

SPS-8 South Dakota Construction Report

**State Highway - 1804
Pollock, South Dakota**

**Sections 460803 and 460804
Supplemental Section 460859**

**Federal Highway Administration
LTPP Division
North Central Region**

Report prepared By:

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June 10, 1996

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*Engineers and Scientists Serving
the Built and Natural Environments®*

June 10, 1996

Mr. Richard Ingberg
Regional Engineer
6875 Washington Avenue South
P.O. Box 39108
Minneapolis, MN 55439-0108

Dear Mr. Ingberg:

Enclosed is the Construction Report for the South Dakota SPS-8 project.

If you have any questions about this report please call Ronald Urbach or Benjamin Worel.

Sincerely,



Ronald R. Urbach, CET



Benjamin J. Worel, PE

Attachment:
Report

c: Mr. Monte Symons, FHWA
Mr. John Miller, PCS/Law
Mr. Cameron Kruse, Braun Intertec

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Experiment SPS-8

The Study of Environmental Effects in the Absence of Heavy Loads

1.0 Introduction

The objective of the SPS-8 experiment is to measure the deterioration and pavement performance related to the environmental effects in the absence of heavy loads. The experiment encompasses both flexible and rigid pavement structures built on conventional nondrained-based materials over three types of subgrade. The factors to be addressed are pavement type, layer thickness and subgrade soil types. The analysis of the information developed from this experiment will provide substantially improved data for validation and improvement of the environmental effects models used in the design of rigid and flexible pavements. One test section will consist of 4 inches of asphaltic concrete over 8 in. of dense-graded aggregate base, and the other will have 7 inches of hot mix asphaltic concrete over 12 inches of dense-graded aggregate base.

The experimental design includes both flexible and rigid test sections. Each test section will contain either two rigid and/or two flexible test sections. The test sections for each pavement type shall be constructed with two different surface course thicknesses on an untreated dense-graded aggregate base.

1.1 Experimental Cell

This SPS-8 experiment in South Dakota is a flexible pavement test section project. It is located in the dry-freeze environmental zone on fine-grained (swelling) subgrade soils.

1.2 Summary of Supplemental Sections

There is one supplemental test section for this project. It consists of the standard construction that was going to be done on that project. The existing asphaltic concrete pavement was ground up and used as a recycled base with a 2-inch asphaltic concrete surface.

1.3 Project Location

The project is located in North Central South Dakota on State Highway 1804. The project is about 1 mile south of the North Dakota border and about 7 miles northwest of Pollock, South Dakota. Highway 1804 is classified as a north/south highway, but the project is located on a portion that runs east/west. Attachment A describes the GPS and SPS projects in South Dakota. Attachment B contains the site location map.

1.4 Type of Roadway

The roadway consists of two lanes with one in each direction (north/south). Attachment C shows the locations of the three sections included in SPS-8. It contains the section number, stationing, WIM location, and culvert locations.

1.5 Traffic Characteristics

The nomination form, supplied by the South Dakota Department of Transportation, indicated the following.

Annual average daily traffic in both directions	73 vehicles
Heavy trucks percent or combinations	4 percent the annual daily average
Estimated 18-kip (80-kn) ESAL rate	14,000 ESALS per year
Total design 18-kip (80-kn) ESALS	28,000
Design period for this reconstruction	20 years

1.6 Known Deviations From Guidelines

The construction of the SPS-8 test sections was started in 1992 and completed in Spring of 1993. This was due to the late letting of the project and an early snow in the fall of 1992. In the fall of 1992 the earthwork and dense-graded base was placed which was tack coated once it was determined the weather would not allow asphalt paving until warmer weather. In the spring of 1993 the asphalt paving was completed. The SPS-8 guidelines state the construction should be done in one construction season. This is also covered in Section 2.0 Project Details.

The project deviation report is included in Attachment D.

1.7 Geometry

The area where the test sections are placed is relatively flat with a farm field approach located between two of the test sections.

1.8 Underground Structures Within Test Sections

Between test sections 460803 and 460804, there are three culverts under the roadway. The culverts are 50 feet after test section 460803 and 150 feet before test section 460804. There is also a culvert located approximately 100 feet after test section 460859. All the culverts are located in the transition between or after the test section.

1.9 Installation of Weather Station

The weather station installation has been put on hold until July 1996. The concrete foundations and chainlink fence were installed by the agency in 1995. The weather station equipment will be located near section 460804 in the right-of-way on the south side of the highway.

1.10 WIM Installations

The WIM was installed between test sections 460804 and 460859. The piezo-tube equipment was manufactured by:

APT Equipment Corporation
1665 Orchard Drive
Chambersburg, PN 17201
Phone: (717) 263-7655
Contact: Siegfried Gassner

The WIM equipment installed was a Model DAW100 system.

1.11 Schedule for Opening to Traffic

Due to the low volume of traffic on this roadway, there was no need for permanent lane closures or detours during construction in 1992 or 1993. Flagpersons were used to slow down and inform traffic of the construction. In 1993, when the paving was completed, flagpersons were also used to route traffic around the paving operation until the pavement had been placed and compacted.

1.12 General Problems

No construction-related problems were found.

1.13 Resident Engineer Information

The overall coordination of the project was handled by the Materials and Research Section of the South Dakota Department of Transportation.

Mr. Daniel Strand
Mr. David Huft

South Dakota Department of Transportation
700 Broadway Avenue East
Pierre, SD 57501-2586
Phone: (605) 773-3292
Fax: (605) 773-3921

The project field coordination was handled by the South Dakota Department of Transportation, Mobridge office.

