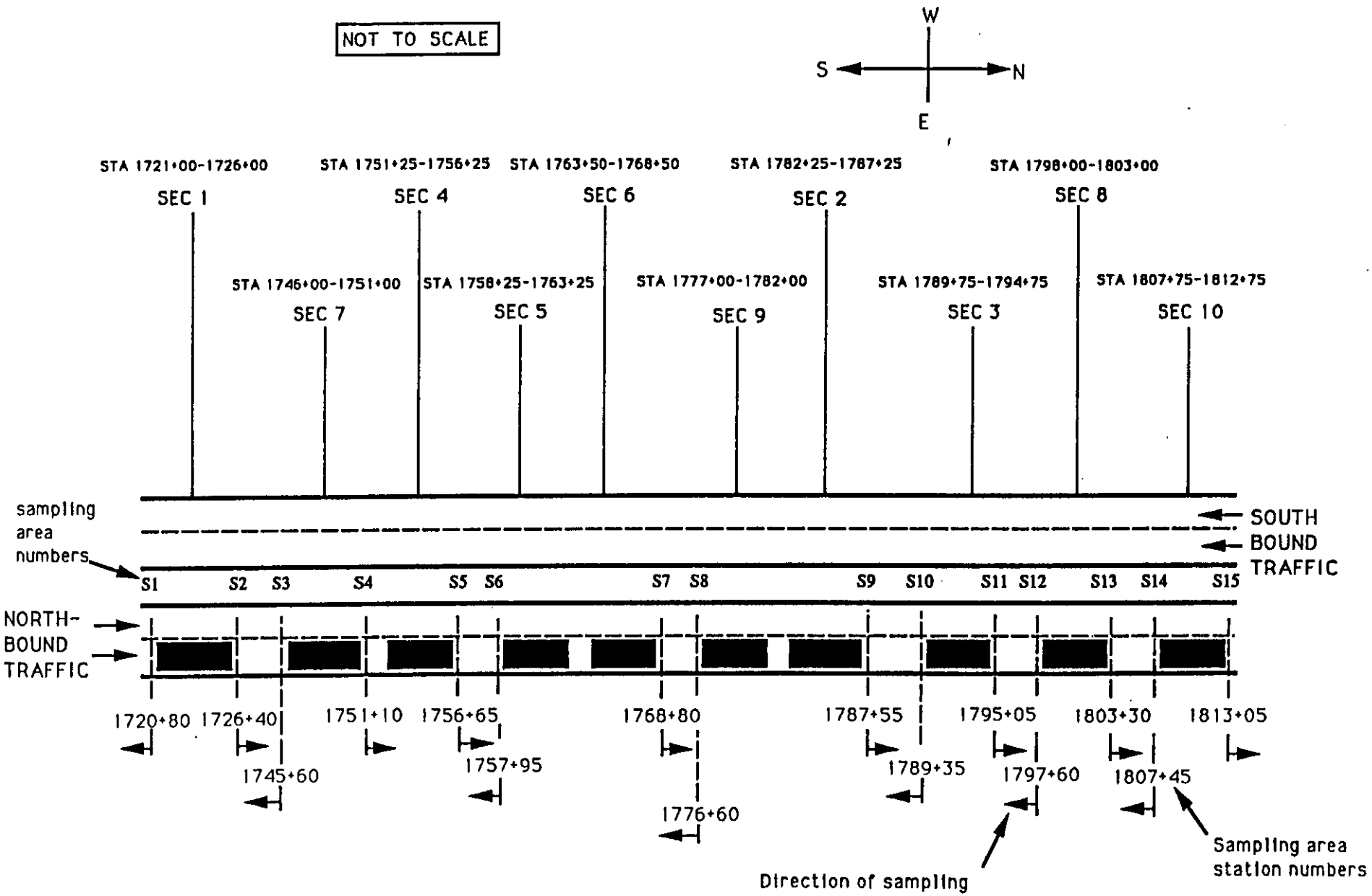


Figure A.1. Schematic layout of test sections before overlay for SPS-5, Mississippi showing locations

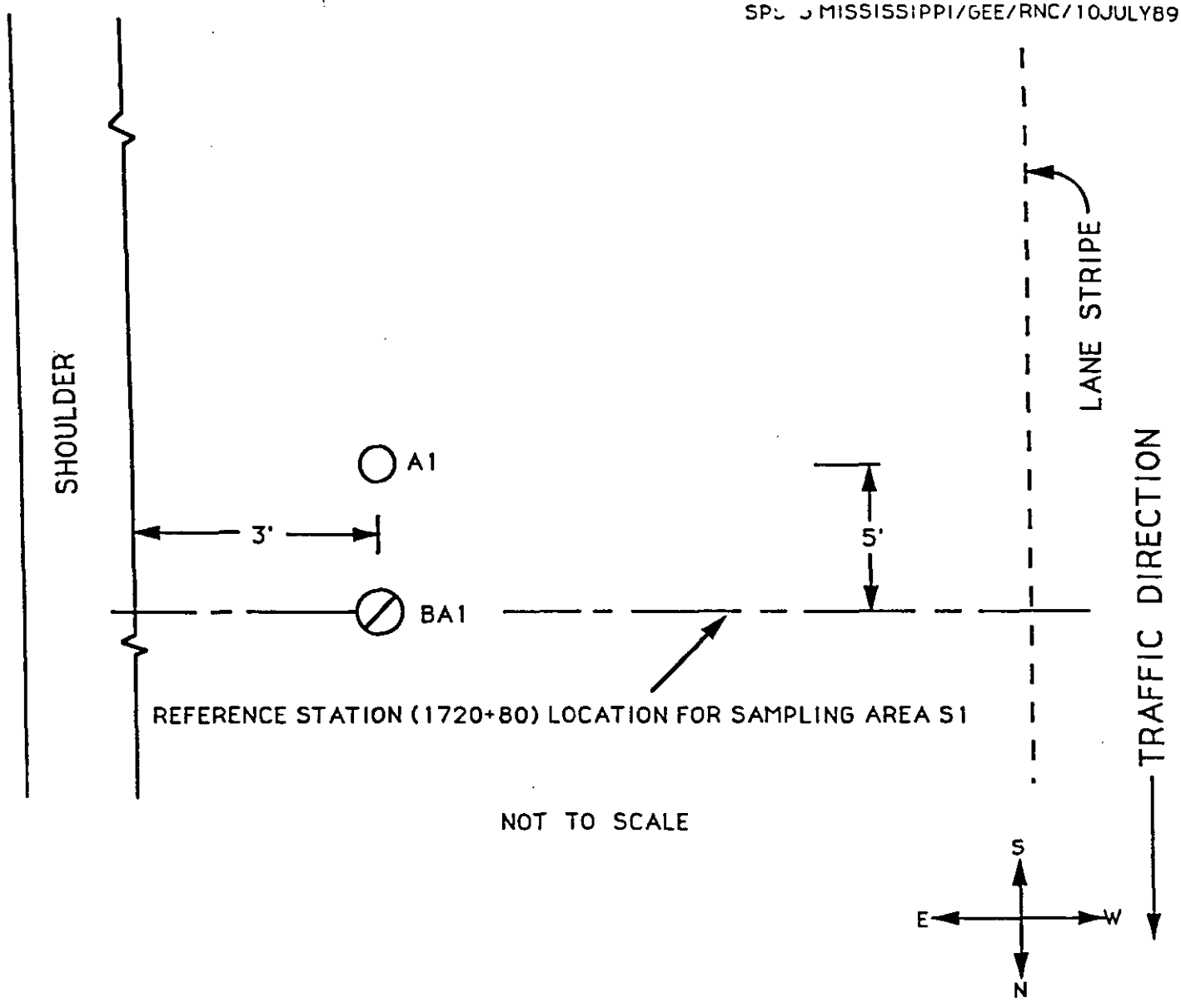
Table A.1. Summary of test section locations, sampling area locations and overlay details for SPS-5 pavement site in Mississippi.

Section Number	Length (feet)	Stations Begin	Stations End	Associated Sampling Area Before Section	Associated Sampling Area After Section	Reference Station (Before/After)	Minimum Required Overlay Length (feet)	Overlay Stations Begin	Overlay Stations End
1	500	1721+00	1726+00	S1	S2	1720+80/1726+40		NO	OVERLAY
7	500	1746+00	1751+00	S3	S4	1745+60/1751+10	575	1745+40	1751+15
4	500	1751+25	1756+25	--	S5	-- /1756+65	560	1751+25	1756+85
5	500	1758+25	1763+25	S6	--	1757+95/ --	535	1757+90	1763+25
6	500	1763+50	1768+50	--	S7	-- /1768+80	535	1763+50	1768+85
9	500	1777+00	1782+00	S8	--	1776+60/ --	550	1776+50	1782+00
2	500	1782+25	1787+25	--	S9	-- /1787+55	535	1782+25	1787+60
3	500	1789+75	1794+75	S10	S11	1789+35/1795+05	600	1789+10	1795+10
8	500	1798+00	1803+00	S12	S13	1797+60/1803+30	595	1797+40	1803+35
10	500	1807+75	1812+75	S14	S15	1807+45/1813+05	570	1807+40	1813+10

Table A.2. Summary of sampling area locations and sampling plan for SPS-5 pavement site in Mississippi.

Sampling Area	Direction/ Station	SAMPLING BEFORE OVERLAY PLACEMENT: AC Pavement Cores	Bituminous Base Cores	Lime Treated Soil	Subgrade Soil Samples	SAMPLING AFTER OVERLAY: AC Overlay Cores
S1	S/1720+80	A1, BA1	A1, BA1	A1, BA1	A1, BA1	-
S2	N/1726+40	A2, BA2	A2, BA2	A2, BA2	A2, BA2	-
S3	S/1745+60	C1-C9	C1-C7	C1-C3		C1-C11
		A3, BA3	A3, BA3	A3, BA3	A3, BA3	
S4	N/1751+10	-	-	-	-	C12-C13
+S5	N/1756+65	C14-C22	C14-C20	C14-C16		C14-C24
		A4,BA4	A4, BA4	A4, BA4	A4, BA4	
S6	S/1757+95	-	-	-	-	C25, C26
S7	N/1768+80	A5	A5	A5	A5, BA5	C27, C60
S8	S/1776+60	-	-	-	A6, BA6	C28, C61
S9	N/1787+55	-	-	-	-	C29, C62
S10	S/1789+35	C30-C38	C30-C36	C30-C32		C30-C40
		A7, TP	A7	A7	A7, TP	
S11	N/1795+05	-	-	-	-	C41, C42
+S12	S/1797+60	C43-C51	C43-C49	C43-C45		C43-C53
		A8, BA7	A8, BA7	A8, BA7	A8, BA7	
S13	N/1803+30	A9	A9	A9	A9	C54, C55
S14	S/1807+45	A10	A10	A10	A10	C56, C57
S15	N/1813+05	BA8	BA8	BA8	BA8	C58, C59
TOTAL CORES/SAMPLES						
* C-Type Cores		36	28	12	-	62
A-Type Cores/Samples		10	10	10	10	-
BA-Type Cores/Samples		7	7	7	8	-
Test Pit Samples		1	-	-	1	-
* Includes						
Extra C-Type Cores:		9	7	3	-	23

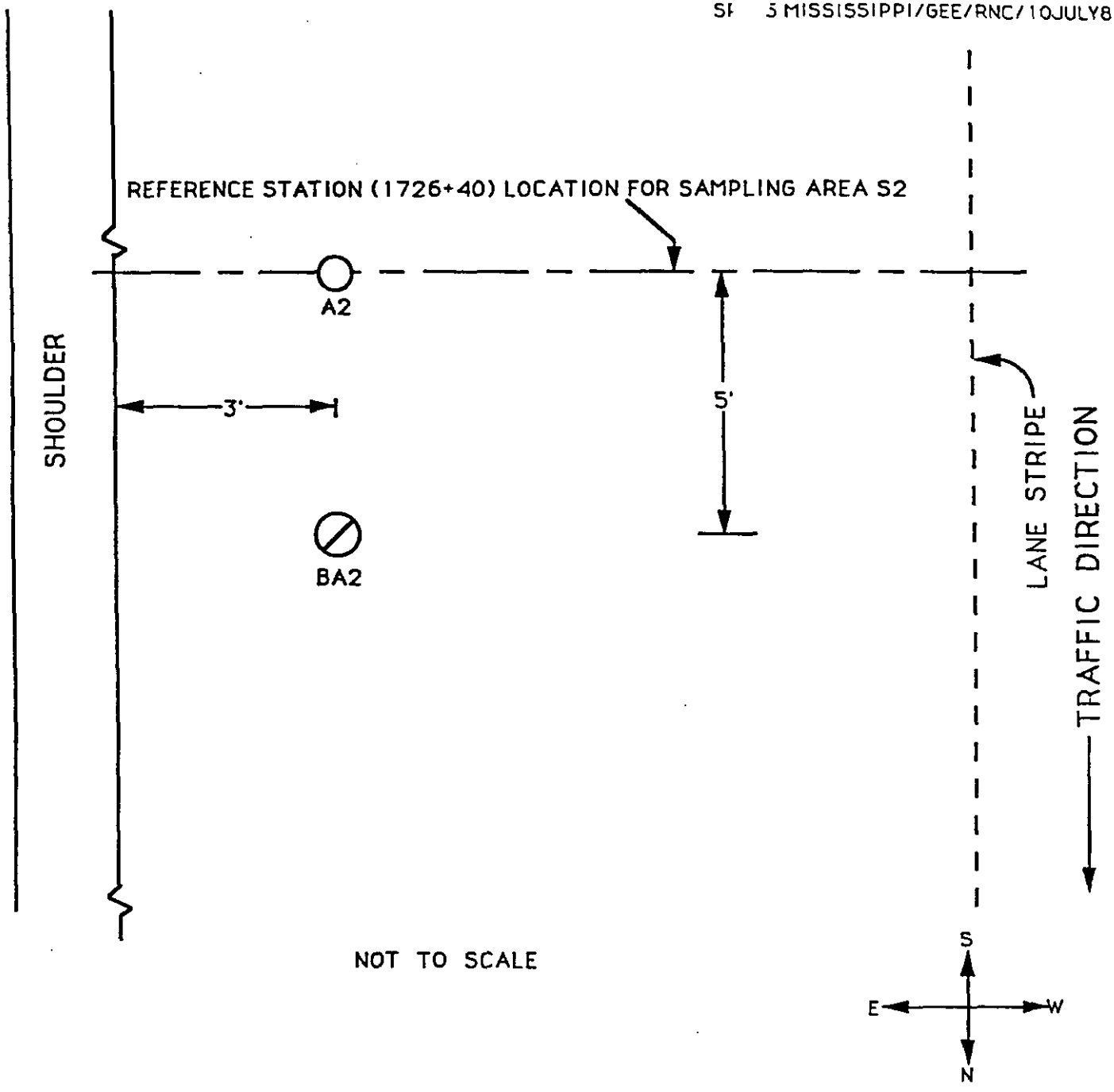
+ Shoulder Auger probes (AP1 and AP2) in sampling areas S5 and S12.



