



**LTPP North Central Regional Office**

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May 7, 2001

Mr. Jack Springer, HRDI-13  
FHWA-LTPP  
Turner-Fairbank Highway Research Center  
6300 Georgetown Pike  
McLean, Virginia 22101-2296

Re: SPS Construction Report for SPS-8 east of Hatley, Wisconsin

Dear Mr. Springer,

I have enclosed a copy of the SPS construction report for the SPS-8 near Hatley, Wisconsin. The remaining reports for the projects in Missouri will be completed in the near future, and sent to you as they are available. Please let me know if you have any comments or questions concerning this report. You may contact me at 217/356-4500.

Sincerely,

Brenda B. Mehnert  
ERES Division of ARA, Inc.

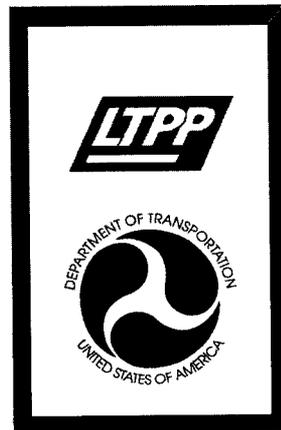
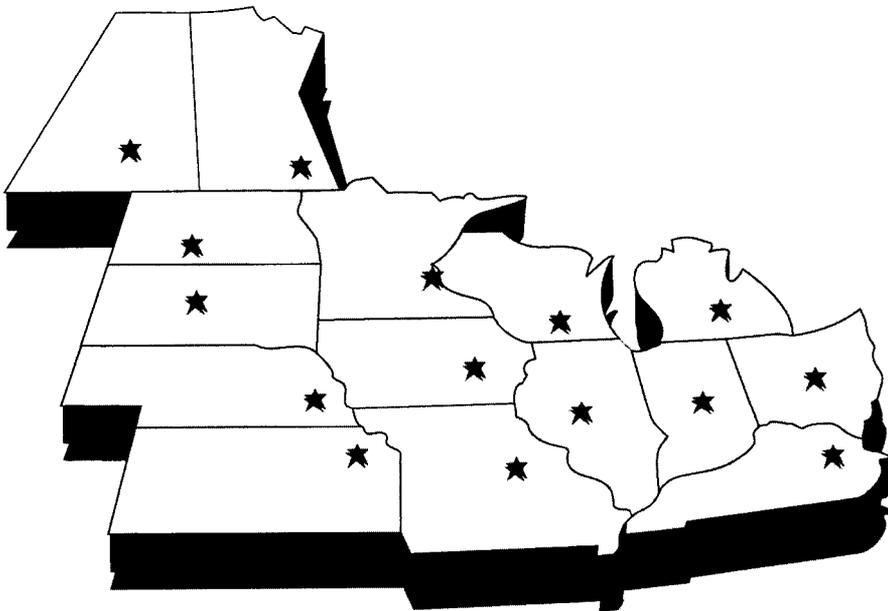
Enclosures:

cc: M. Symons (FHWA-COTR)  
J. Jiang (LTPP-DATS)

# Construction Report for Wisconsin SPS-8

**DTFH61-96-C-00013**

May 7, 2001



**SPS-8 Construction Report  
Marathon County, Wisconsin  
Apple Lane /Frontage Rd  
(Adjacent to State Highway 29)**

**Sections 550805 and 550806**

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

**Report Prepared By:  
Brenda B. Mehnert**

**ERES Consultants  
A Division of Applied Research Associates, Inc.  
505 West University Ave.  
Champaign, Illinois 61820**