Mr. Kelly Armfield
Mr. John Vilbrandt

South Dakota Department of Transportation
P.O. Box 488
West Highway 12
Mobridge, SD 57601-0488
(605) 845-3844

The SHRP/LTPP Regional Engineer.

Richard C. Ingberg

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6875 Washington Avenue South
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LTPP North Central Regional Office Representatives

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Eugene Skok, Jr., Ph.D.
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1.14 Materials Sampling and Testing

The field sampling and testing plan included in Attachment E was produced by Braun Intertec. The actual field sampling and testing was done by personnel and coordinated by Mr. John Vilbrandt from the South Dakota DOT Mobridge office. No deviations or problems were disclosed.

The field samples taken during and after construction were sent to the North Central Regional Testing Laboratory and the materials reference library (MRL).

The North Central Regional samples were sent to Braun Intertec in Minneapolis, Minnesota. The samples sent were:

Asphalt Core Samples
Bulk Asphalt Mix Samples
Bulk Granular Base, Recycled Base, and Subgrade Materials
Moisture Samples for the Base and Subgrade Materials

The MRL samples were sent to the MRL storage facility in Austin, Texas.

Two 55-gallon barrels of the aggregate used for the asphaltic concrete.
Six five-gallon pails of the asphaltic concrete cement used.
Two five-gallon pails of the asphaltic concrete mix.

1.15 Contractor Information

The general contractor for the project was:

Border States, Incorporated
P.O. Box 3162
Fargo, ND 58013
(701) 237-4860
Dayna Fredrickson, Project Foreman

1.16 Key Construction Equipment

The following equipment is known to have been used on the construction of the SPS-8 South Dakota test sections.

Soil Compaction

- Sheepsfoot roller trailer
- Pneumatic roller trailer
- Double-Drum vibratory roller
- Self-propelled pneumatic roller

Tack Coat

- Tackcoat truck

Asphalt Plant

- General Steel - Model DDR-400 "Drum Plant"

Asphalt Paver

- Blawknox - Model PF-200 Paver

Asphalt Compaction

- Dynapac CC50A - Double-drum breakdown roller
- Rex SP-910B - Single-steel drum final roller

2.0 Project Details

The original asphalt pavement consisted of a 1½ inch asphalt layer with 5 inches of lime-treated base placed on the fine-grained subgrade.

The project specifications consisted of breaking up the existing pavement to a maximum nominal particle size of 1½ inches. The roadway was then shaped to get the profile required. Two inches of Class E asphaltic concrete hot mix was placed to complete the new roadway. This procedure was used for test section 460859 (state control) and the rest of the state's construction project from the North Dakota border to the city of Pollock, South Dakota.

Test sections 460803 and 460804 required widening the shoulders to give a 12-foot paved width and a 4-foot outside shoulder. Prior to placing the material to widen the roadway, the existing pavement and the base materials were removed. Additional subgrade soils were removed or replaced with borrow material to obtain the required grades. As the fill material was placed, it was compacted with sheepsfoot and pneumatic rollers. After the subgrade material had been compacted and shaped to the required elevations, the dense-graded aggregate base was placed. This dense-graded aggregate base was placed and compacted with double-drum vibratory roller and self-propelled pneumatic rollers. The dense-graded aggregate base was placed in maximum thicknesses of 4 inches.

Because of poor fall weather conditions, the asphalt concrete layer was not placed in 1992 on any of the test sections including the rest of the state's project. In the fall of 1992, the dense-graded

aggregate base material was completed and sealed with a tack coat to help hold this material in place and limit the amount of moisture that could enter the base and subgrade.

In the spring of 1993, it was determined that the tack coat placed in the fall of 1992 did a very good job of holding the base material and limiting the amount of moisture going into the base material. In checking the grade, they found that the only areas that required a minimal amount of additional fill would be in the transition areas and would not effect the three test sections.

Test section 460803 required 4 inches of asphaltic concrete pavement. It was placed in two lifts (2 inches plus 2 inches).

Test section 460804 required 7 inches of asphalt concrete pavement. It was placed in three lifts (3 inches plus 2 inches plus 2 inches).

Test section 460859 required 2 inches of asphalt concrete pavement. It was placed in one 2-inch lift.

The asphalt plant was approximately 4 miles east of Pollock, South Dakota, approximately 20 miles east of the project. The asphaltic concrete mix was produced in a plant manufactured by General Steel, Model DDS-400. This plant is a drum-style plant, which has a capacity of approximately 400 tons per hour. After the asphaltic concrete was brought to the site, it was placed with a Blawknex Model PF-200 Paver. It was paved in a 12-foot width.

A double drum Dynapac CC50A breakdown roller was used. The final rolling was done using a Rex SP-910B single drum steel roller.