○ 6 inch OD core through AC pavement surface, bituminous base, and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A1

⊘ 12 inch OD core of AC pavement surface, bituminous base, and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade: BA1

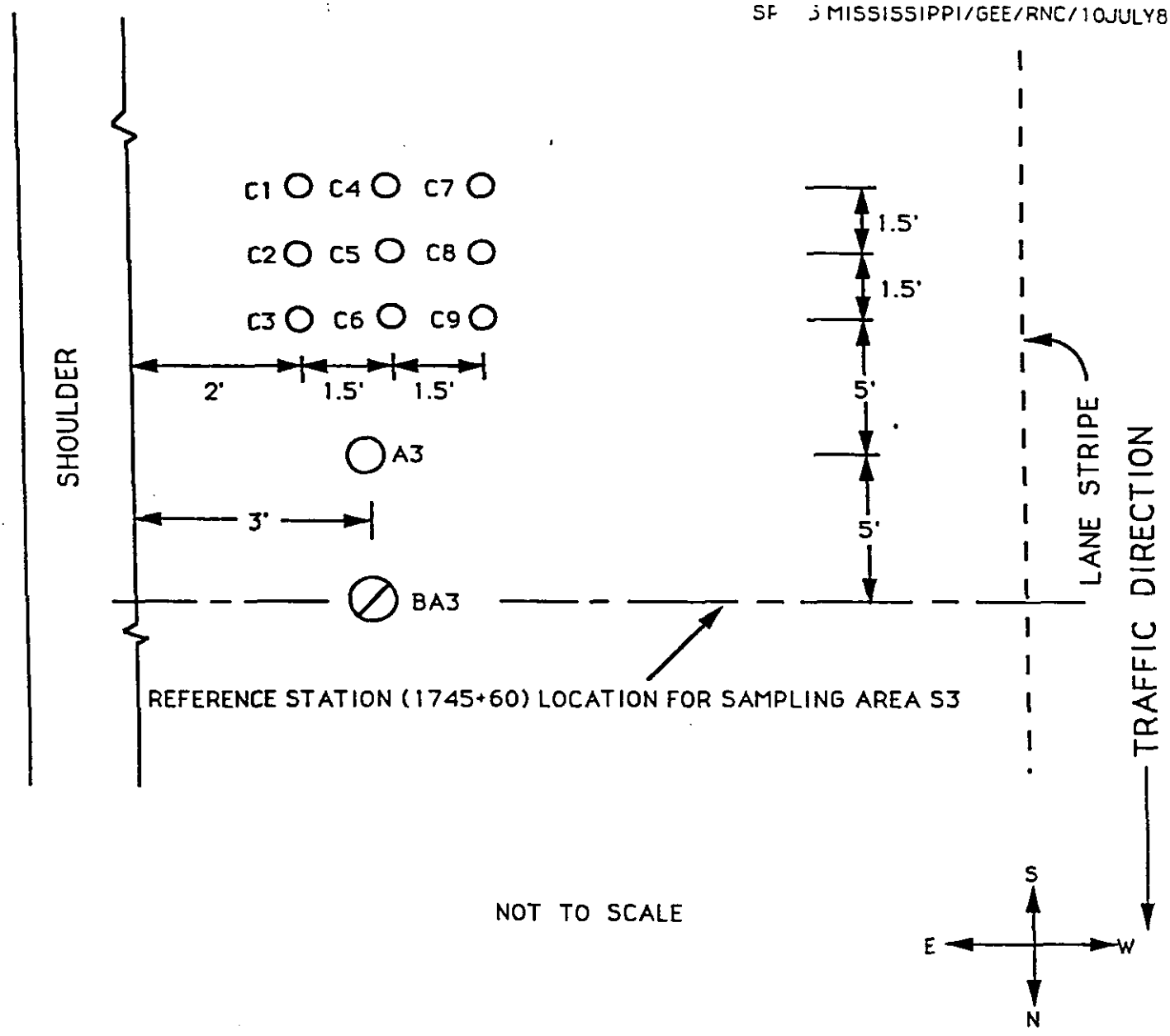
Figure A.2. Before overlay sampling plan for station 1720+80 before section 1. Sampling area S1.



○ 6 inch OD core through AC pavement surface, bituminous base, and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A2

⊘ 12 inch OD core of AC pavement surface, bituminous base, and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade: BA2

Figure A.3. Before overlay sampling plan for station 1726+40 after section 1. Sampling area S2.



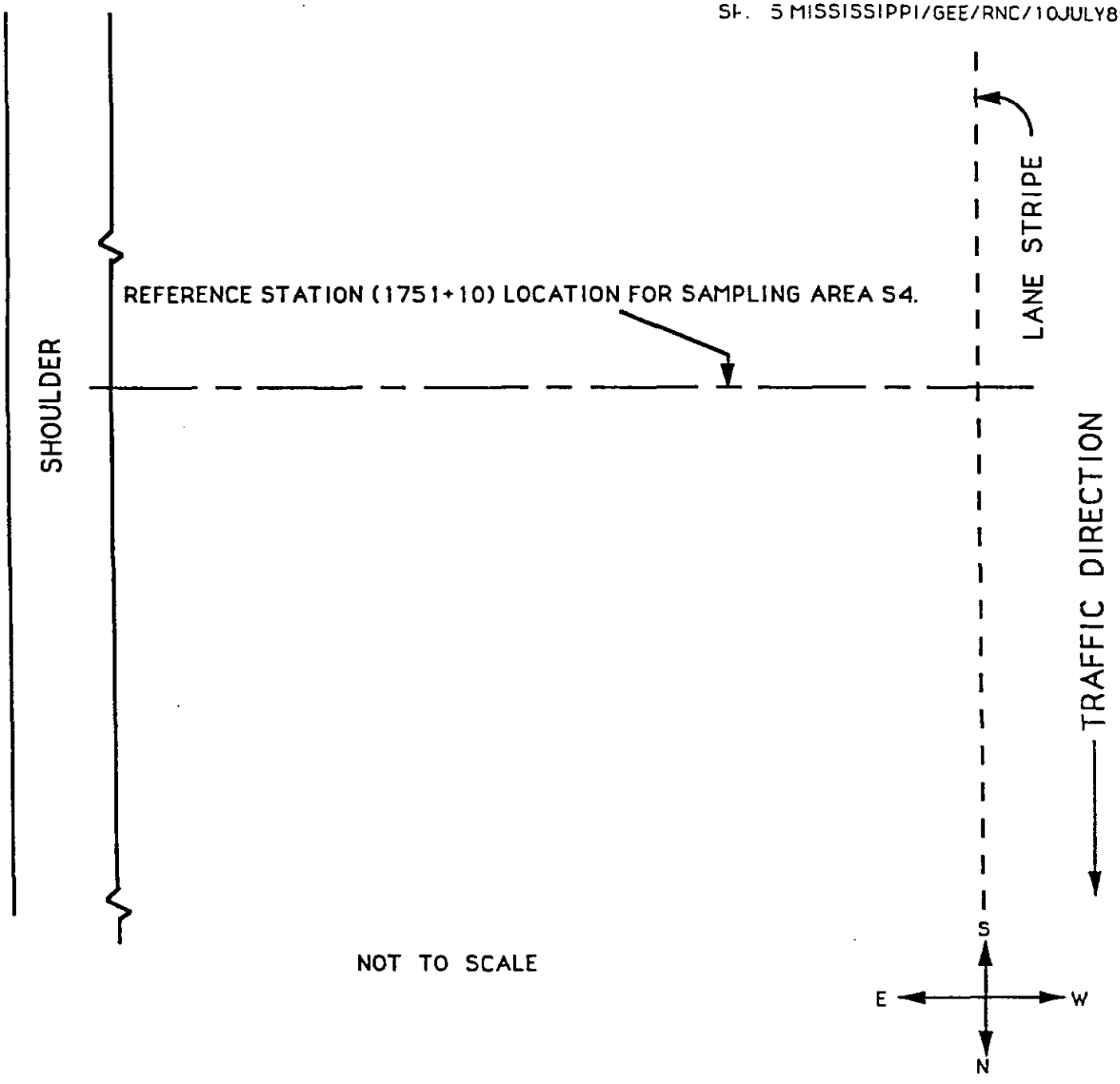
○ 4 inch OD core as described in the following :

AC pavement surface : C1-C9
AC pavement surface and bituminous base : C1-C7
AC pavement surface, bituminous base and lime treated soil : C1-C3

◯ 6 inch OD core through AC pavement surface, bituminous base and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A3

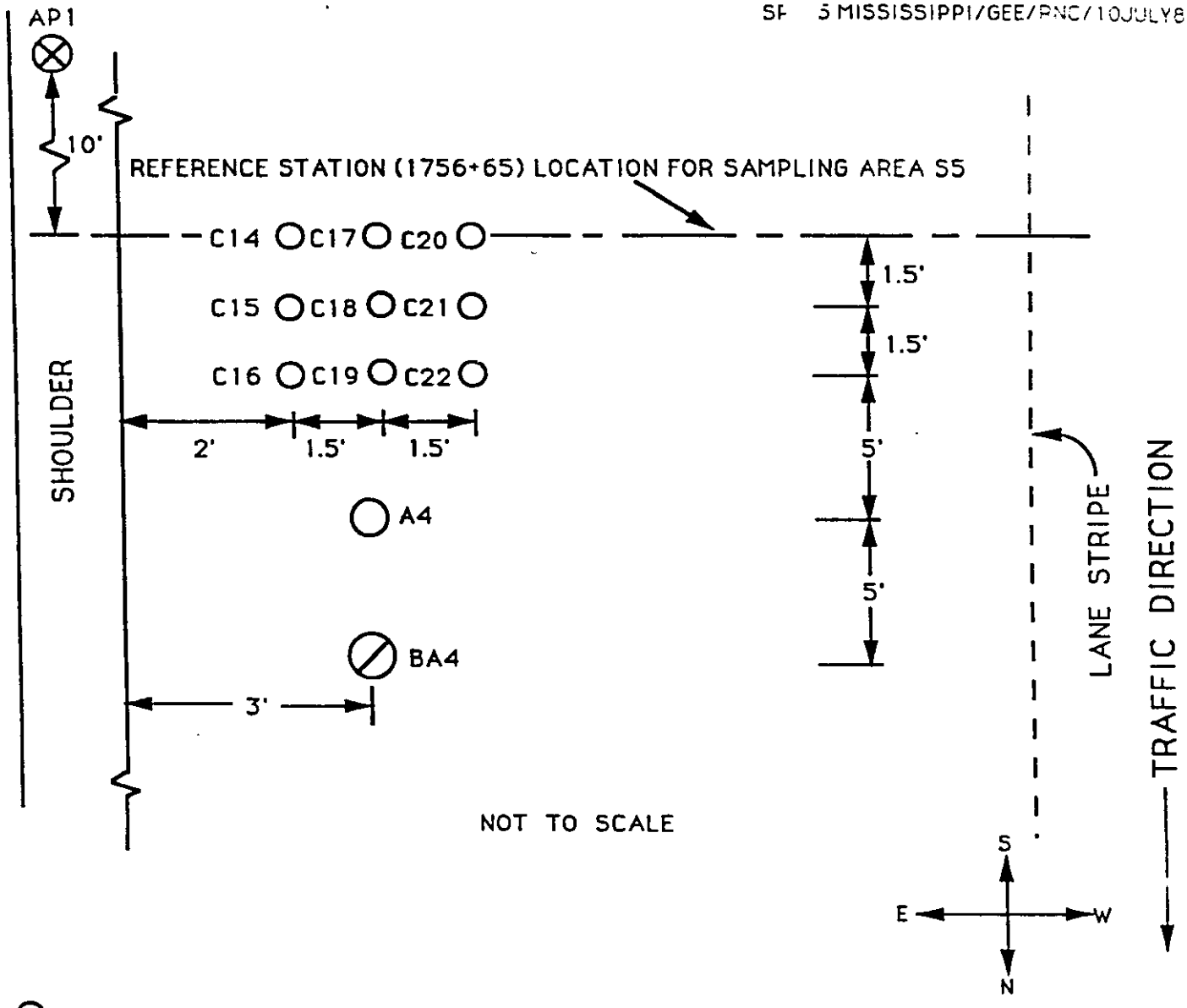
⊘ 12 inch OD core of AC pavement surface, bituminous base and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade : BA3

Figure A.4. Before overlay sampling plan for station 1745+60 before section 7. Sampling area S3.



NO SAMPLES PLANNED BEFORE OVERLAY

Figure A.5. Before overlay sampling plan for station 1751+10 after section 7. Sampling area S4.



○ 4 inch OD core as described in the following :

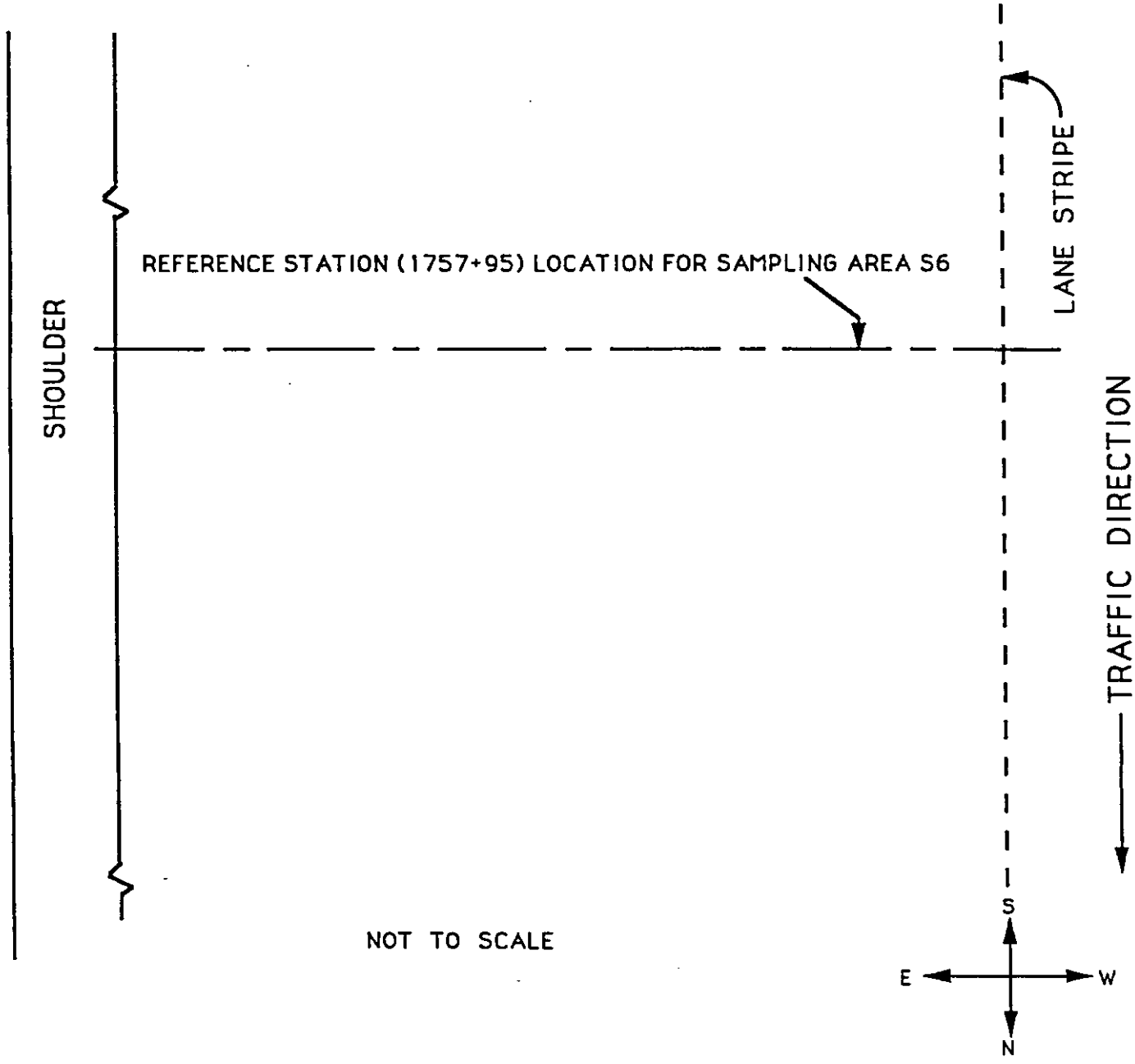
AC pavement surface : C14-C22
AC pavement surface and bituminous base : C14-C20
AC pavement surface, bituminous base and lime treated soil : C14-C16

◯ 6 inch OD core through AC pavement surface, bituminous base and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A4.

⊘ 12 inch OD core of AC pavement surface, bituminous base and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade : BA4.