**May 7, 2001**

# TABLE OF CONTENTS

<b>1 PROJECT OVERVIEW .....</b>	<b>1</b>
1.1 EXPERIMENT CELL.....	1
1.2 PROJECT LOCATION .....	1
1.3 PROJECT LAYOUT .....	2
1.4 TRAFFIC CHARACTERISTICS.....	2
1.5 LIMITS OF TEST SECTIONS .....	2
1.6 WEATHER MONITORING .....	2
1.7 TRAFFIC MONITORING .....	3
1.8 PERSONNEL.....	3
1.9 KNOWN DEVIATIONS FROM GUIDELINES .....	5
1.10 SUMMARY OF KEY CONSTRUCTION EQUIPMENT.....	5
<b>2 PROJECT DETAILS.....</b>	<b>6</b>
2.1 DESIGN FEATURES .....	6
2.2 MATERIAL SAMPLING AND TESTING.....	6
2.3 CONSTRUCTION ACTIVITIES.....	7
2.4 SUBGRADE PREPARATION .....	7
2.5 PLACEMENT OF BASE LAYER .....	7
2.7 ASPHALT PAVING.....	8

## ATTACHMENTS

**ATTACHMENT A: PROJECT LOCATION**

**ATTACHMENT B: SITE LAYOUT**

**ATTACHMENT C: MATERIAL SAMPLING AND TESTING PLAN**

**ATTACHMENT D: LAYER DESCRIPTION AND THICKNESS FOR EACH SECTION**

**ATTACHMENT E: PROJECT DEVIATION REPORT**

# 1 Project Overview

The Strategic Highway Research Program (SHRP) SPS-8 project investigates environmental effects on both rigid and flexible pavements in the absence of heavy loads. This project encompasses both types of structures built on conventional non-drained base materials over three types of subgrade. The factors addressed on the long-term pavement performance of these two types of pavements are:

- Pavement type
- Layer thickness
- Subgrade soil types

The analysis of 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.

Two flexible pavement test sections were constructed for this project. One test section consisted of 114 mm of asphaltic concrete over 203 mm of uncrushed gravel, and the other consisted of 178 mm of hot mix asphaltic concrete over 305 mm of uncrushed gravel. Both sections were constructed over a coarse-grained subgrade.

This report summarizes the “as-built” pavement layers of the Wisconsin SPS-8 site that includes 2 SHRP test sections constructed the fall of 1997. Field tests were performed, and laboratory samples obtained and analyzed, at different stages of construction from each test section. All samples were taken from the eastbound lane.

## 1.1 Experiment Cell

This Wisconsin SPS-8 experiment is located in the wet-freeze environmental zone and was constructed on a coarse-grained subgrade. There is moderate frost heave activity in this area. The pavement was reconstructed with only enough of the existing pavement removed to accommodate the new pavement structure while maintaining the existing grade. The existing pavement was 102 mm of asphalt concrete (AC) placed on 178 mm of crushed rock base placed on a silty sand subgrade following the 1972 AASHTO Structural Design Method.

## 1.2 Project Location

The Wisconsin SPS-8 project is located on Apple Lane (frontage road) on the north side of Wisconsin State Highway 29 (STH-29) in Marathon County, Wisconsin. Specifically, the two sections are located on the eastbound lane of this two-lane road. This site is roughly 0.8 km east of Hatley, Wisconsin, and adjacent to the SPS-1 site. Attachment A is a general project location map.

The test site is located on a 1.5 percent downgrade. The horizontal curvature for both sections is tangent. The lanes are 4 m wide and have asphalt concrete shoulders that are 1 m wide. The shoulders were constructed with 102 mm of AC on a 203 mm of crushed stone base.

### 1.3 Project Layout

The Marathon County SPS-8 site incorporates 2 SHRP sections. Attachment B contains the test section layout that summarizes AC thickness and layer descriptions.

### 1.4 Traffic Characteristics

This two-lane section of Apple Lane is classified as a local road. Table 1 shows traffic data at the time of construction.

Table 1. Traffic data for Wisconsin SPS-8.

<b>Annual Average Daily Traffic (two directions) (1995)</b>	<b>100 Vehicles</b>
Estimated 18K ESAL Rate in Study Lane (1000 ESAL/YR)	1.3
% Heavy Trucks and Combinations (of AADT)	7.4%
Total Design 18K ESAL Applications in Design Lane	25,550 vehicles
Design Period	20 years

### 1.5 Limits of Test Sections

Table 2 shows the limits of the test sections at the SPS-8 site. Each test section includes a monitoring section of 152 m (500 ft) and 15 m (50 ft) at each end of the monitoring section to be used as sampling areas.