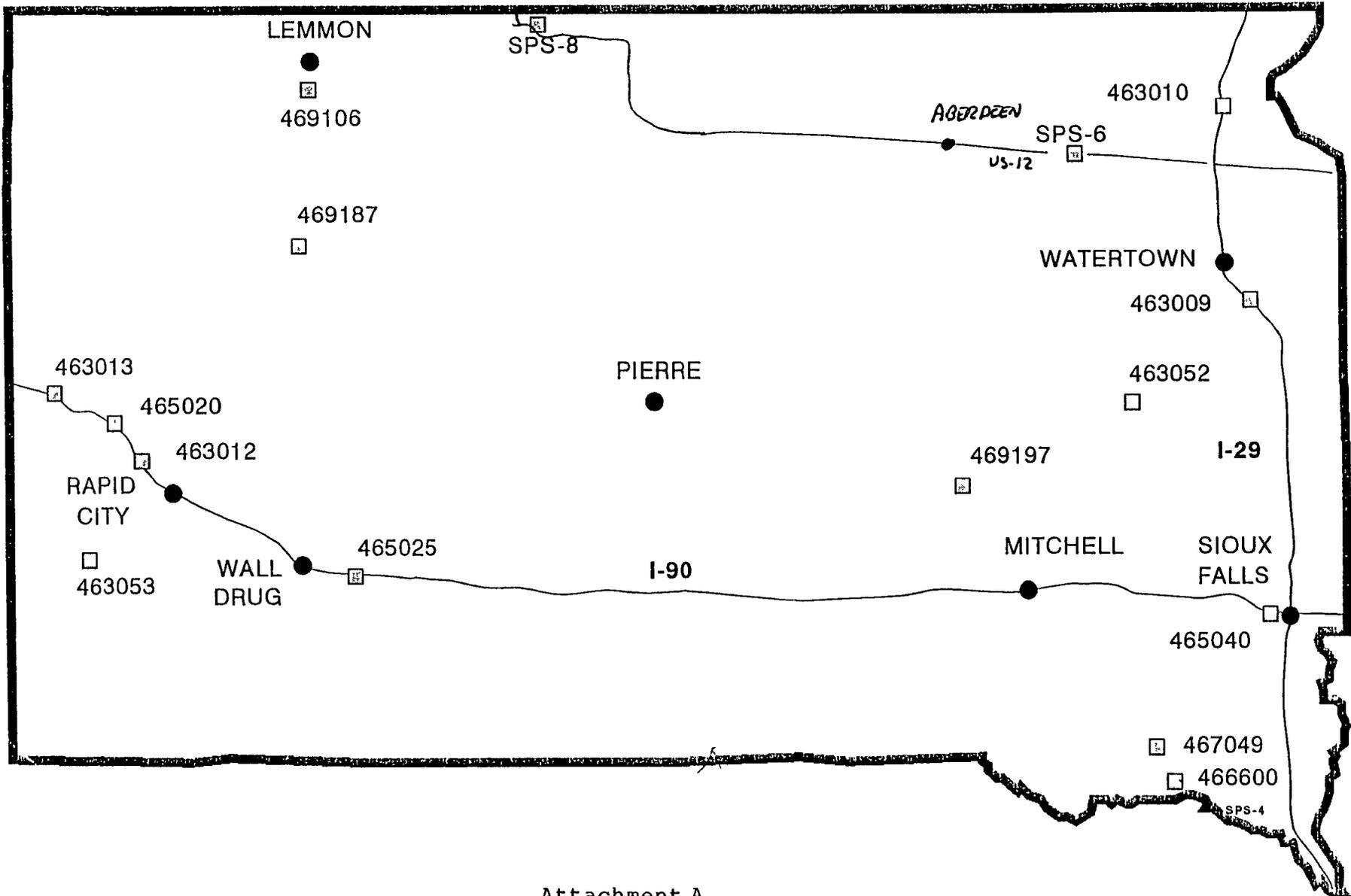
Attachment E is a copy of the plans and specifications for the cross section of the existing pavement and also the transition between test sections.

3.0 Initial Performance

The test sections have been performing as expected. Monitoring has not shown anything out of the ordinary. Section 460859 has been found to produce large deflections during FWD testing but still is performing well.

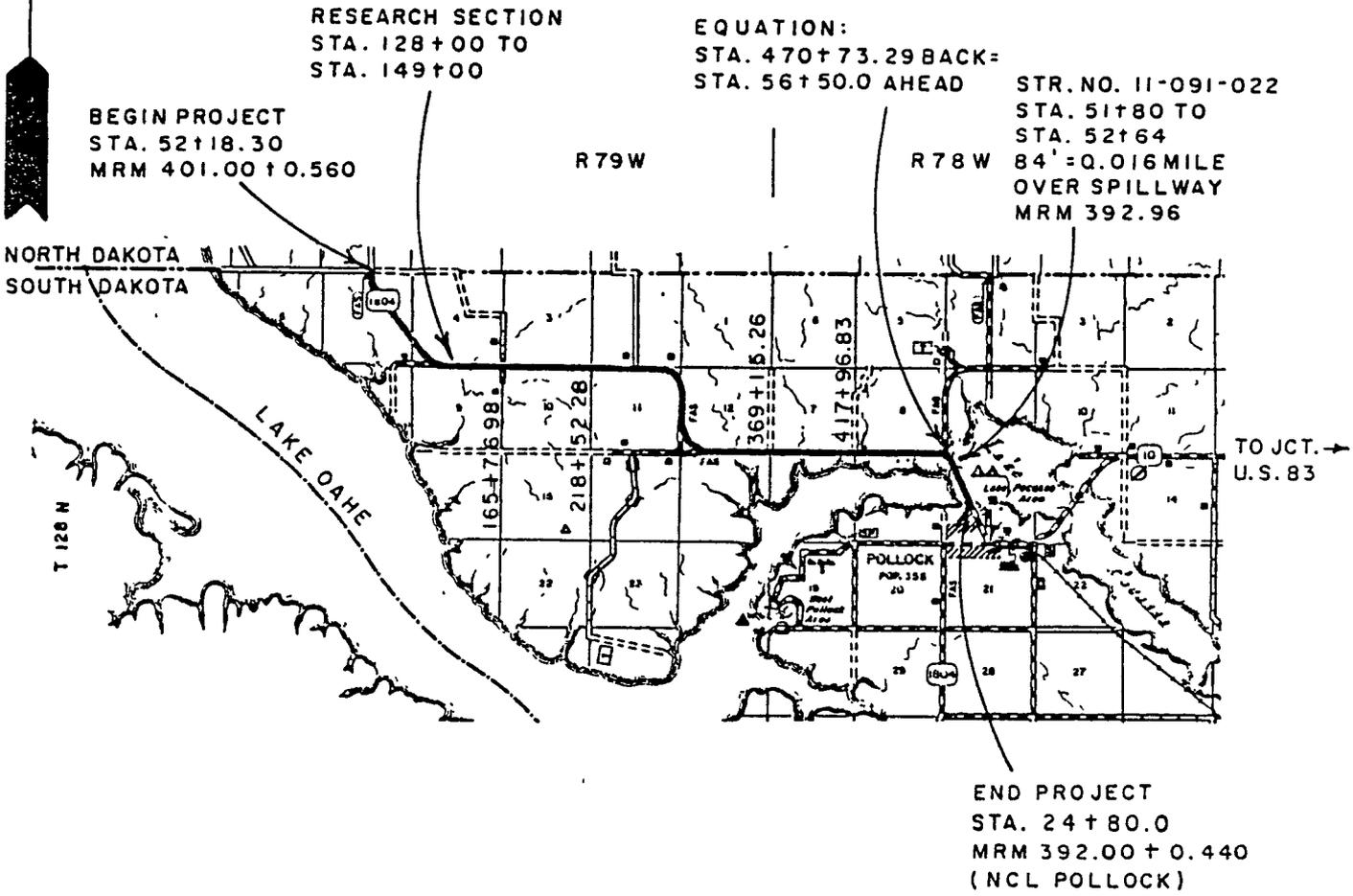
Test section 460804 is also a seasonal instrumentation project. The seasonal instrumentation equipment was installed in July, 1994. The seasonal monitoring was performed on this test section for fall 1994, through fall 1995. It is planned that the monitoring will be every other year for the next ten years.