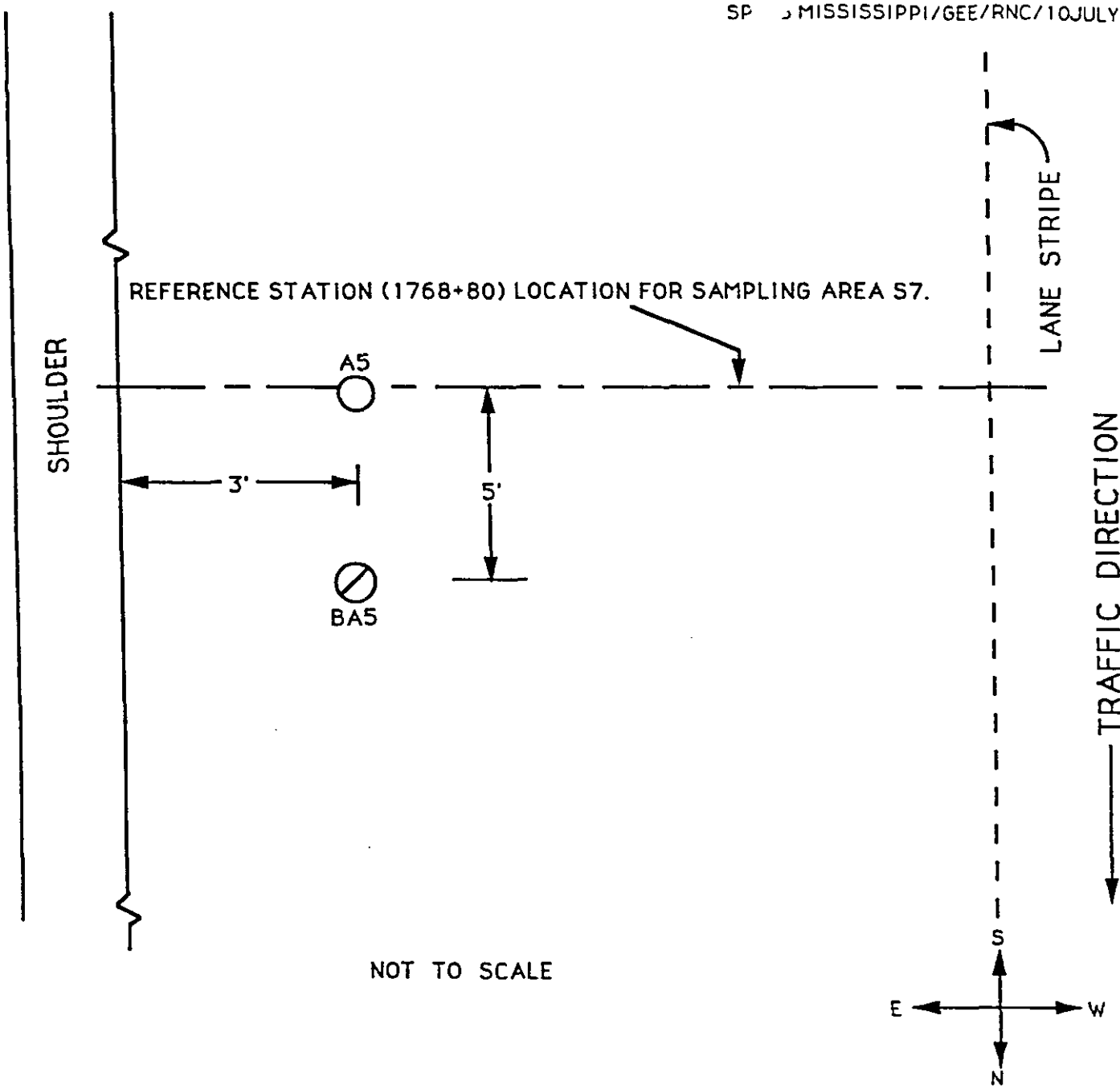
⊗ 4 inch or 6 inch OD auger probe through shoulder to a maximum depth of 20 feet or until refusal is encountered: AP1

Figure A.6. Before overlay sampling plan for station 1756+65 after section 4. Sampling area S5.



NO SAMPLES PLANNED BEFORE OVERLAY

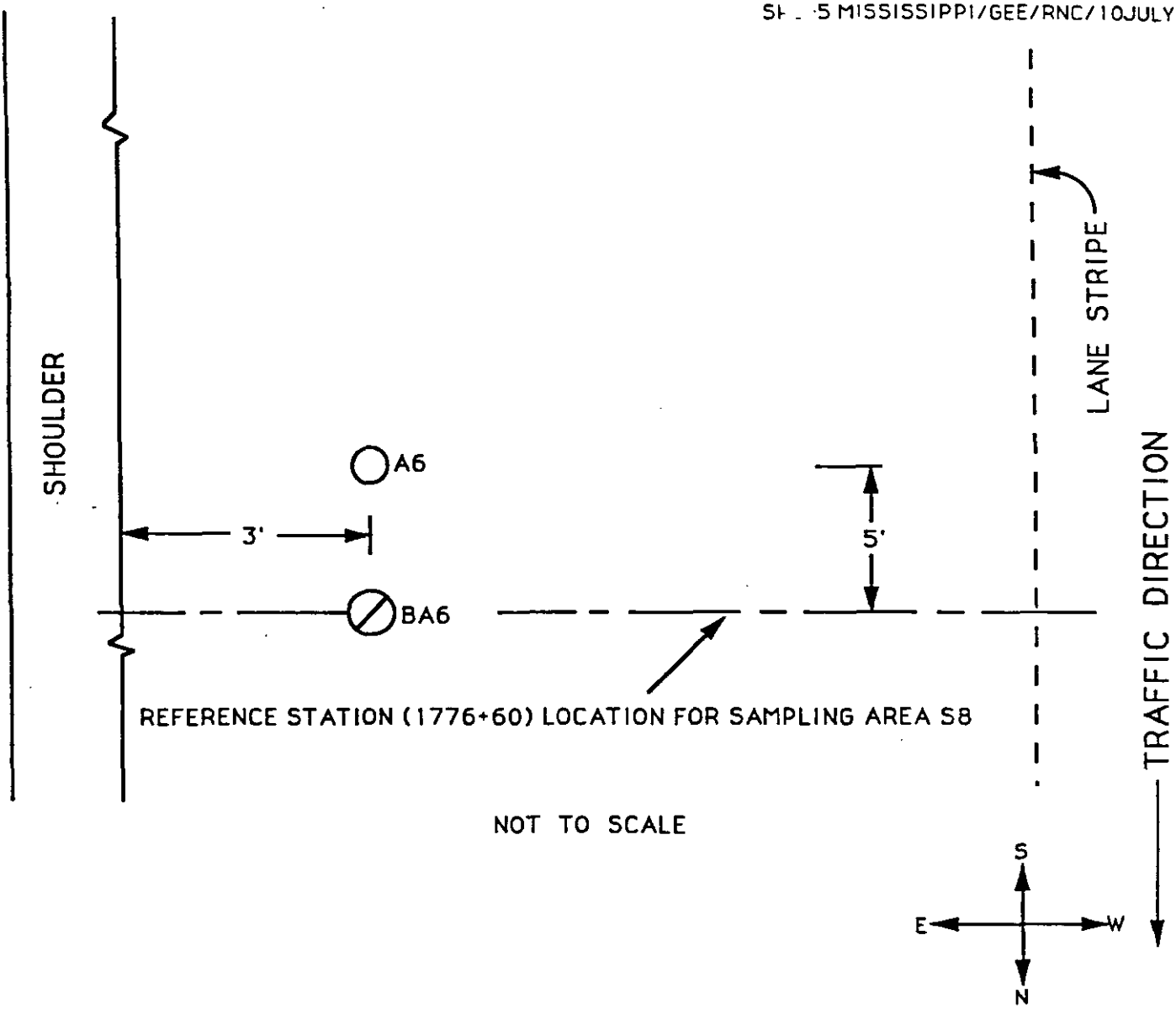
Figure A.7. Before overlay sampling plan for station 1757+95 before section 5. Sampling area S6.



○ 6 inch OD core through AC pavement surface, bituminous base, and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A5

⊘ 12 inch OD core of AC pavement surface, bituminous base, and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade: BA5

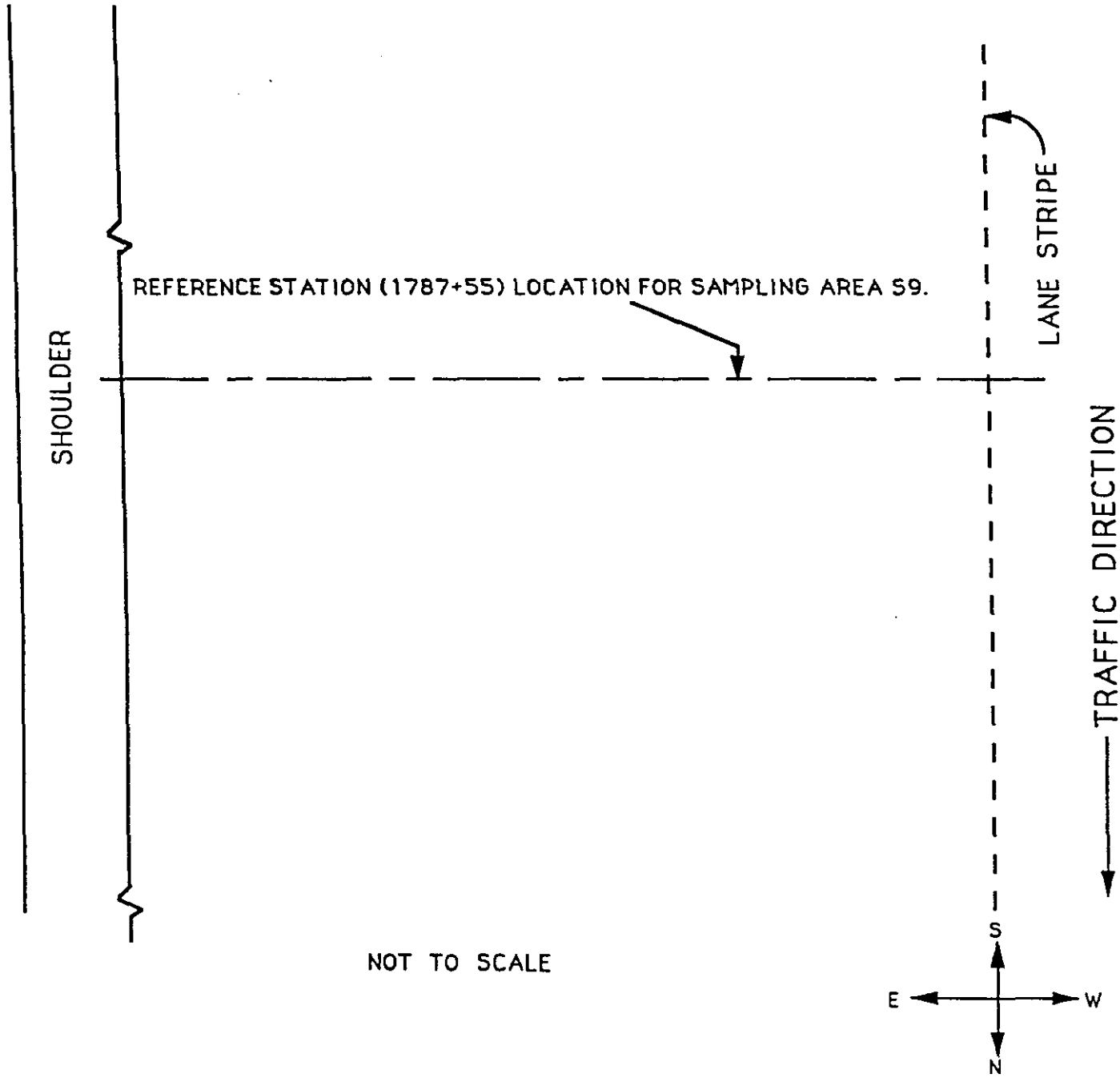
Figure A.8. Before overlay sampling plan for station 1768+80 after section 6. Sampling area S7.



○ 6 inch OD core through AC pavement surface, bituminous base, and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A6

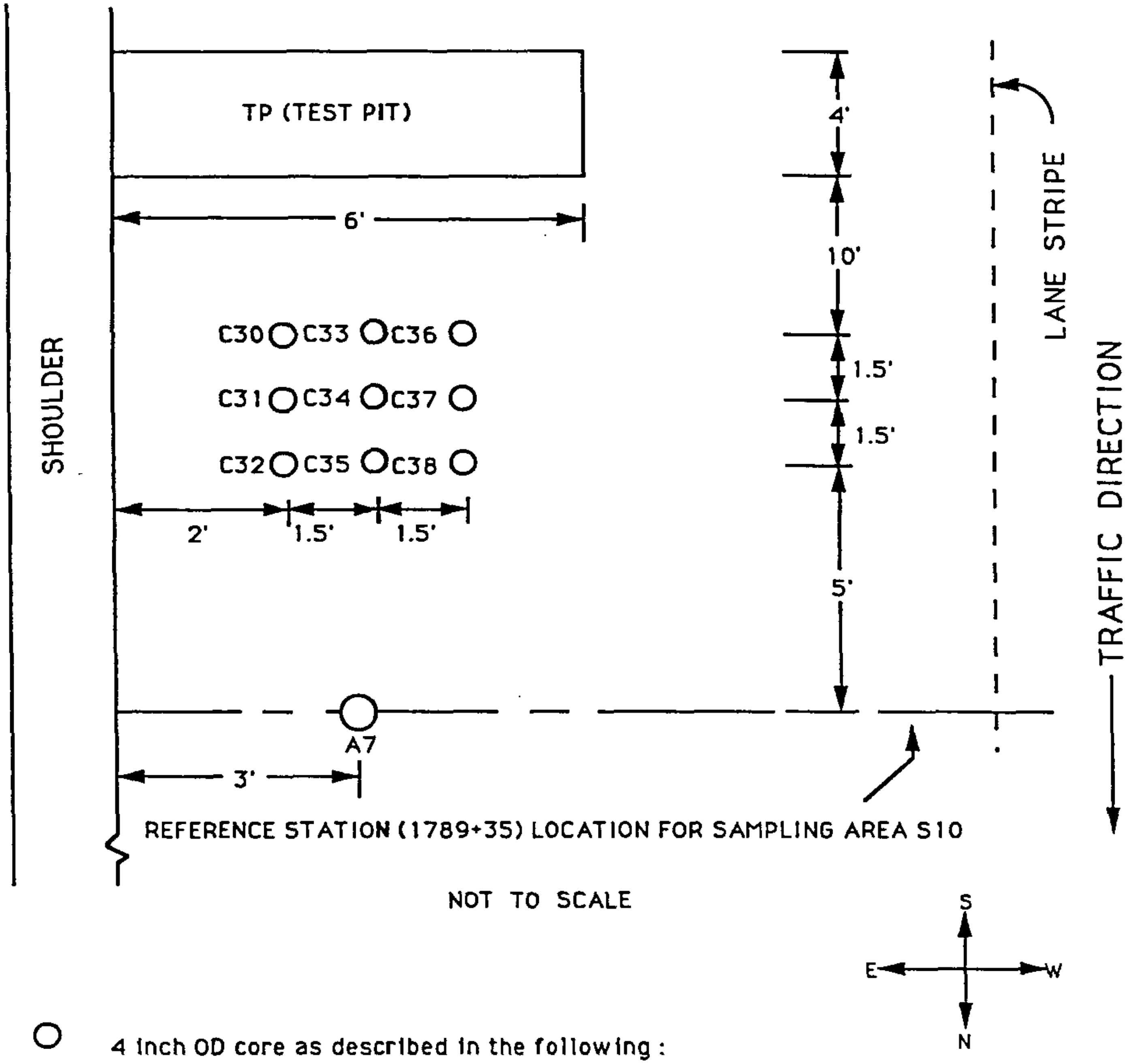
⊘ 12 inch OD core of AC pavement surface, bituminous base, and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade: BA6

Figure A.9. Before overlay sampling plan for station 1776+60 before section 9. Sampling area S8



NO SAMPLES PLANNED BEFORE OVERLAY

Figure A.10. Before overlay sampling plan for station 1787+55 after section 2. Sampling area S9.