Table 2. Limits of Wisconsin SPS-8 test sections.

<b>Test Section #</b>	<b>183-m (600-ft) Test Section</b>		<b>152-m (500-ft) Monitoring Section</b>	
	<b>Beginning Station</b>	<b>End Station</b>	<b>Beginning Section</b>	<b>End Station</b>
550805	105+50	111+50	106+00	111+00
550806	117+00	123+00	117+50	122+50

### 1.6 Weather Monitoring

During construction, a site was prepared for a weather monitoring station. This AWS unit was installed in June 1997, 5.6 km from Hatley.

## **1.7 Traffic Monitoring**

The traffic-monitoring device was installed near the SPS-2 project, approximately 5 km from this site. This weight-in-motion (WIM) system was installed August 29, 1997, to classify all individual axles by wheel in all lanes of State Highway 29. The WIM equipment used in this project was a DAW-100 unit manufactured by PAT, Equipment. Their address is:

1665 Orchard Dr.  
Chambersburg, PA 17201  
Phone (717) 263-7655

The WIM scale (in each lane) consists of two bending plates mounted in the pavement that cover half of each lane. The bending plates in each lane are staggered with an inductance loop for vehicle classification between bending plates. The WIM device is located at station 1073+81 both directions near the intersection of State Highway 29 and County Highway D.

## **1.8 Personnel**

### North Central Regional Coordination Office

ERES Consultants, a Division of ARA, Inc.  
Tom Wilson  
Principal Investigator  
505 West University Avenue  
Champaign, Illinois 61820 (800) 344-7477

### Material Testing

Construction-Geotechnical Consulting Engineering/Testing, Inc. (CGC)  
3011 Perry St.  
Madison, WI 53713 (608) 288-4100

University of Wisconsin-Madison, Structures Materials Lab  
Peter J. Bosscher and Hussain U. Bahia  
2210 Engr. Bldg., 14515 Engr. Dr.  
UW-Madison, WI 53706 (608) 265-4481

Kapur & Associates, Inc.  
Joel Weber  
7711 N. Port Washington Rd.  
Milwaukee, WI 53217 (715) 253-3827

American Asphalt of Wisconsin  
P.O. Box 98  
Mosinee, WI 5455-0098 (715) 693-5200

Field Sampling and Testing

Kapur & Associates, Inc.  
Joel Weber  
7711 N. Port Washington Rd.  
Milwaukee, WI 53217 (715) 253-3827

Construction Technology Laboratories, Inc.  
5420 Old Orchard Rd.  
Skokie, IL 60077-1030 (847) 965-7500

Design Team

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411 East Wisconsin Ave.  
Suite 1600  
Milwaukee, WI 53202 (414) 272-2426

LTPP Design Review

John Miller  
PCS/LAW  
A Division of Law Engineering and Environmental Services, Inc.  
2104 Indian Creek Court, Suite A  
Beltsville, Maryland 20705 (301) 210-4105

State Department of Transportation

Scott Schwandt (Nomination form)  
Steve Shoer, PE (chief pavement & research engineer)  
Wisconsin Department of Transportation  
3502 Kinsman Blvd.  
Madison, WI 53704-2507 (608) 246-5399

Contractors

Tom Pagel  
Pagel Construction  
1380 Division St.  
Almond, WI 54909 (715) 366-2975

Ray Gausmann  
Mathy Construction Co.  
920 10<sup>TH</sup> Ave. N.  
Onalaska, Wisconsin 54650 (608) 783-6411

Mr. Dan Beaudoin  
James Cape & Sons, Co., Inc.  
6422 North Hwy. 31  
Racine, WI 53401-1315

## **1.9 Known Deviations from Guidelines**

Attachment E contains project deviation reports filled out during and after construction.