LTPP TEST SITE LOCATIONS SOUTH DAKOTA GENERAL PAVEMENT STUDIES



Attachment B
Site Location

RS 3804(33)392
 CAMPBELL COUNTY
 PROCESS IN PLACE SURFACING
 AND ASPHALT CONCRETE SURFACING
 LENGTH: 8.527 MILES
 PCEMS. NO. 3714



SCALE 1/2" = 1 MILE

Attachment C
Test Section Layout

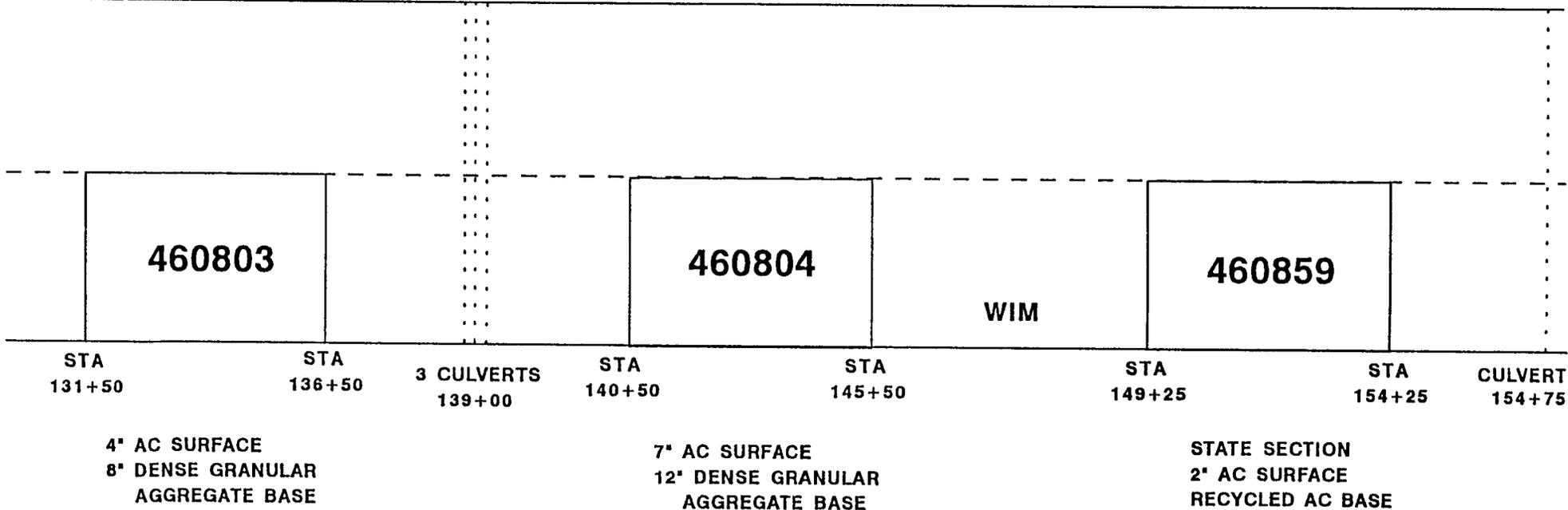
SPS - 8
POLLOCK, SOUTH DAKOTA
ST-1804 -- SOUTHBOUND LANE

JUNE 1993



<---
 1 MILE TO
 NORTH DAKOTA

--->
 TO POLLOCK
 SOUTH DAKOTA



NOTE: FHWA HAS CHANGED THE SECTION NUMBERING TO THE FOLLOWING TO KEEP THE SPS-8 SECTIONS CONSISTENT WITH OTHERS IN THE STUDY.