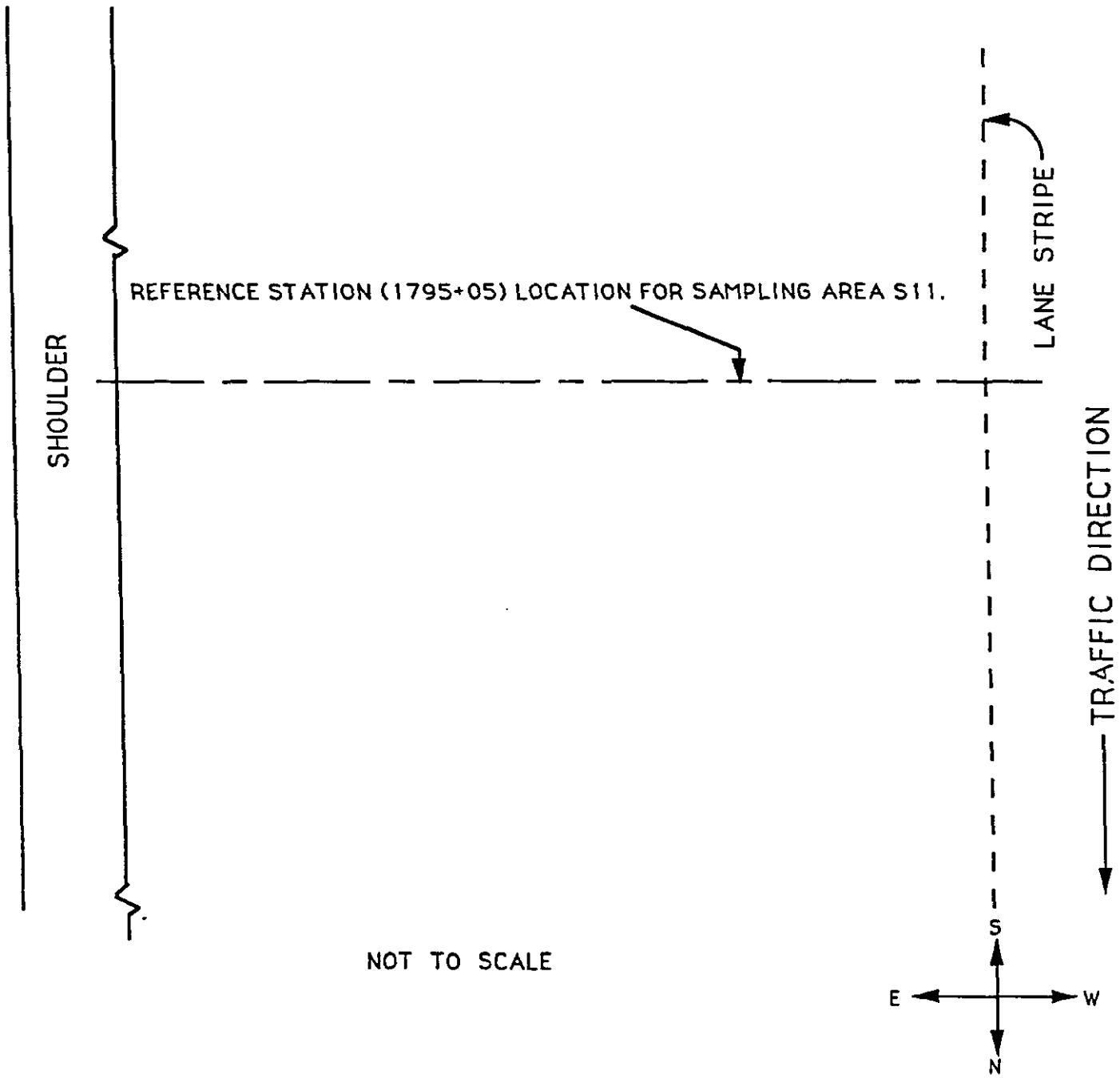
○ 4 inch OD core as described in the following :

AC pavement surface : C30-38
AC pavement surface and bituminous base : C30-36
AC pavement surface, bituminous base and lime treated soil : C30-32

◯ 6 inch OD core through AC pavement surface; bitumnous base and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A7

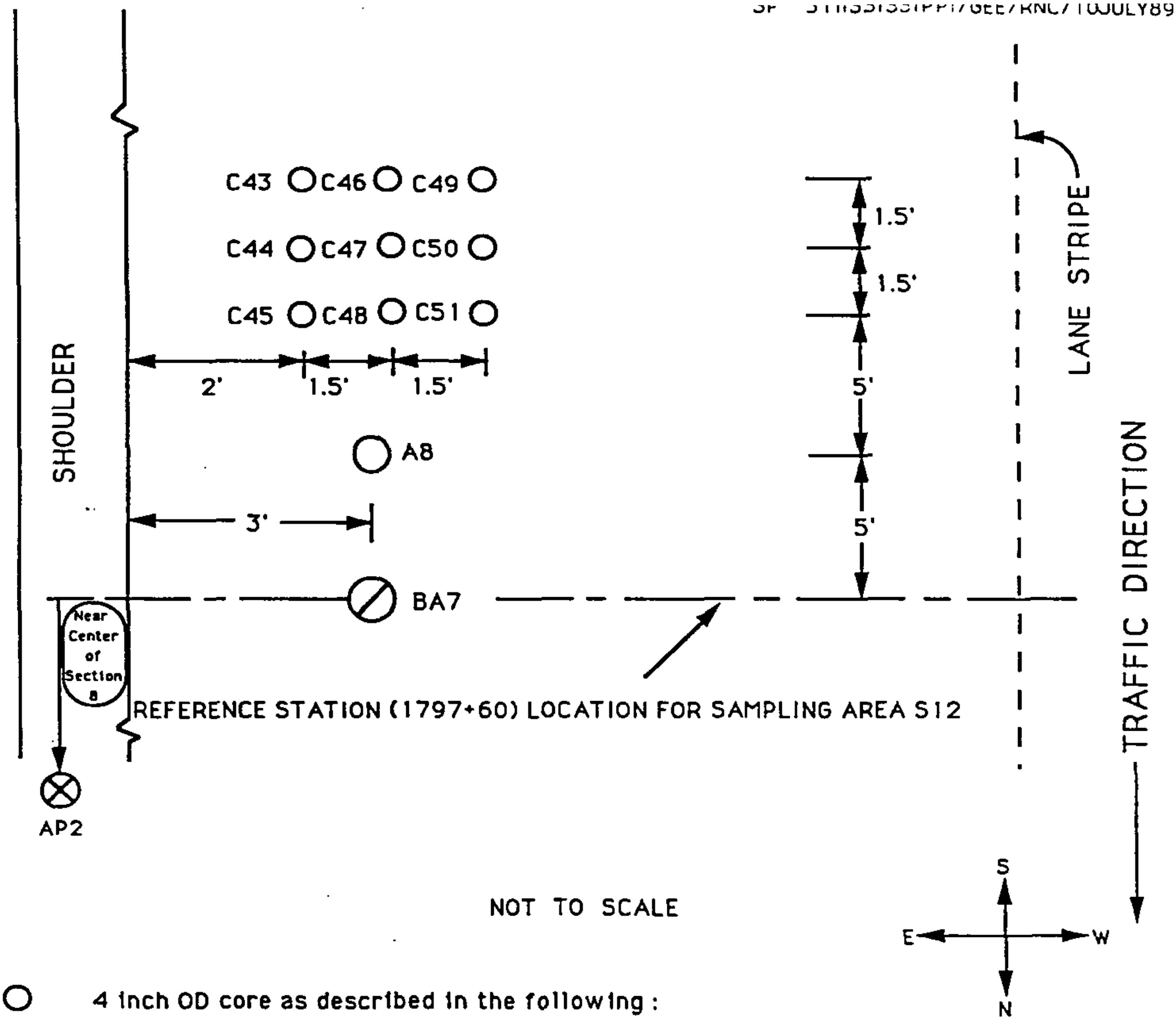
▭ Test pit (4' x 6' x 12" below top of untreated subgrade). Removal of pavement layers; collection of pavement slabs; nuclear density and moisture measurements on granular base and subgrade; bulk sampling of granular base and subgrade: TP

Figure A.11. Before overlay sampling plan for station 1789+35 before section 3. Sampling area S10.



NO SAMPLES PLANNED BEFORE OVERLAY

igure A.12. Before overlay sampling plan for station 1795+05 after section 3. Sampling area S11.



○ 4 inch OD core as described in the following :

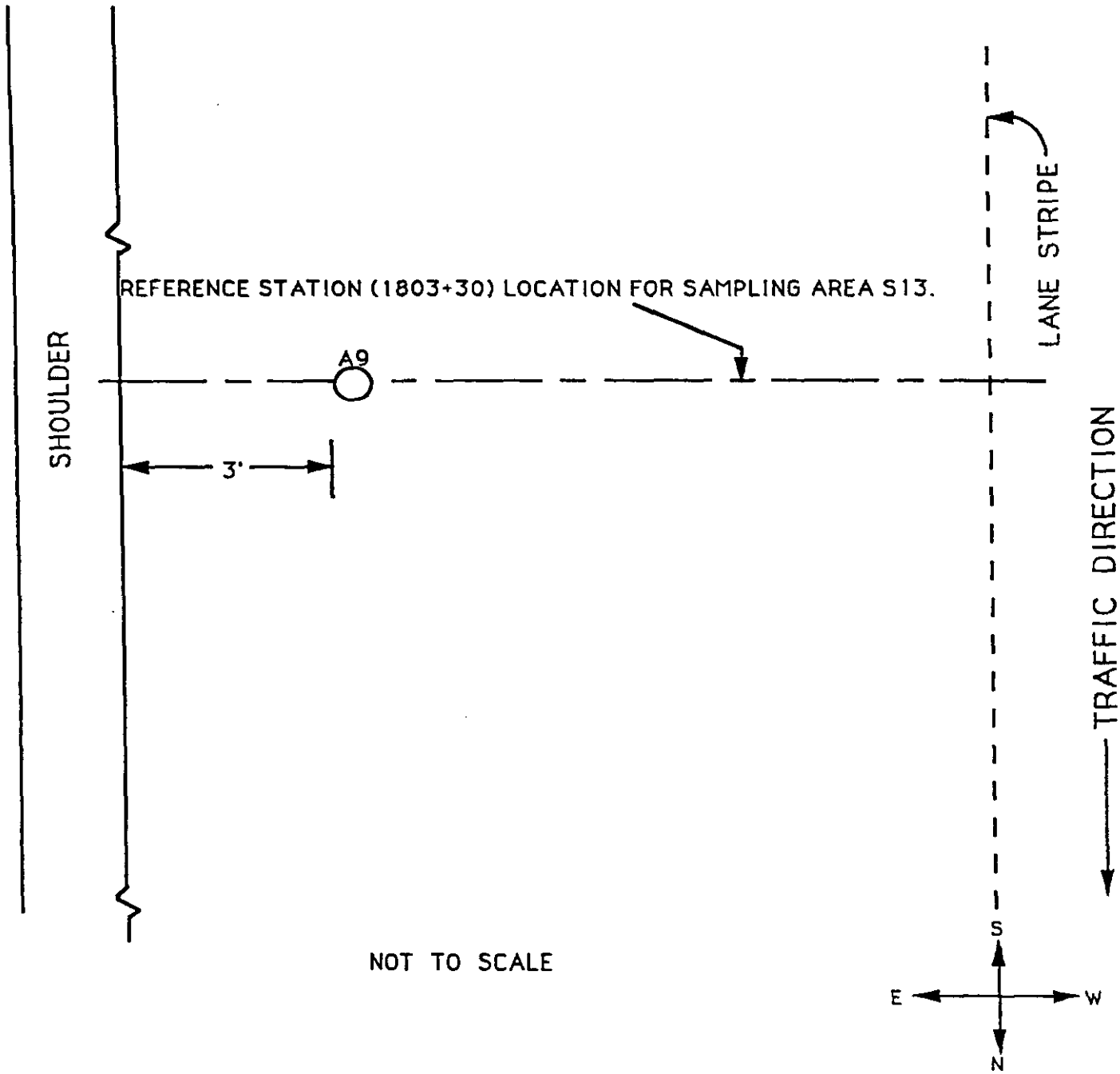
AC pavement surface : C43-C51
AC pavement surface and bituminous base : C43-C49
AC pavement surface, bituminous base and lime treated soil : C43-C45

○ 6 inch OD core through AC pavement surface; bituminous base and lime treated soil; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A8

⊘ 12 inch OD core of AC pavement surface, bituminous base and lime treated soil. Augering and bulk sampling of subgrade to a depth of 12 inches below top of untreated subgrade: BA7

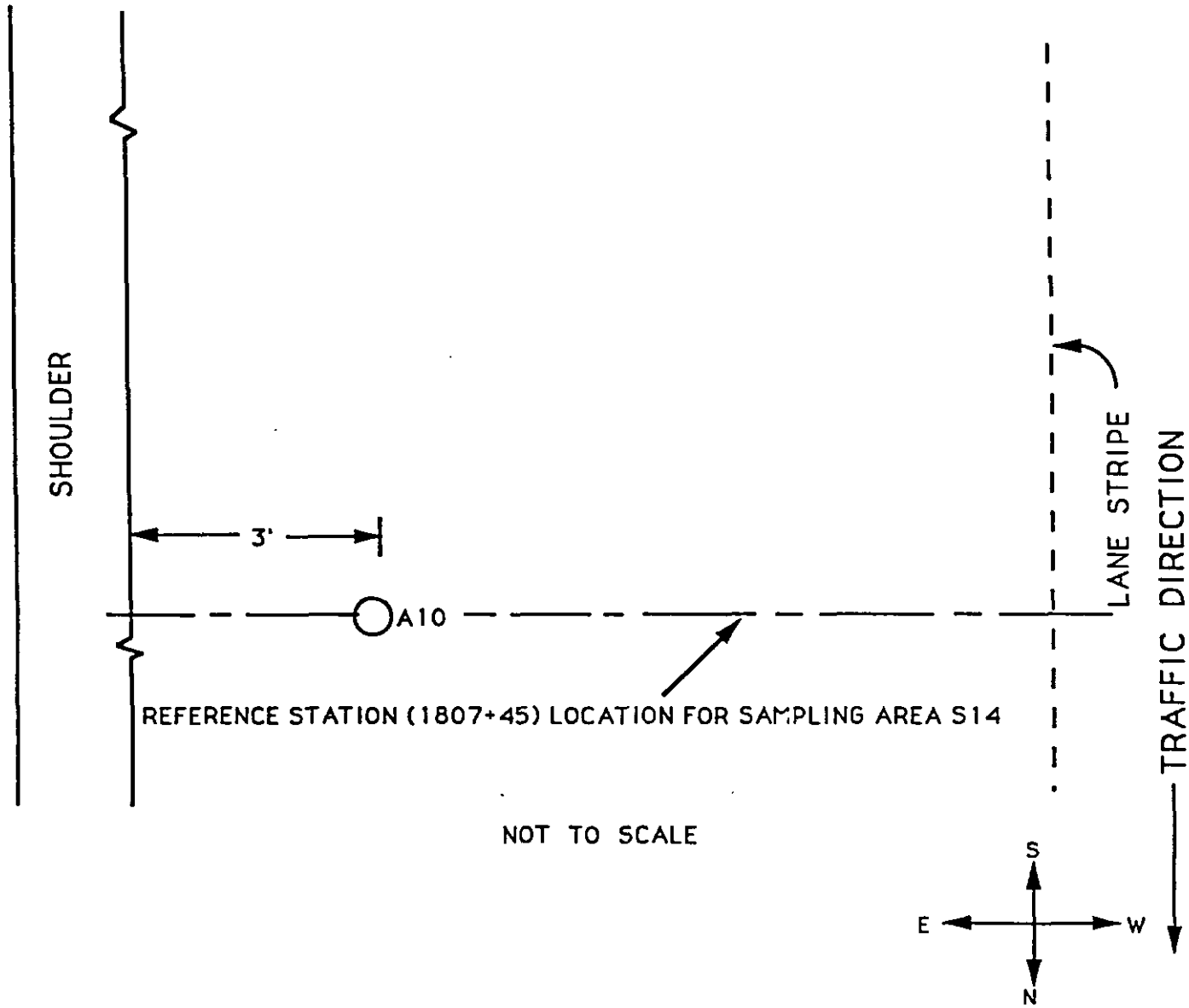
⊗ 4 inch or 6 inch OD auger probe through shoulder to a maximum depth of 20 feet or until refusal is encountered: AP2

Figure A.13. Before overlay sampling plan for station 1797+60 before section 8. Sampling area S12.