## **1.10 Summary of Key Construction Equipment**

### Subgrade Preparation

- Push cat
- Scrapers
- Bulldozers

### Uncrushed Gravel Base Preparation

- Single drum vibrator (8.0-ton)
- Base trimmer

### Asphalt Concrete Pavement Placement

- Blaw-Knox (model PF-172) paver
- 10.0-ton steel wheel tandem roller
- 25.0-ton pneumatic rubber-tired roller at 90 psi
- 11.5-ton single drum vibrator (2600 vibrations/min)
- Asphalt concrete drum mix plant

## 2 Project Details

Project meetings were held on-site weekly from the initial meeting, May 1997, through the end of construction, November 1997. These meetings were attended by representatives from the contractor, sub-contractors, LTPP, and Wisconsin DOT and were an effective way of communicating changes or delays.

### 2.1 Design Features

Table 3 summarizes the asphalt and base layer thickness for each section. Edge drains were not installed in either of the sections.

Table 3. Summary of material thickness and edge drains for each section.

<b>Test Section Number</b>	<b>Surface AC Thickness (mm)</b>	<b>Base Material and Thickness (mm)</b>	<b>Edge Drains</b>
550805	114	Uncrushed Gravel (203)	No
550806	178	Uncrushed Gravel (305)	No

### 2.2 Material Sampling and Testing

Locations of material sampling and field testing for each layer are given in attachment C. ERES Consultants submitted the sampling and testing plan using the LTPP guidelines for SPS-8 projects. LTPP sampling field testing procedures have been developed specifically for the SHRP program, and all activities were performed in accordance with these guidelines unless noted in attachment E. Samples for laboratory testing were sent to C.G.C., James Cape & Sons Co., Inc., the University of Wisconsin, Madison, and the Wisconsin Department of Transportation.

Samples for long-term storage were obtained from the asphalt concrete surface layers and the uncrushed gravel base. These samples were sent to Material Reference Library (MRL).

#### Samples for Long-Term Storage

- 3-5 gal buckets of AC
- 6-5 gal buckets of AC mix
- 2-55 gal drums of aggregate

## 2.3 Construction Activities

Both sections were located on cut areas from the old pavement location. Removal of the existing pavement for this project began in early September 1997. Subgrade preparation followed shortly thereafter. Paving operations were completed by mid-November 1997. Figure 1 shows a backhoe removing the existing pavement from the adjacent SPS-1 project.



Figure 1. Asphalt removal process using backhoe.

## 2.4 Subgrade Preparation

Subgrade preparation began September 15, 1997, and was completed October 16, 1997. Scrapers, bulldozers, and push cats were used for compacting the subgrade. Both sections were reconstructed with a typical subgrade lift thickness of 203 mm. This thickness was obtained with two lift thicknesses of 102 mm.

## 2.5 Placement of Base Layer

### Uncrushed Gravel Placement

Preparation of the unbound aggregate base layer began on October 31, 1997. An 8-ton single drum vibrator roller was used for compaction. Lift thickness was 102 mm, depending on the

desired thickness of the layer. When a 305-mm base was desired, two lifts of 152 mm were typically used. A base trimmer was used to maintain the desired elevation and to trim the excess off the top of the uncrushed gravel.

## **2.7 Asphalt Paving**

Paving operations began November 7, 1997, and completed the same day. Two asphalt concrete mixes are used in these test sections, the Type HV binder course and Type HV surface course. The Mosinee Drum Mix Plant, located 30 minutes from the site, produced the hot mix asphalt concrete (dense graded) for this site. Placement of the asphalt concrete was performed with a Blaw-Knox, model PF-172, paver with a laydown width of 4.5 m. There was one longitudinal surface joint located between the lanes. The mean laydown temperature of the asphalt was 136°C, and the air temperature was 4°C.