460801 NOW 460803
 460802 NOW 460804
 460803 NOW 460859

Attachment D
Project Deviation Report

LTPP SPS-8 Project Deviation Report Project Summary Sheet	State Code	4	6
	Project Code	0	8

Project Classification Information	
SPS Experiment Number: SPS-8	State or Province: South Dakota
LTPP Region:	<input type="checkbox"/> North Atlantic <input checked="" type="checkbox"/> North Central <input type="checkbox"/> Southern <input type="checkbox"/> Western
Climate Zone:	<input checked="" type="checkbox"/> Dry-Freeze <input type="checkbox"/> Dry-No Freeze <input type="checkbox"/> Wet-Freeze <input type="checkbox"/> Wet-No Freeze
Subgrade Classification:	<input checked="" type="checkbox"/> Fine Grain <input type="checkbox"/> Coarse Grain <input type="checkbox"/> Active (SPS-8 Only)
Project Experiment Classification Designation (SPS 1, 2 and 8): Sections 3 and 4	
Construction Start Date: September 1992	Construction End Date: May 1993
FHWA Incentive Funds Provided to Agency for this Project: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	

Deviation Summary	
Site Location Deviations:	<input type="checkbox"/> No Deviations <input checked="" type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations
Construction Deviations:	<input type="checkbox"/> No Deviations <input checked="" type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations

Data Collection and Processing Status Summary	
Inventory Data (SPS 5,6,7,9): Not Applicable	<input type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available
Materials Data:	<input checked="" type="checkbox"/> All Scheduled Samples Obtained and Tested <input type="checkbox"/> Incomplete
Construction Data:	<input checked="" type="checkbox"/> All Required Data Obtained <input type="checkbox"/> Incomplete/Missing Data Elements
Historical Traffic Data: Not Applicable	<input type="checkbox"/> All Required Historical Estimates Submitted (SPS 5,6,7,9) <input type="checkbox"/> Required Estimates Not Submitted
Traffic Monitoring Equipment: Site Related	<input type="checkbox"/> WIM Installed On-Site <input checked="" type="checkbox"/> AVC Installed On-Site <input type="checkbox"/> ATR Installed On-Site <input type="checkbox"/> No Equipment Installed
Traffic Monitoring:	<input type="checkbox"/> Preferred <input type="checkbox"/> Continuous <input checked="" type="checkbox"/> Minimum <input type="checkbox"/> Below Minimum <input type="checkbox"/> Site Related
Traffic Monitoring Data:	<input checked="" type="checkbox"/> Monitoring Data Submitted <input type="checkbox"/> No Monitoring Data Submitted
FWD Measurements:	<input checked="" type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed
Profile Measurements:	<input type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Post-Construction Tests Performed
Distress Measurements:	<input type="checkbox"/> Preconstruction Tests Performed <input checked="" type="checkbox"/> Post-Construction Tests Performed
Maint. & Rehab. Data:	<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available
Friction Data:	<input checked="" type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input type="checkbox"/> Data Not Available

Report Status	
Materials Sampling and Test Plan:	<input checked="" type="checkbox"/> Document Prepared <input type="checkbox"/> Final Submitted to FHWA
Construction Report:	<input checked="" type="checkbox"/> Document Prepared <input type="checkbox"/> Final Submitted to FHWA
AWS: (SPS 1, 2, & 8) None	<input type="checkbox"/> AWS Installed <input type="checkbox"/> AWS Installation Report Submitted to FHWA

Attachment E
Sampling and Testing Plan

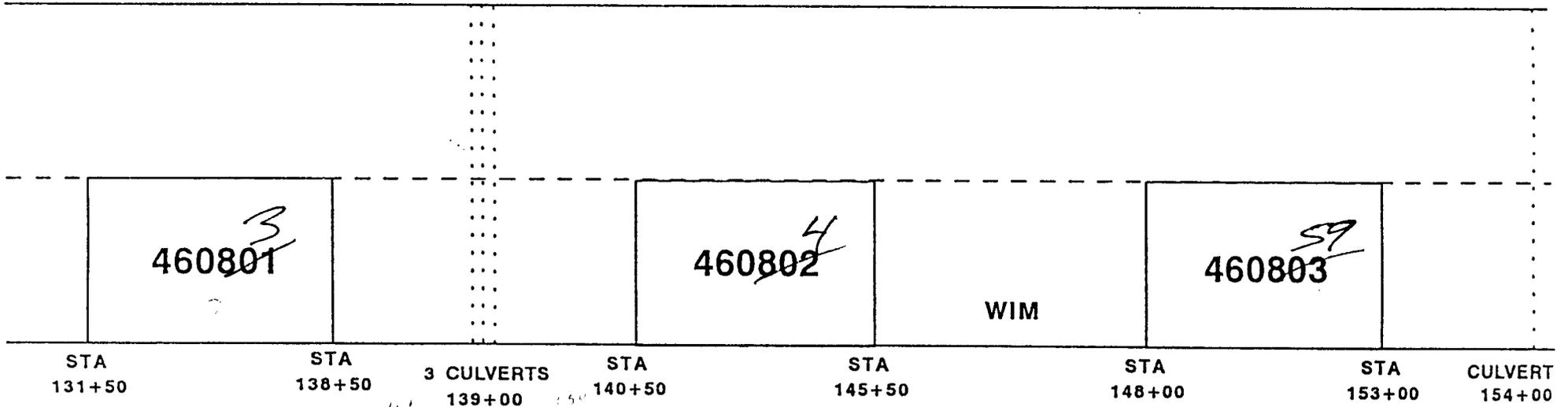
SPS - 8
POLLOCK, SOUTH DAKOTA
ST-1804 -- SOUTHBOUND LANE