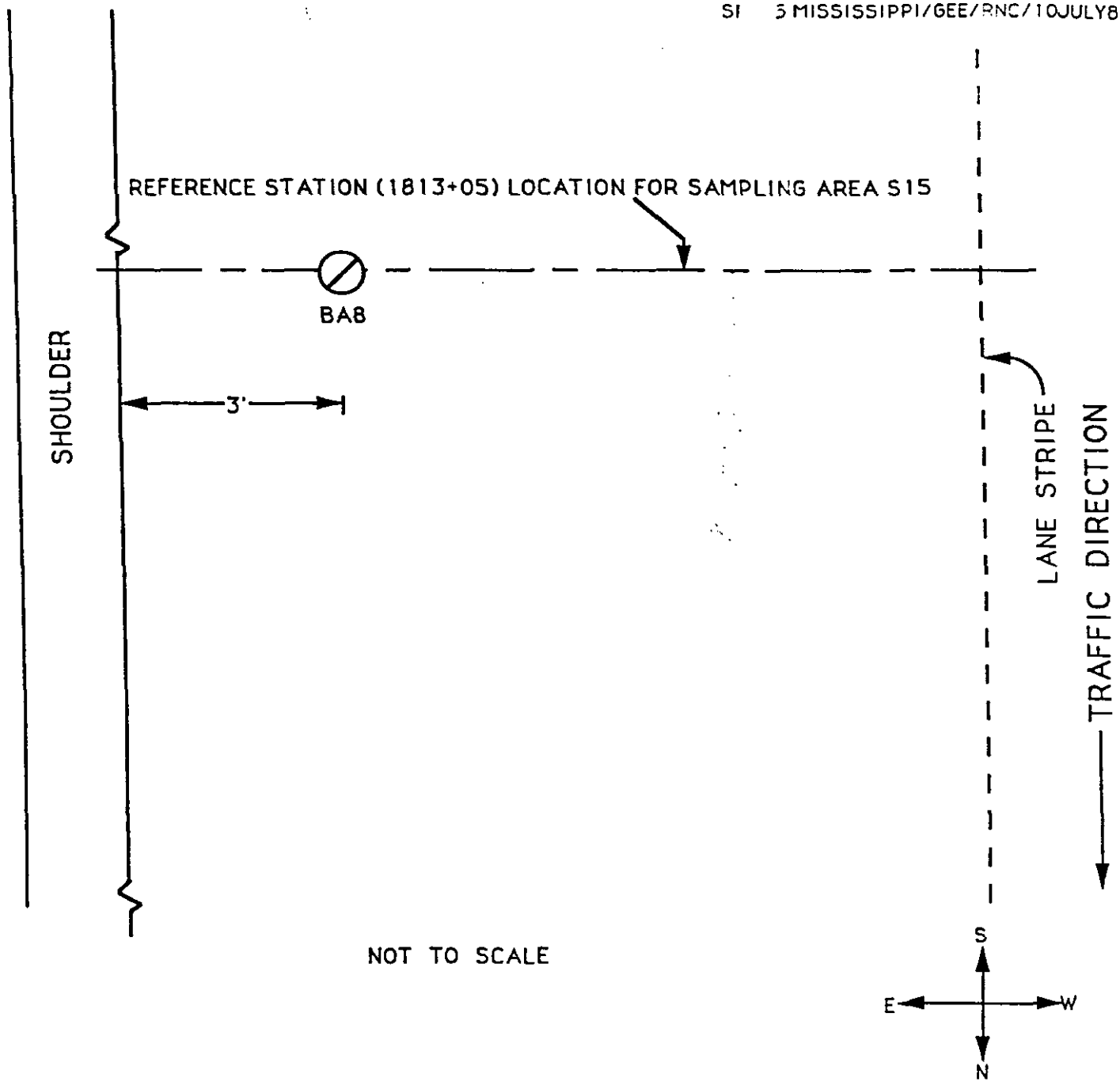
○ 6 inch OD core through AC pavement surface; augering of granular base; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A9

(jure A.14. Before overlay sampling plan for station 1803+30 after section 8. Sampling area S13.



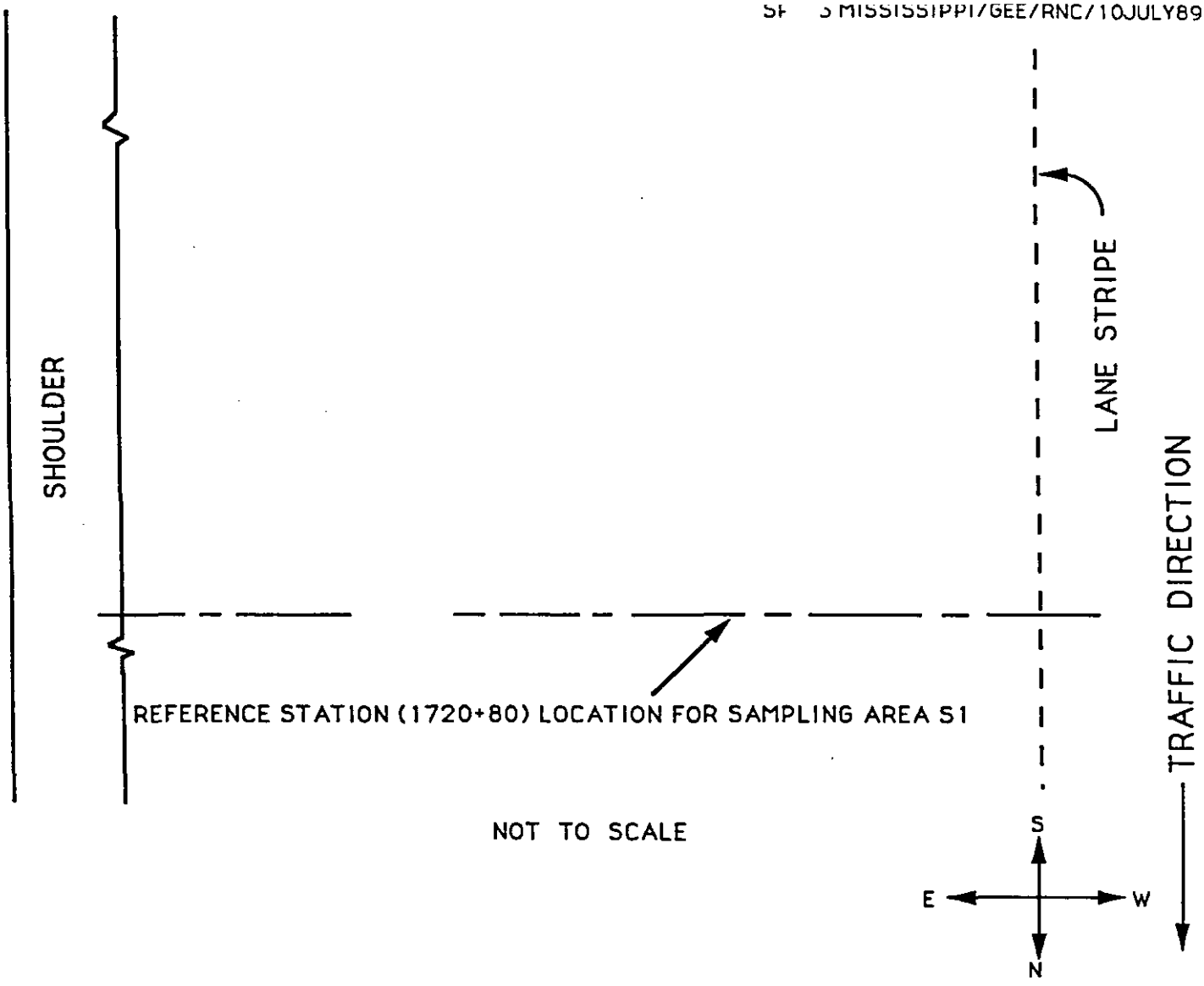
○ 6 inch OD core through AC pavement surface; augering of granular base; thin-walled tube sampling and/or splitspoon sampling of subgrade to a depth 5 feet below top of subgrade, as directed by SHRP authorized representative: A10

Figure A.15. Before overlay sampling plan for station 1807+45 before section 10. Sampling area S14.



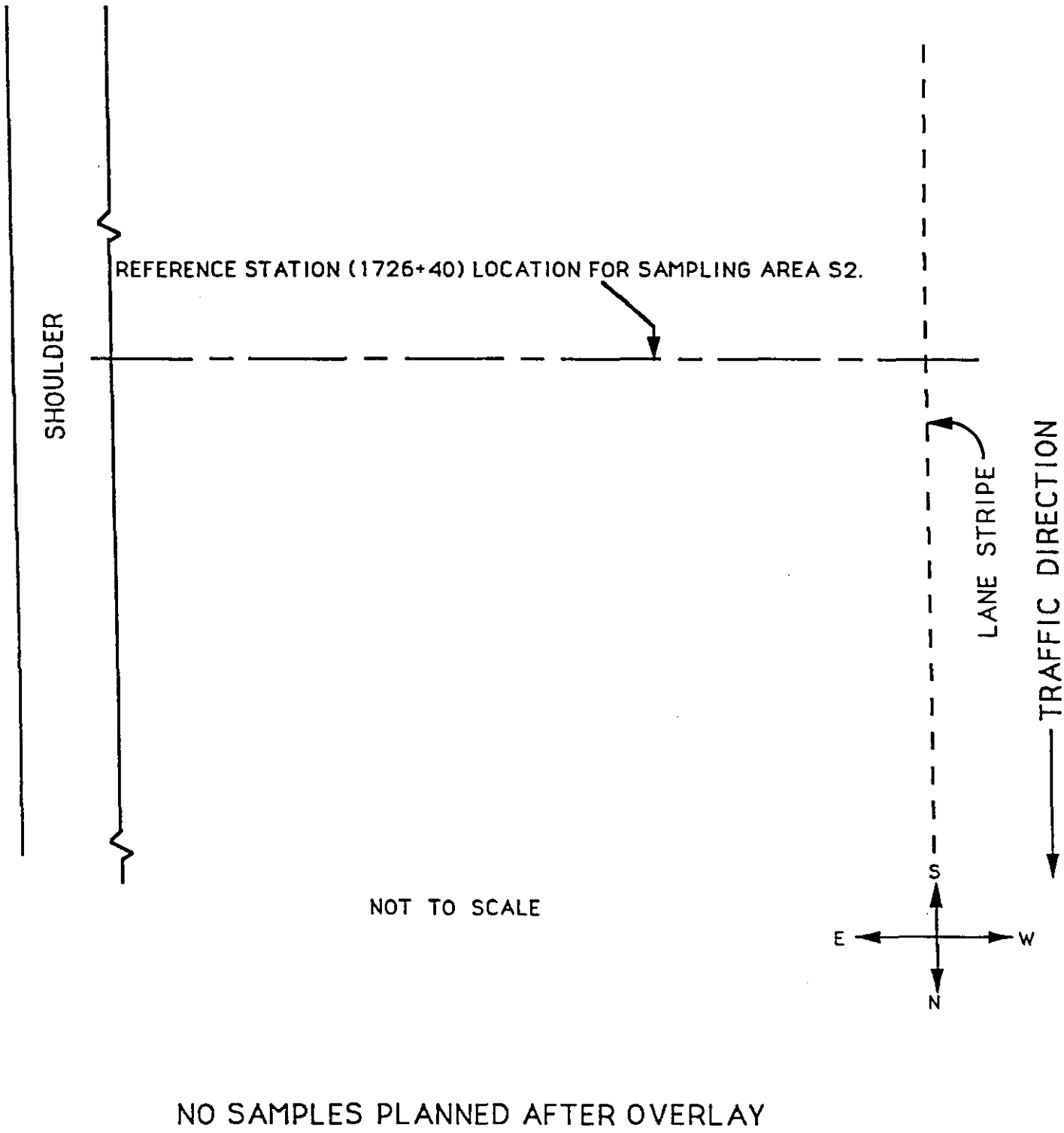
⊘ 12 inch OD core of AC pavement surface, bituminous base, and lime treated soil. Augering and bulk sampling of subgrade to a depth 12 inches below top of untreated subgrade: BA8

Figure A.16. Before overlay sampling plan for station 1813+05 after section 10. Sampling area S15.



NO SAMPLES PLANNED AFTER OVERLAY

Figure A.17. After overlay sampling plan for station1720+80 before section 1. Sampling area S1.



NO SAMPLES PLANNED AFTER OVERLAY

Figure A.18. After overlay sampling plan for station 1726+40 after section 1. Sampling area S2.

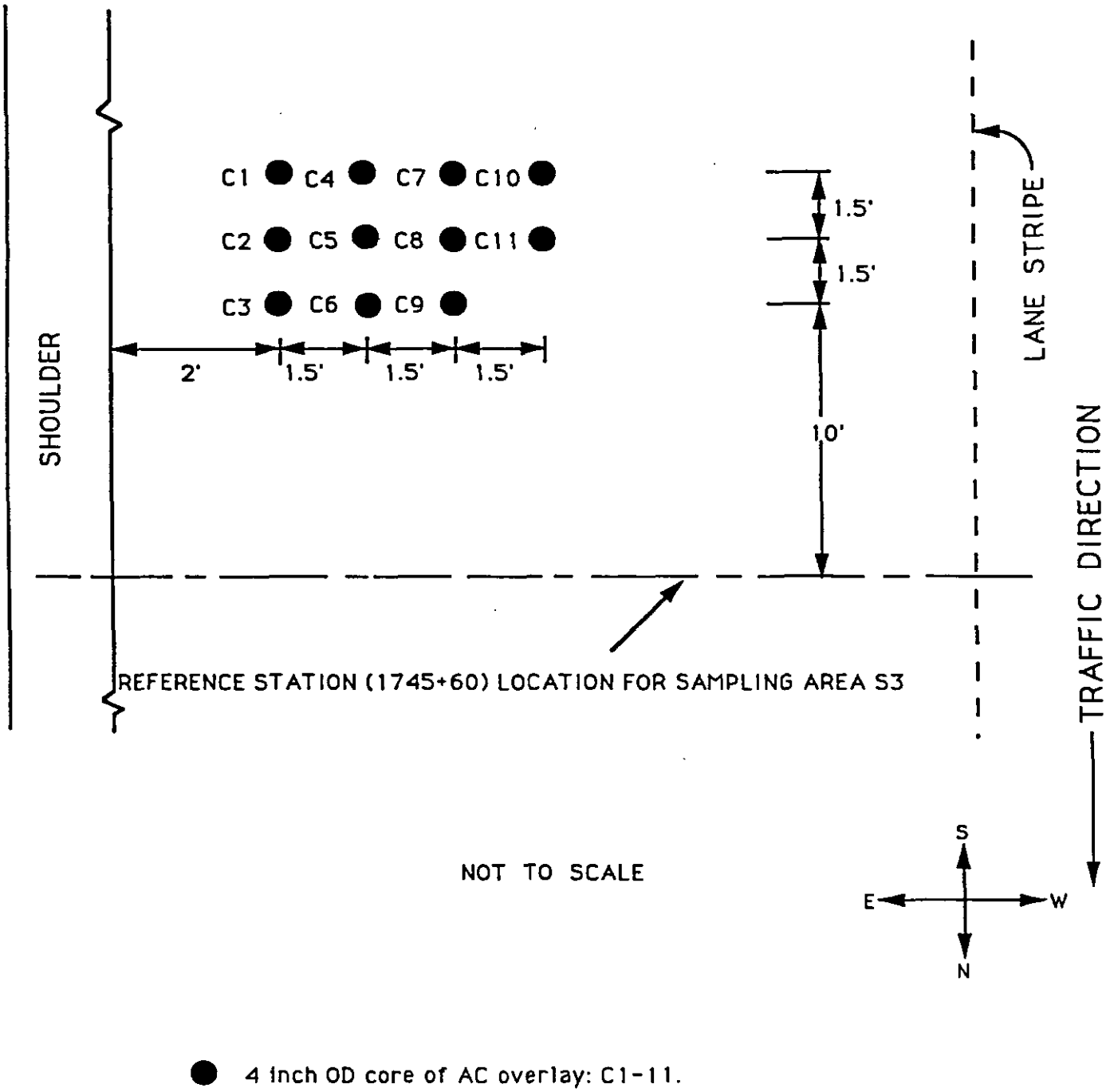


Figure A.19. After overlay sampling plan for station 1745+60 before section 7. Sampling area S3.