SEPT 1992



<---
 1 MILE TO
 NORTH DAKOTA

--->
 TO POLLOCK
 SOUTH DAKOTA



4" AC SURFACE
 8" DENSE GRANULAR
 AGGREGATE BASE

7" AC SURFACE
 8" DENSE GRANULAR
 AGGREGATE BASE

STATE SECTION
 2" AC SURFACE
 RECYCLED AC BASE

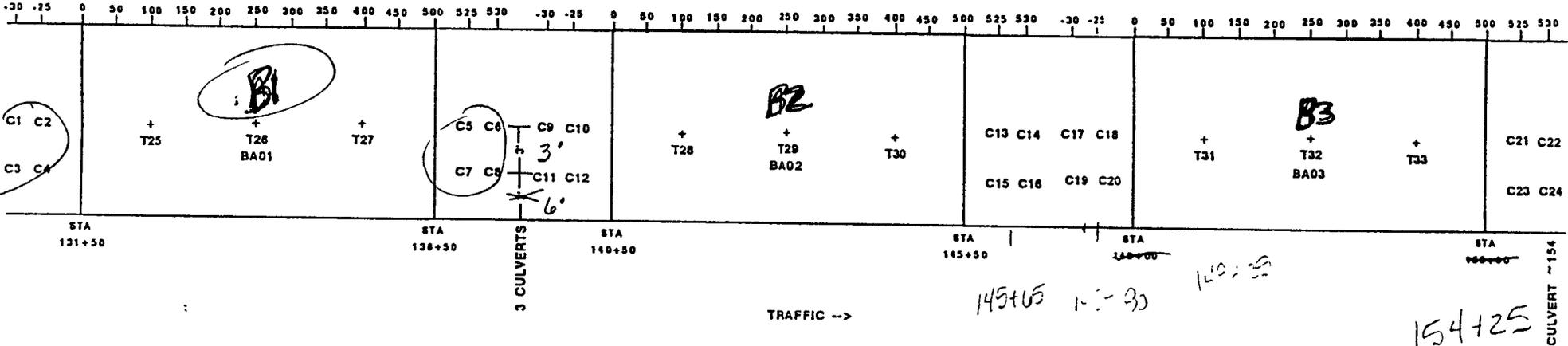
**SPS-8 SOUTH DAKOTA
SAMPLING AND TESTING PLAN
ST-1804
SOUTHBOUND LANE**

ASPHALT TESTING

03
460801

04
460802

59
460803



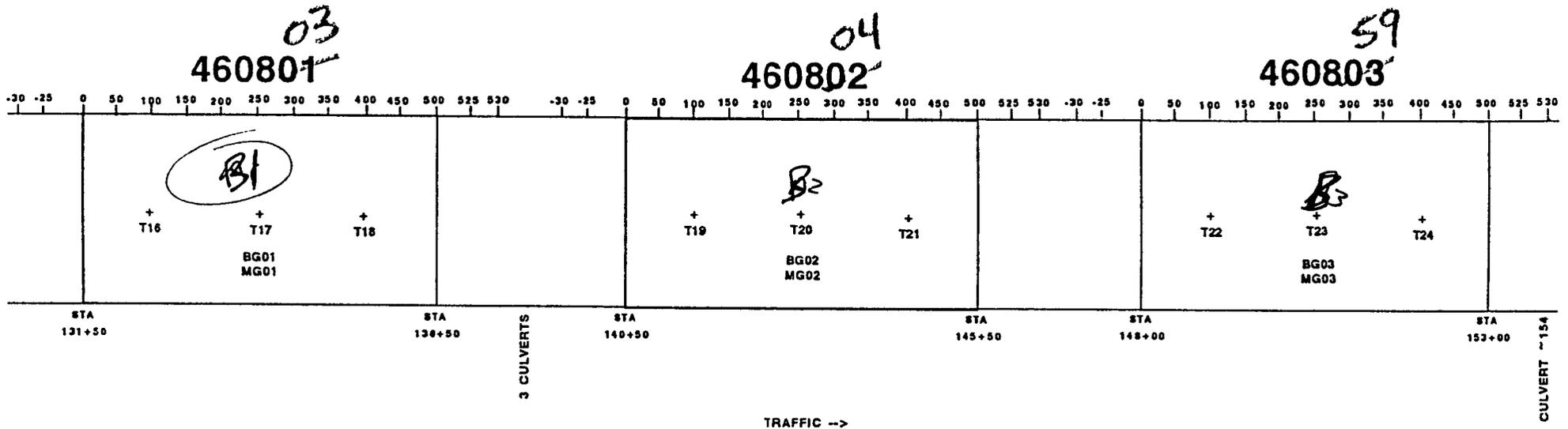
TESTING REQUIRED:

- T25-T33: NUCLEAR DENSITY/MOISTURE TESTS
- BA01-BA03: AC BULK SAMPLES OF EACH MIX (100 LBS EACH)
- C1-C24: 4" ASPHALT CORES

FWD TESTING: 1 MONTH AFTER PAVING (DONE BY SHRP/LTPP)

**SPS-8 SOUTH DAKOTA
SAMPLING AND TESTING PLAN
ST-1804
SOUTHBOUND LANE**

BASE TESTING



TESTING REQUIRED:

^E
T16-T24: NUCLEAR DENSITY/MOISTURE TESTS

— BG01-BG03: BULK GRANULAR (250-300 LBS EACH)