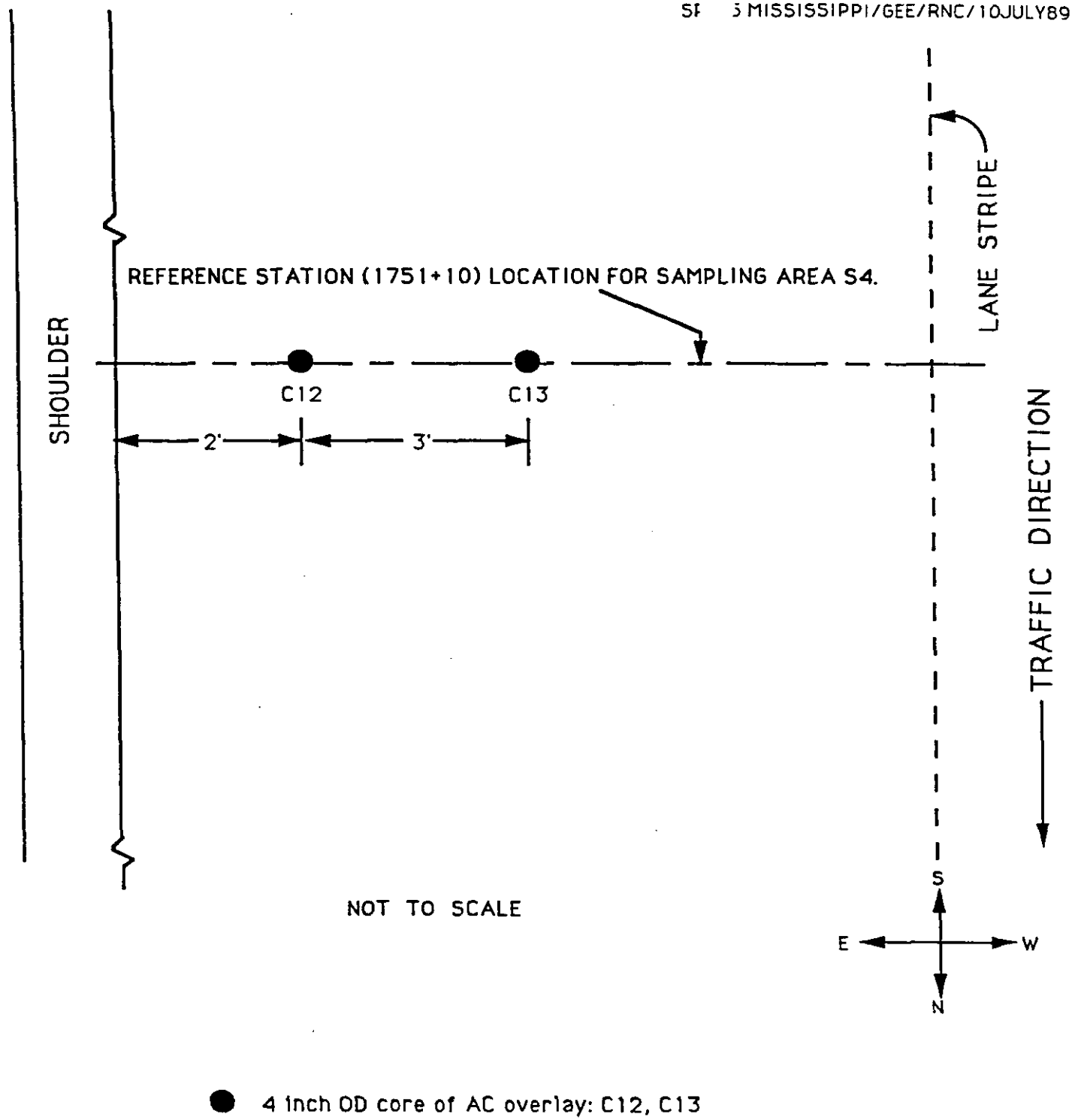


Figure A.20. After overlay sampling plan for station 1751+10 after section 7. Sampling area S4.

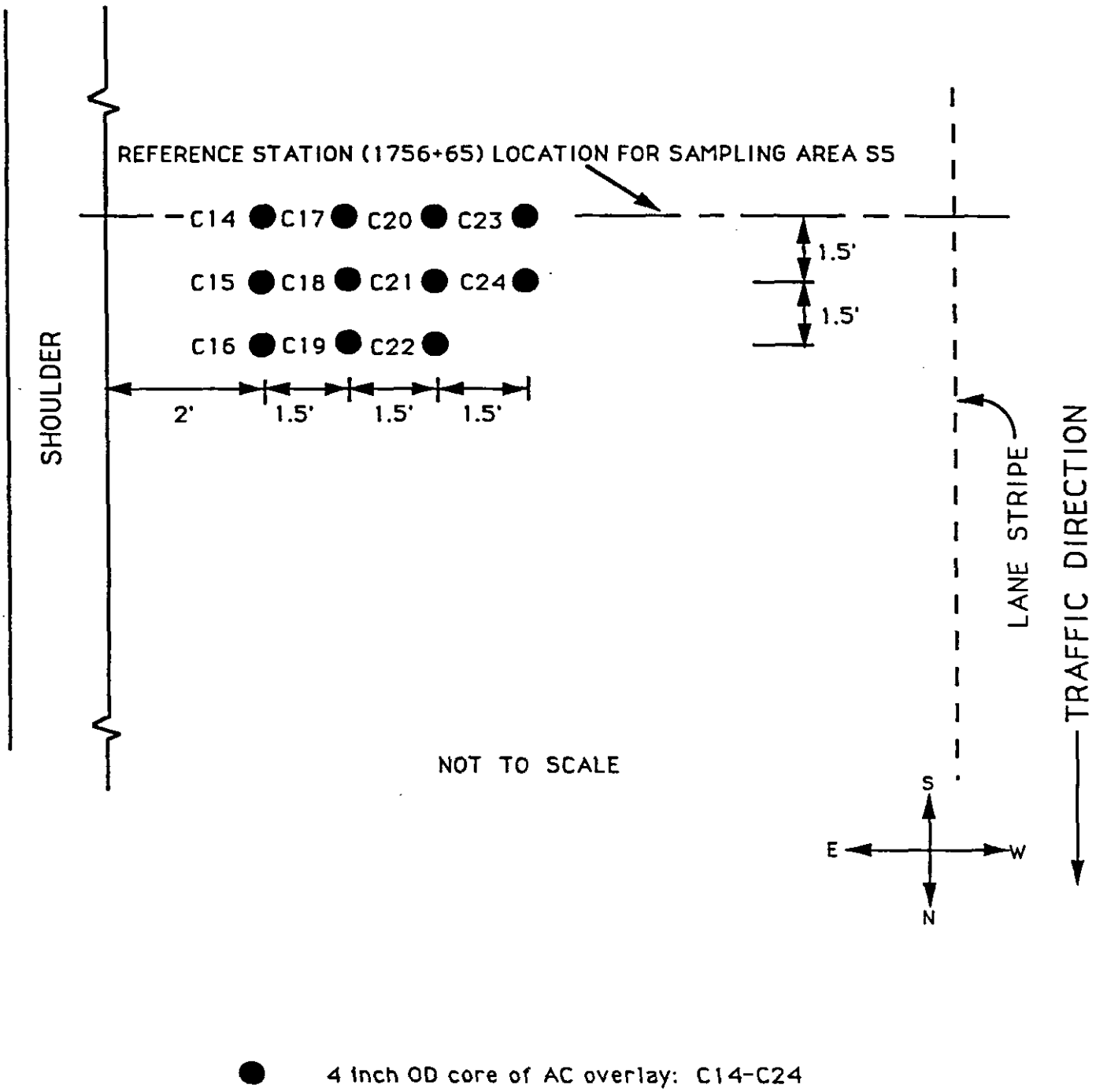


Figure A.21. After overlay sampling plan for station 1756+65 after section 4. Sampling area S5.

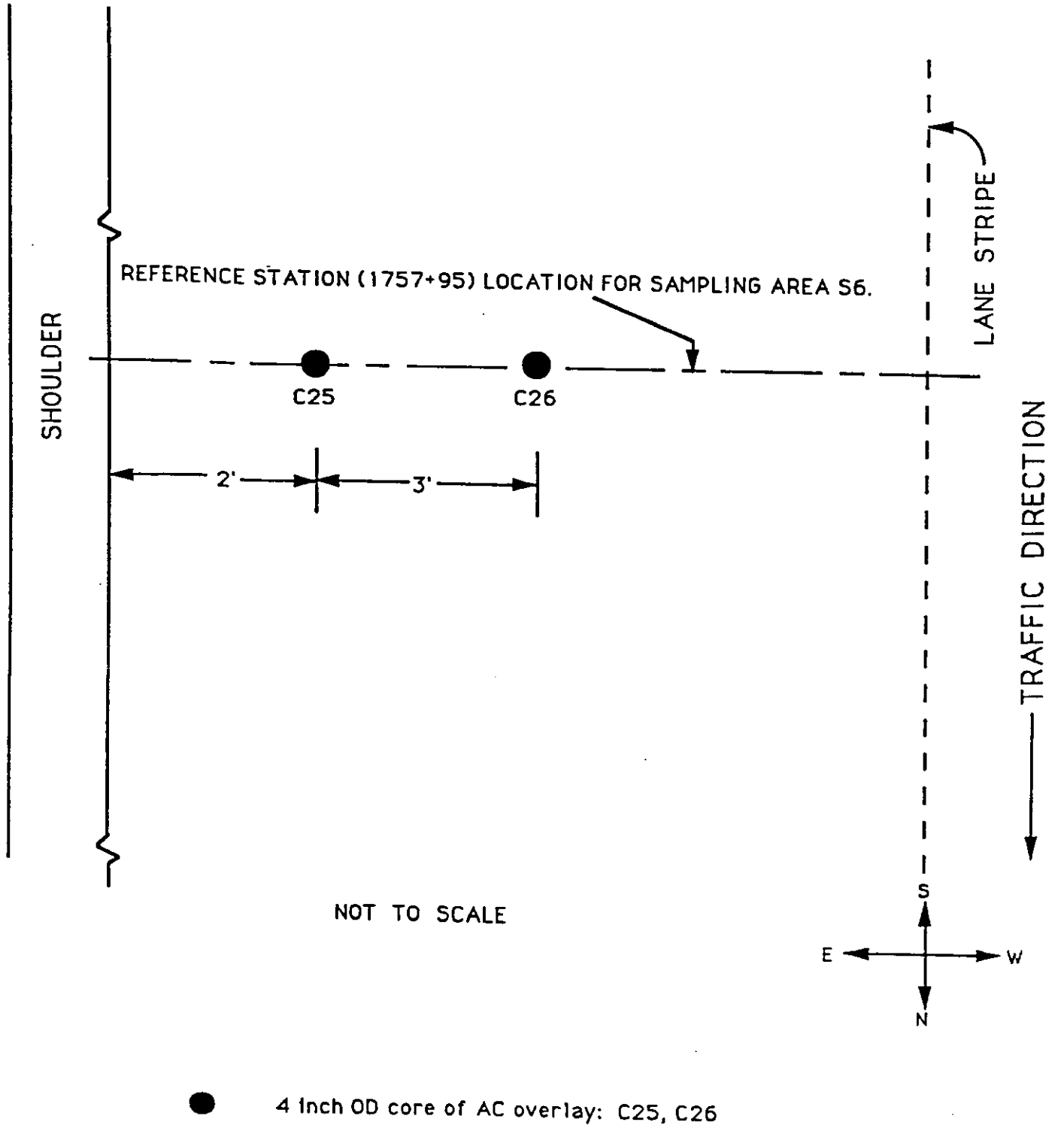


Figure A.22. After overlay sampling plan for station 1757+95 before section 5. Sampling area S6.

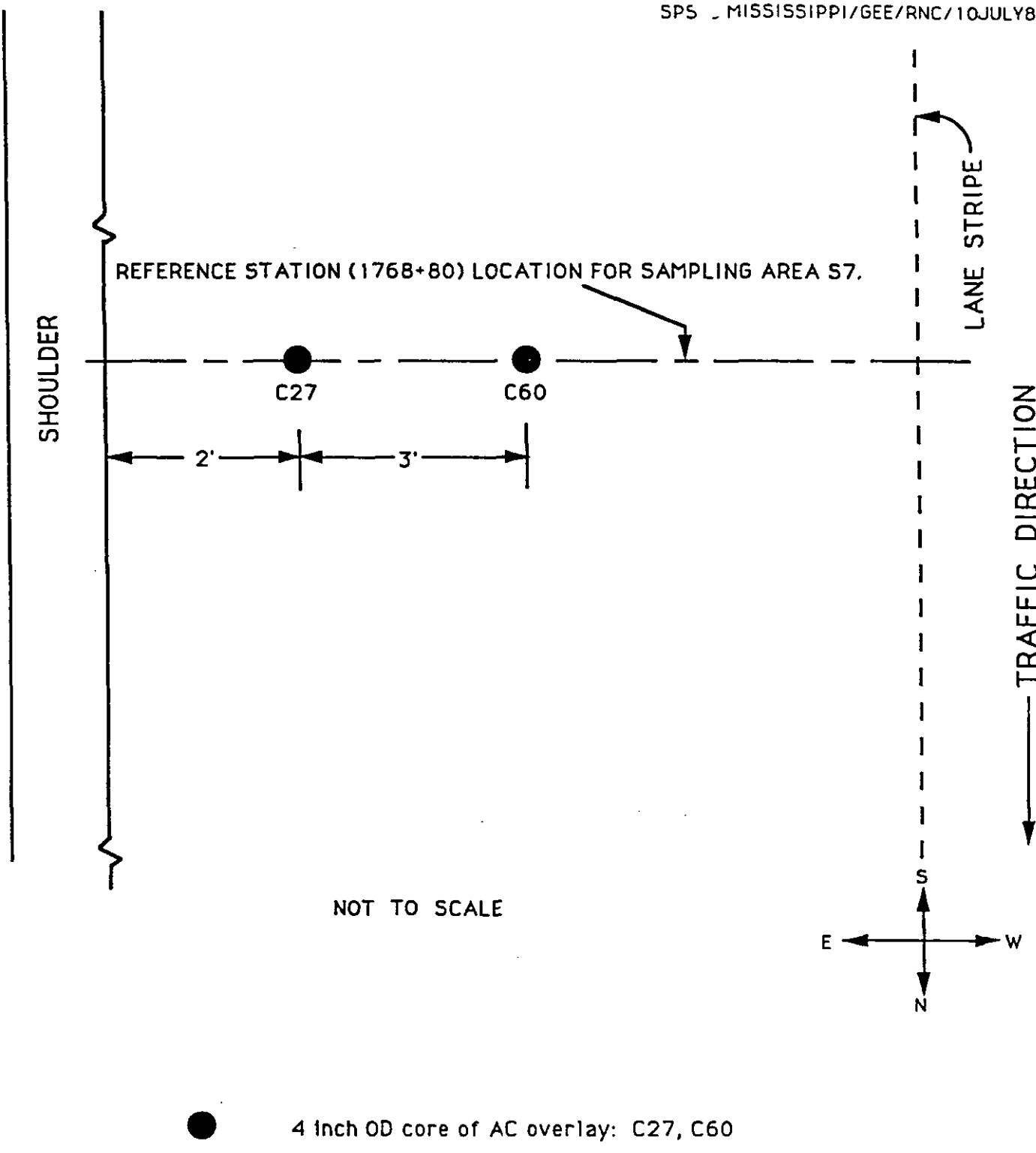


Figure A.23. After overlay sampling plan for station 1768+80 after section 6. Sampling area S7.