— MG01-MG03: MOISTURE GRANULAR (2 SEALED SAMPLES EACH)

FWD TESTING: BEFORE AC LAYER IS PLACED (DONE BY SHRP/LTPP)

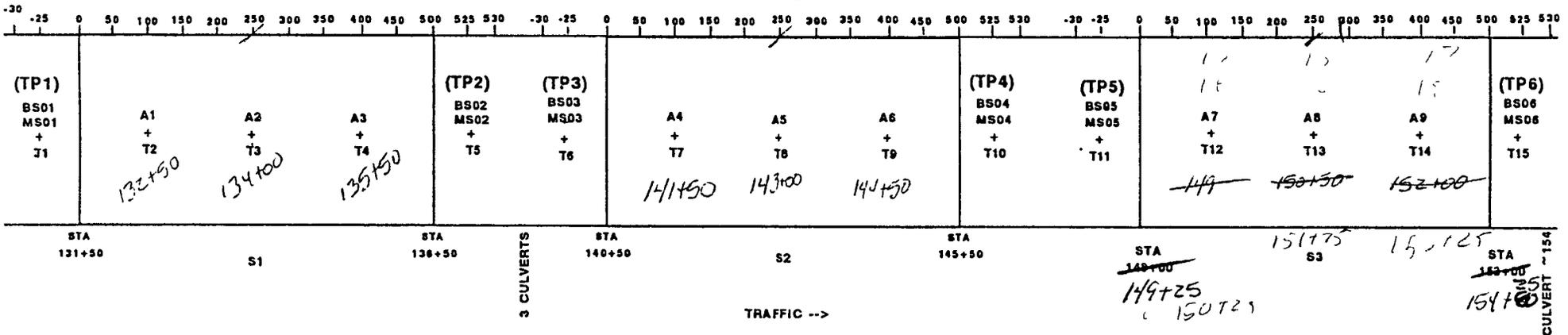
**SPS-8 SOUTH DAKOTA
SAMPLING AND TESTING PLAN
ST-1804
SOUTHBOUND LANE**

SUBGRADE TESTING

03
460801

04
460802

59
460803



TESTING REQUIRED:

- S1-S3: SHOULDER PROBE (20FT OR UNTIL REFUSAL)**
- T1-T15: NUCLEAR DENSITY/MOISTURE TESTS**
- TP1-TP6: TEST PITS (SAMPLE AREA)**

- BS01-BS06: BULK SUBGRADE (250-300 LBS EACH)**
- MS01-MS06: MOISTURE SUBGRADE (2 SEALED SAMPLES EACH)**

FWD TESTING: TEST BEFORE BASE IS PLACED (DONE BY SHRP/LTPP)

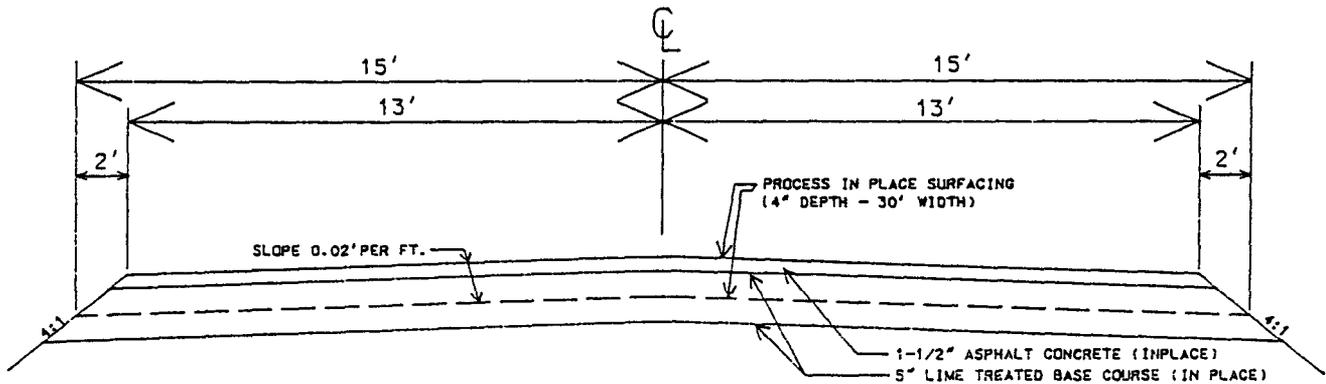
*Moisture only
110°C
12 hr + only 6
15 min*

Attachment F

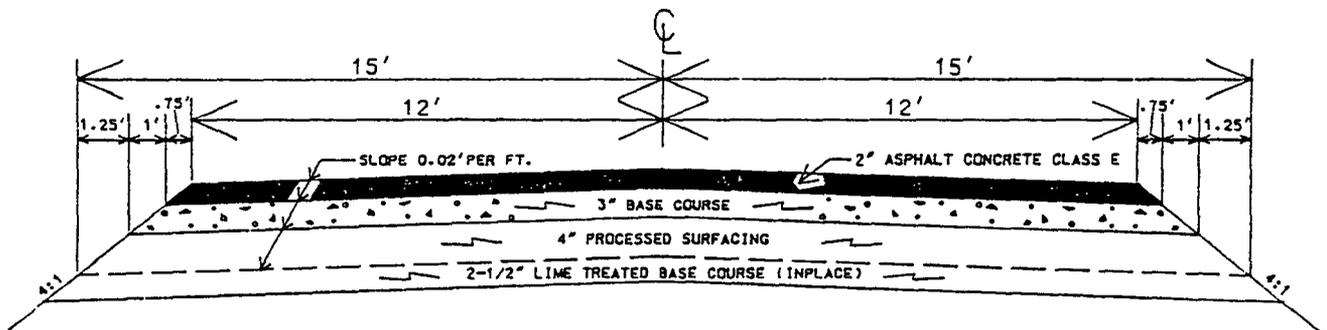
**Cross Section of Existing Section
Cross Section of Transitions**