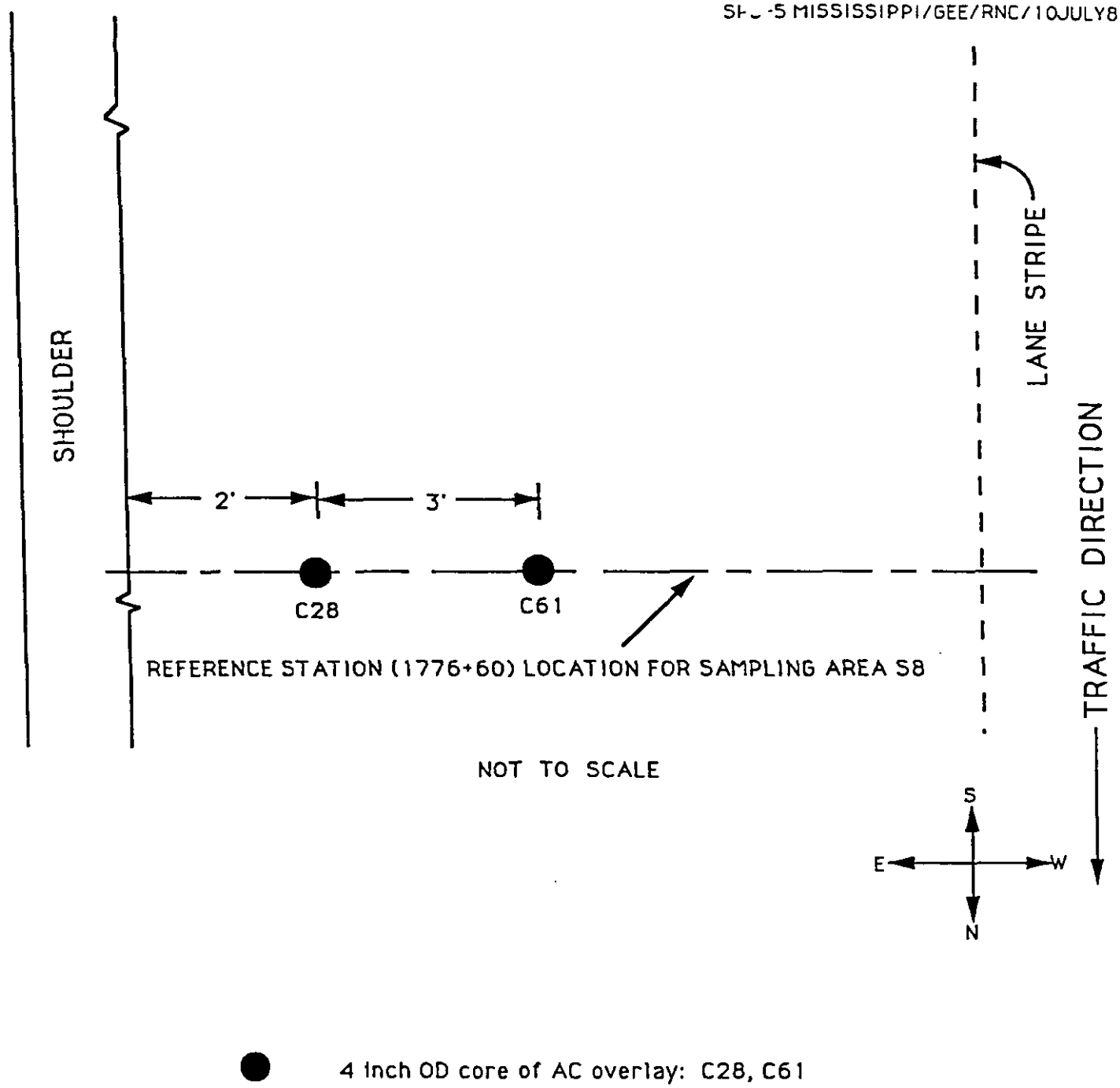


Figure A.24. After overlay sampling plan for station 1776+60 before section 9. Sampling area S8.

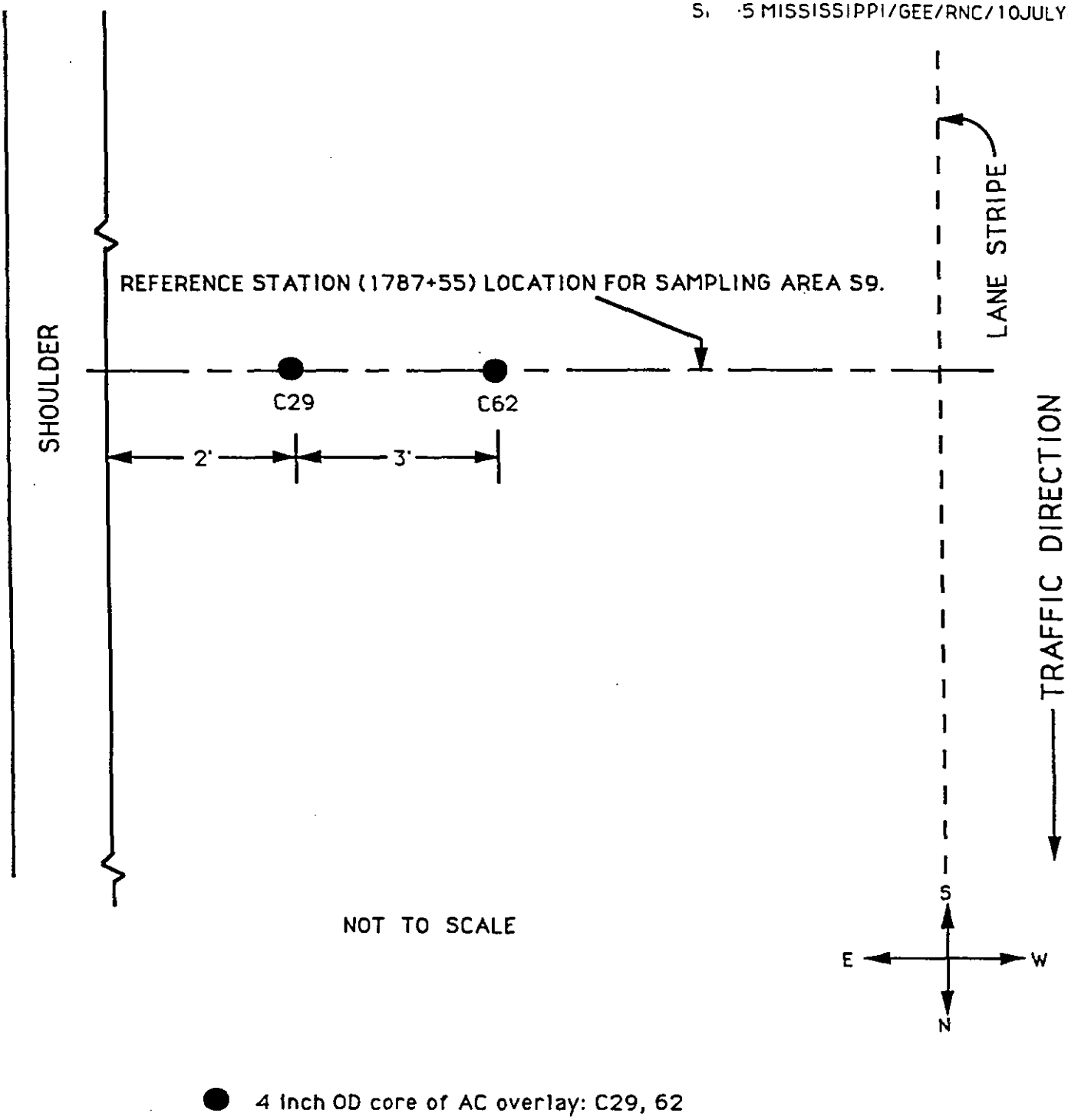
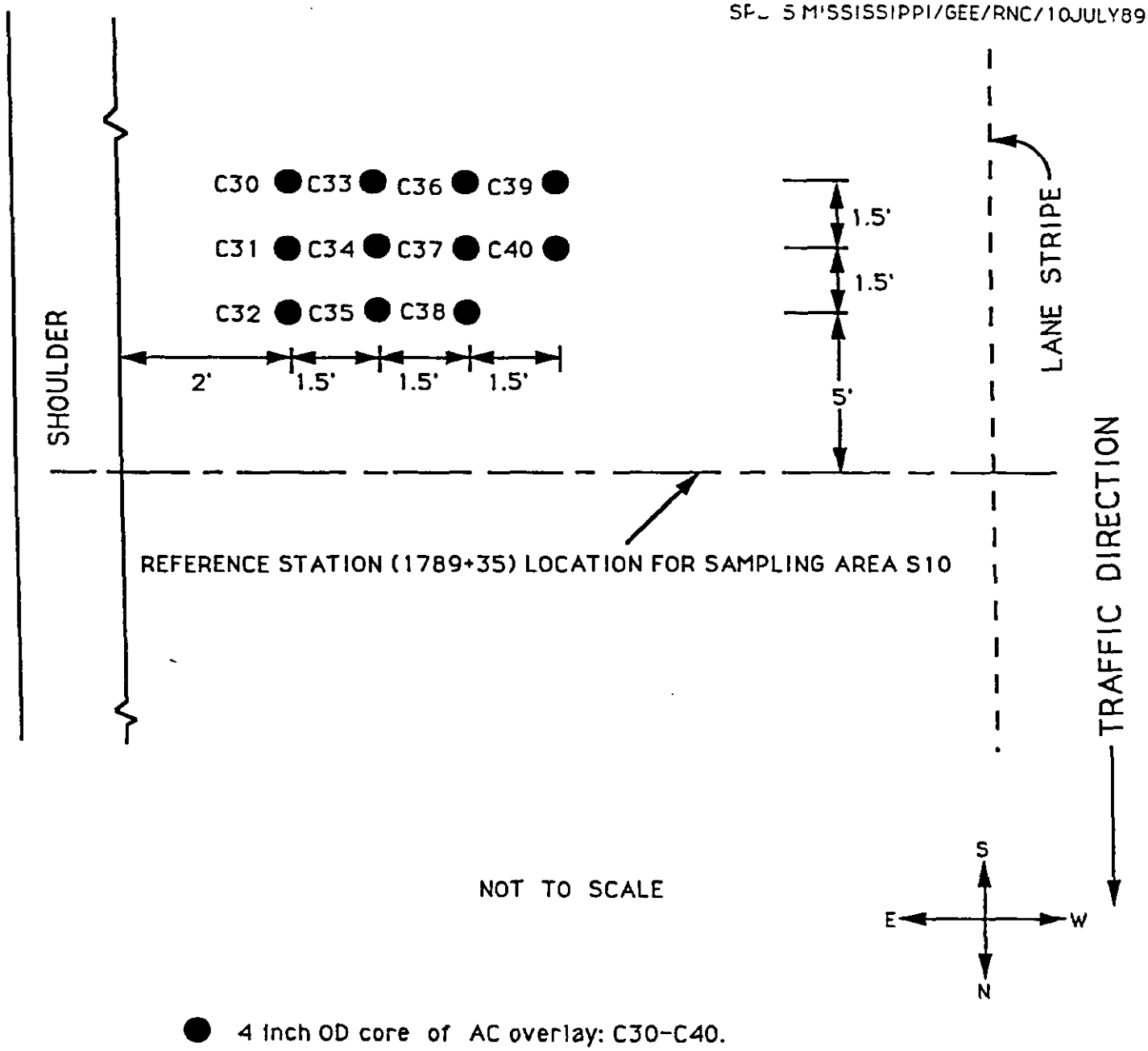


Figure A.25. After overlay sampling plan for station 1787+55 after section 2. Sampling area S9.



gure A.26. After overlay sampling plan for station 1789+35 before sections 3. Sampling area S10.

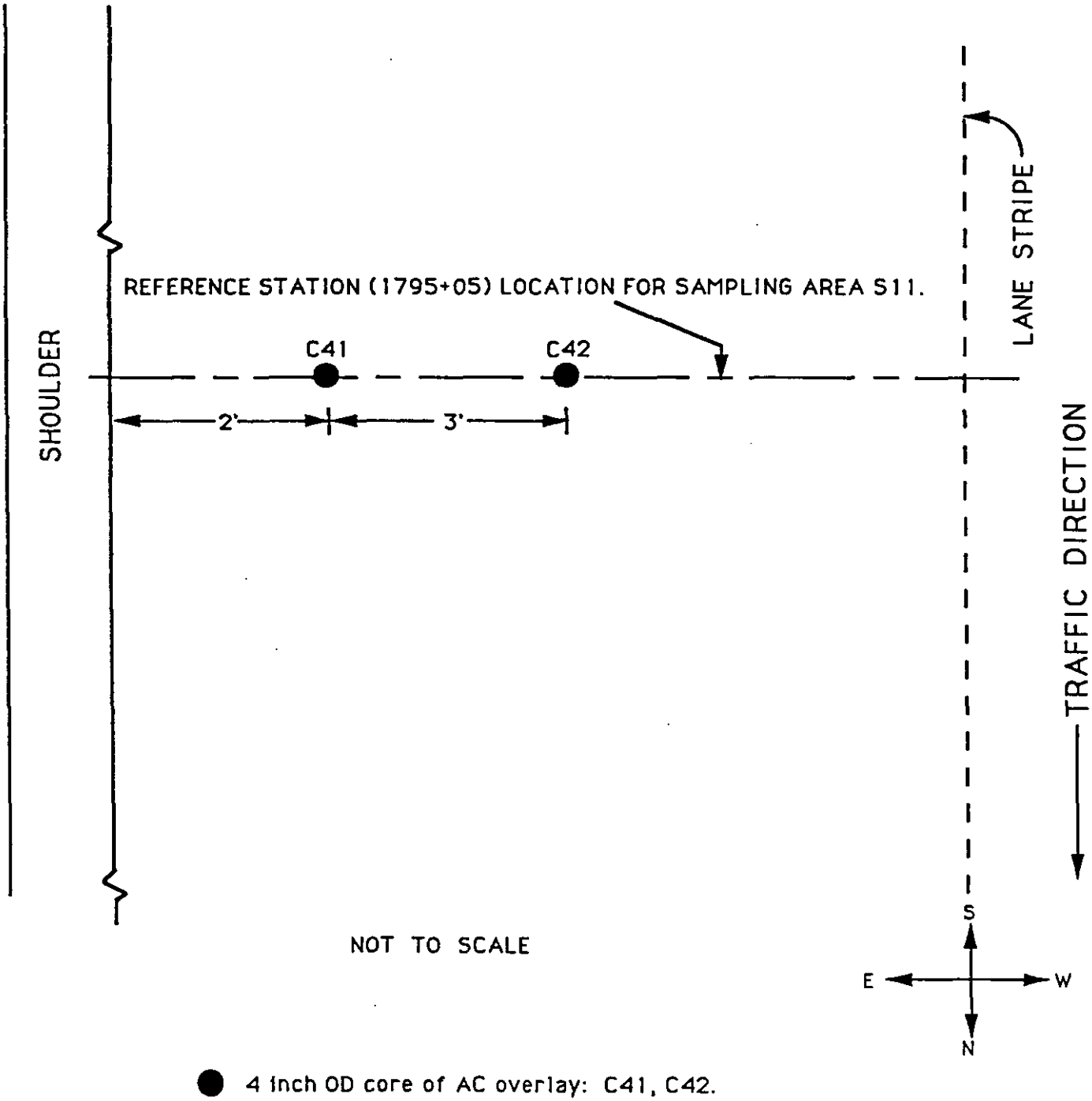


Figure A.27. After overlay sampling plan for station 1795+05 after section 3. Sampling area S11.