TYPICAL SECTIONS
CODE NO. 1000

STATION 52+18.30 TO STATION 470+73.29
(EXISTING SECTION)



STATION 52+18.30 TO STATION 129+00
STATION 148+00 TO STATION 470+73.29
(SECTION SHOWING PROCESSED BASE MATERIAL,
BASE COURSE, AND ASPHALT CONCRETE SURFACING)



TRANSITIONS:

STATION 128+00 TO STATION 131+00

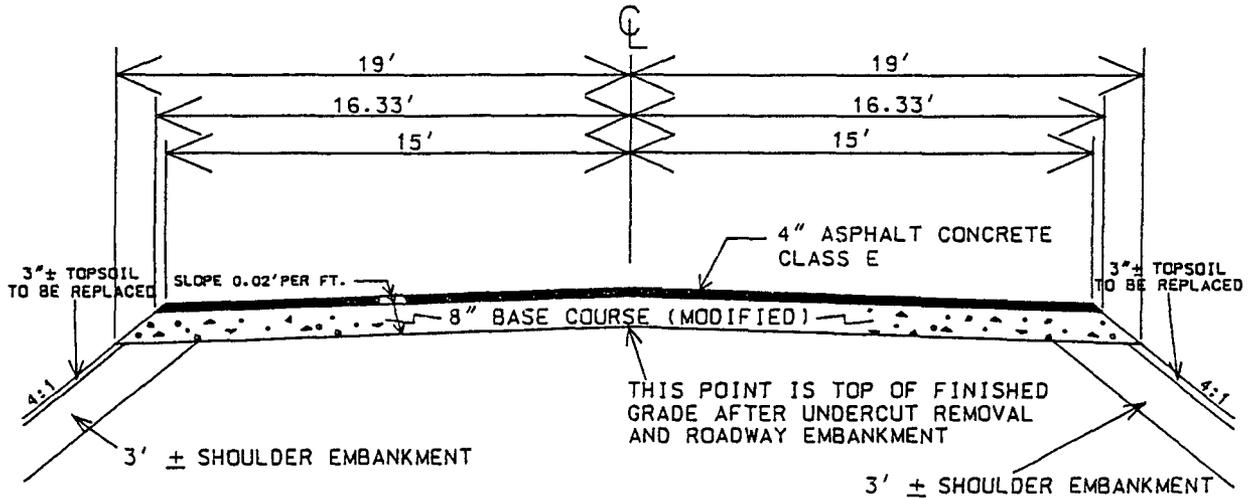
STATION 146+00 TO STATION 149+00

Attachment G

Cross Section of Test Sections 460803 and 460804

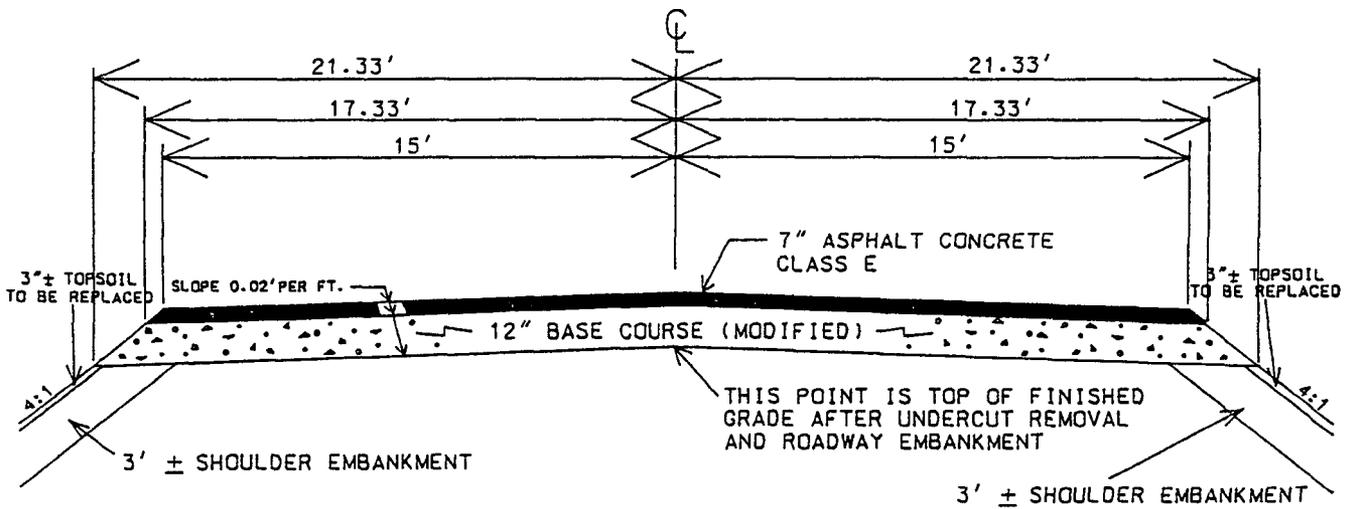
TYPICAL RESEARCH SECTIONS

STATION 131+00 TO STATION 137+00



TRANSITION: STATION 137+00 TO STATION 140+00

STATION 140+00 TO STATION 146+00



NOTE:

SEE SHEET NOS. 34 & 35 FOR DETAILS