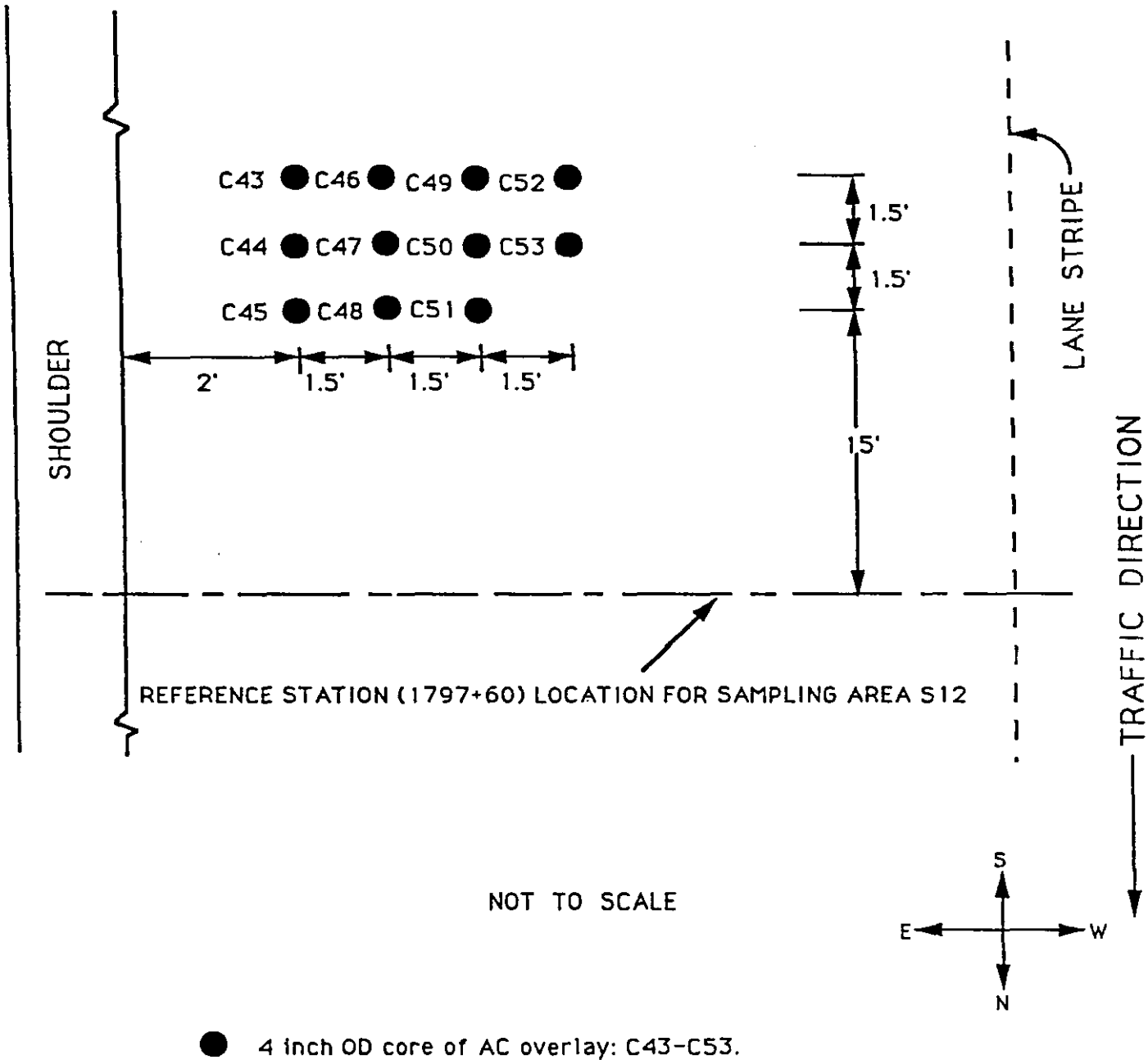


Figure A.28. After overlay sampling plan for station 1797+60 before section 8. Sampling area S12

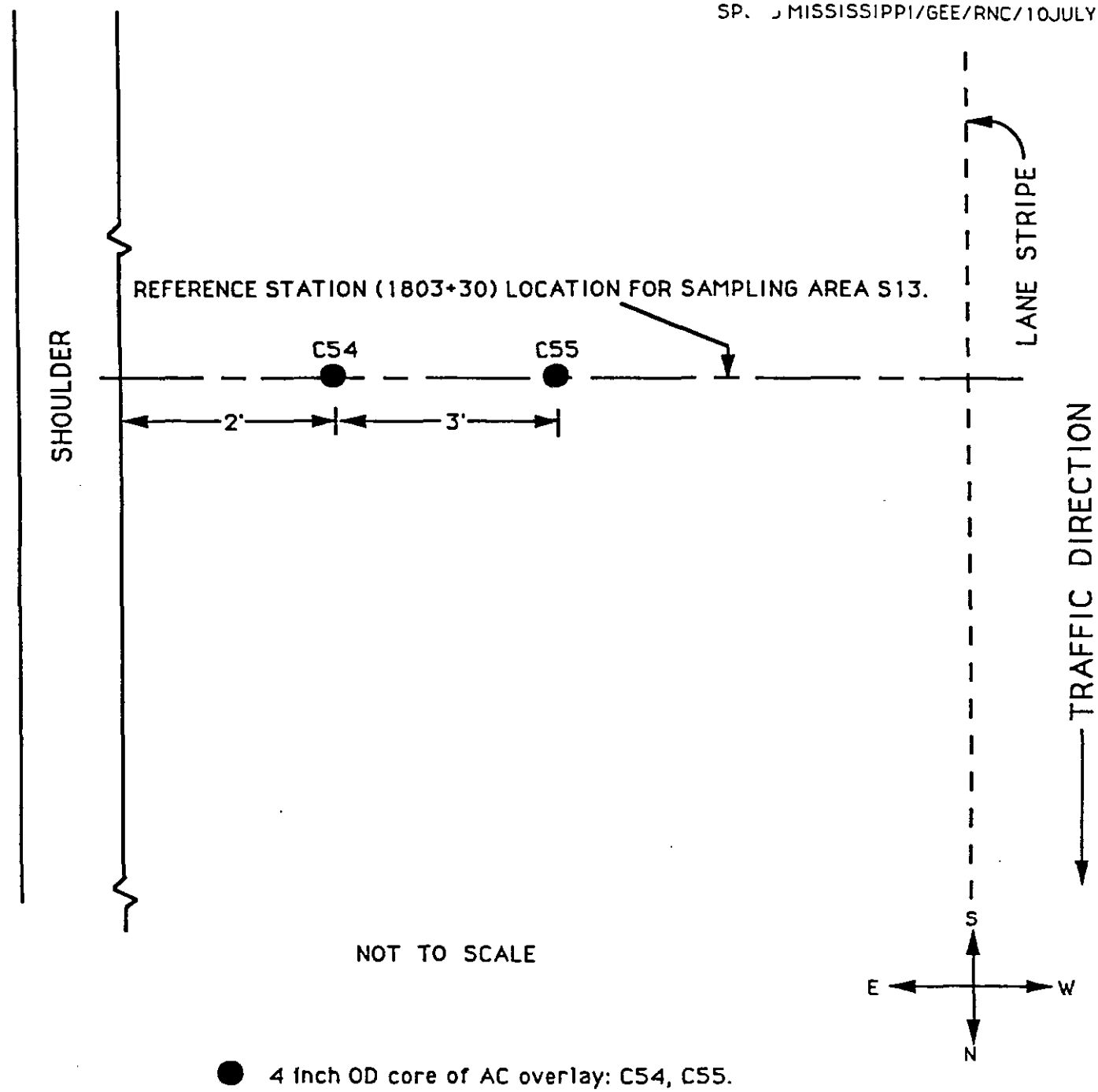


Figure A.29. After overlay sampling plan for station 1803+30 after section 8. Sampling area S13.

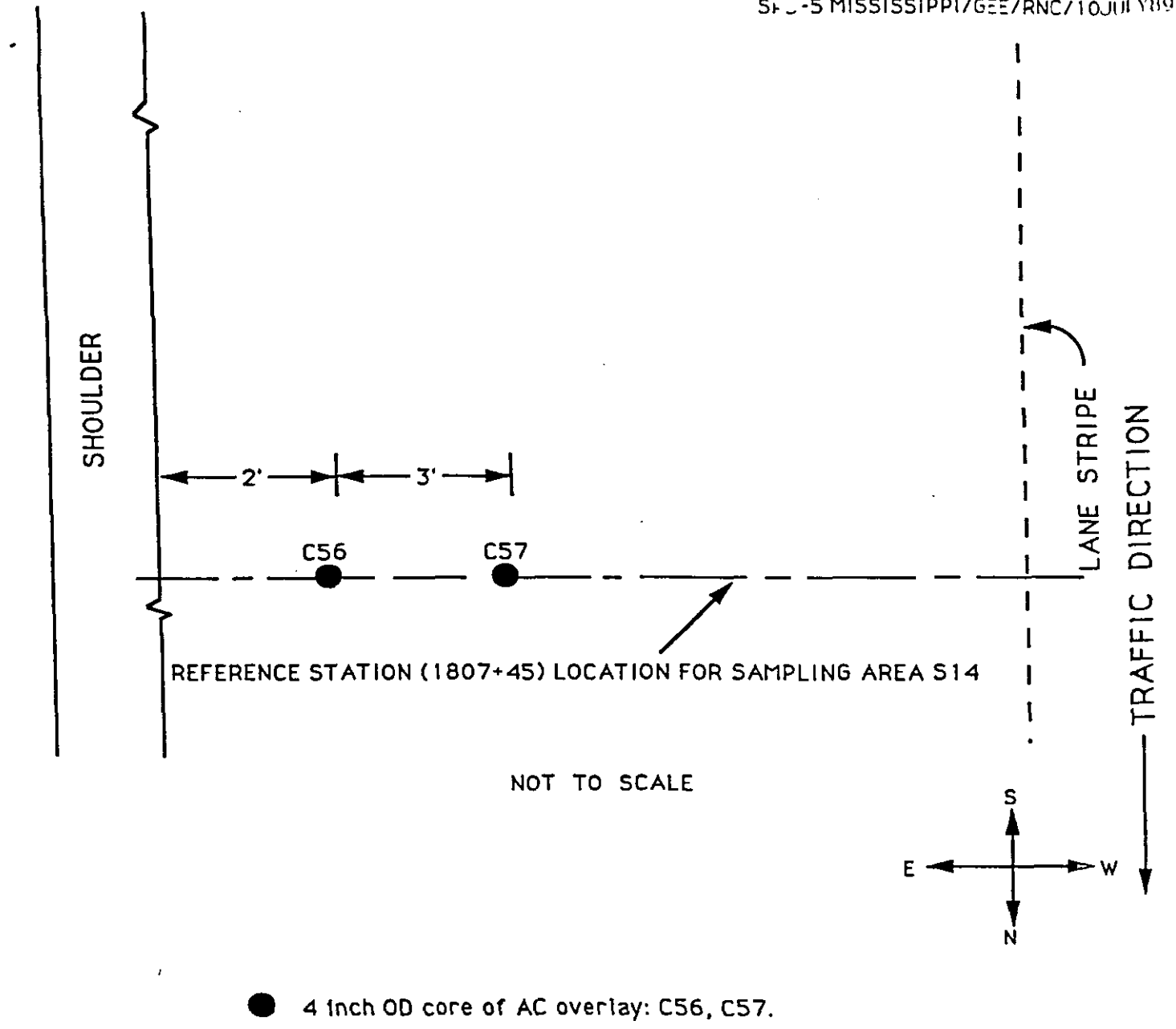


Figure A.30. After overlay sampling plan for station 1807+45 before section 10. Sampling area S14.

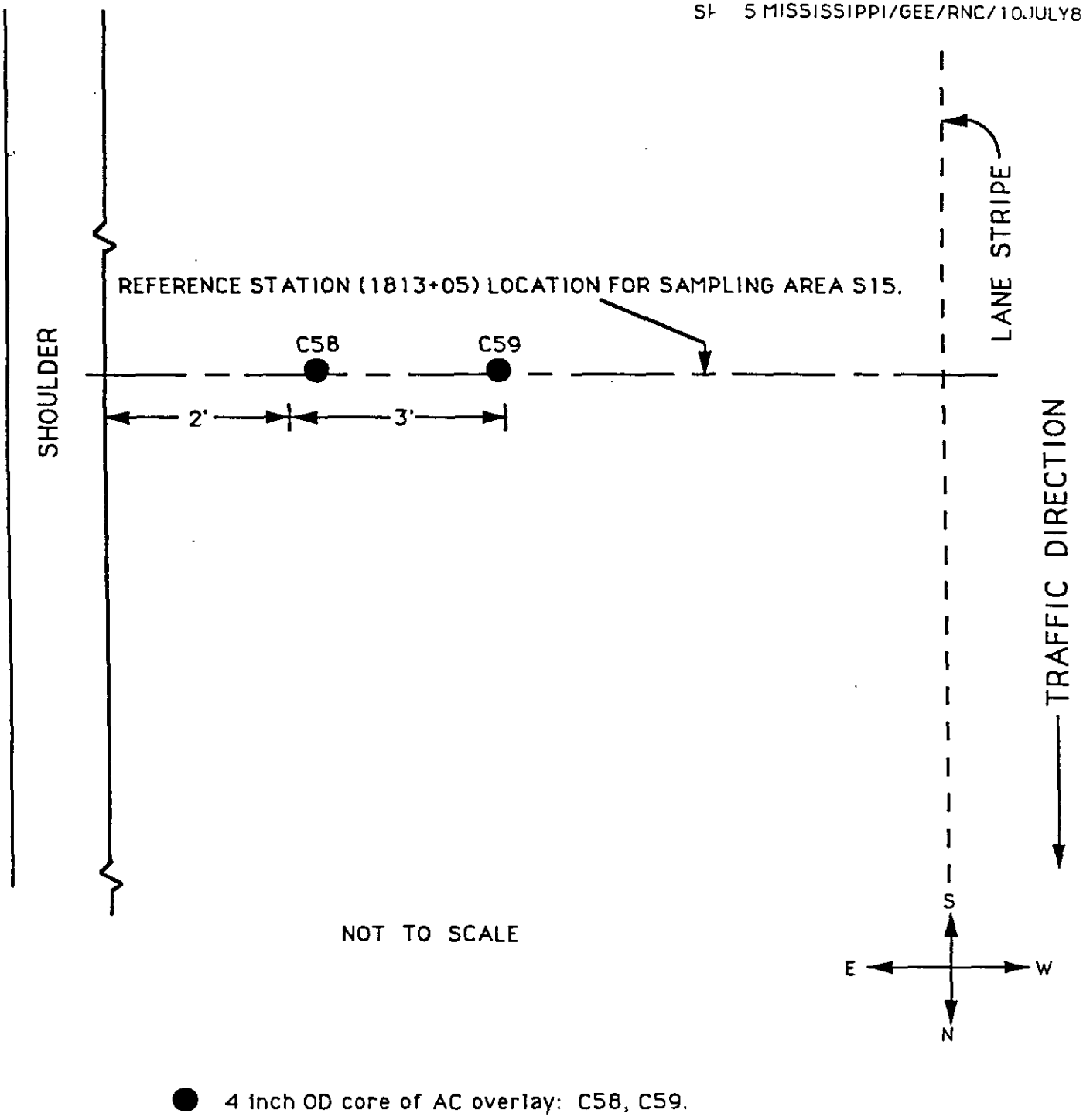


Figure A.31. After overlay sampling plan for station 1813+05 after section 10. Sampling area S15.