The AC binder course was placed before the final AC surface. A minimum compacted thickness of 58 mm was maintained for the AC binder for section 550805. For section 550806, the minimum compacted thickness for the first lift was 71 mm, and the minimum compacted thickness for the second lift was 69 mm. The mean laydown temperature of the asphalt was 136°C, and the air temperature was 7°C.

Typically, for the AC surface layers, breakdown compaction was performed with three passes of an 11.5-ton single drum vibrator. Three passes with a pneumatic-tired roller at 90 psi were used for the intermediate compaction. Lastly, a 10.0-ton steel-wheel tandem roller made the final three passes.

**Attachment A**  
**Project Location**

# Wisconsin (55)

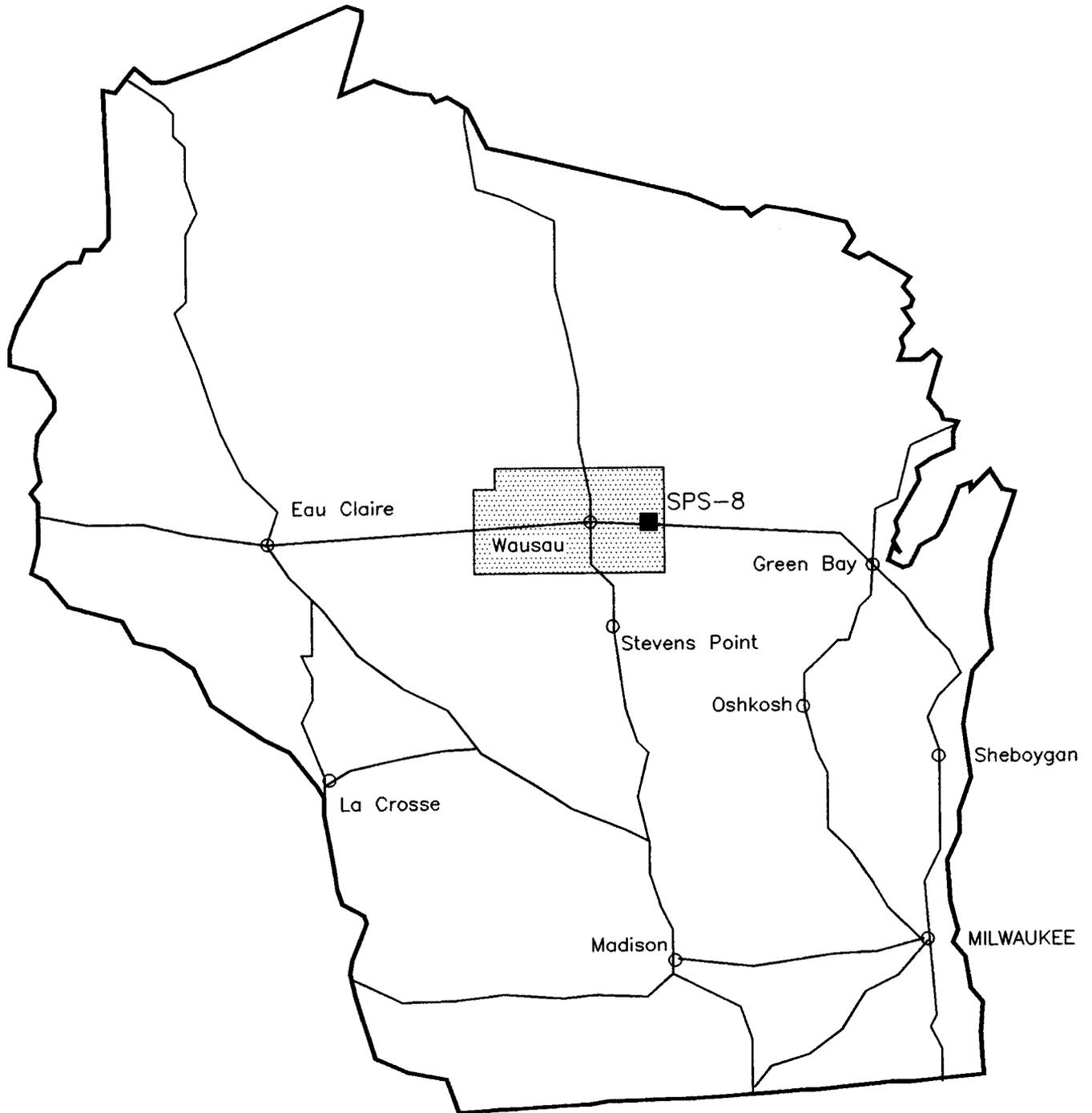
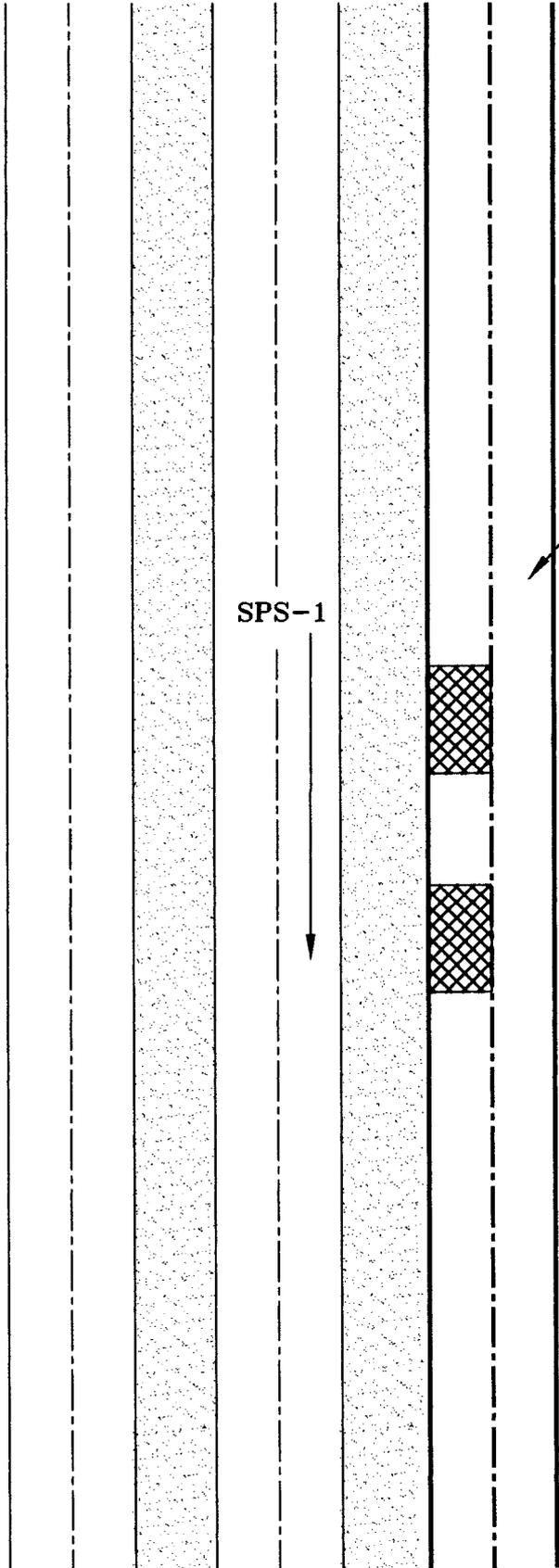
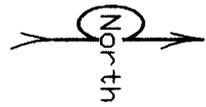


Figure A-1. General Project Location.

**Attachment B**

**Site Layout**

**WISCONSIN SPS-8**  
**Marathon County**  
**EB Apple Lane/Frontage Road**  
**(Adjacent to State Highway 29)**  
**.8 km East of Hatley**



Apple Lane / Frontage Road

550805  
 114mm AC/203mm Uncrushed Gravel

550806  
 178mm AC/305mm Uncrushed Gravel

AS BUILT FALL 1997

**Legend**

AC-Asphalt Concrete Pavement Type HV

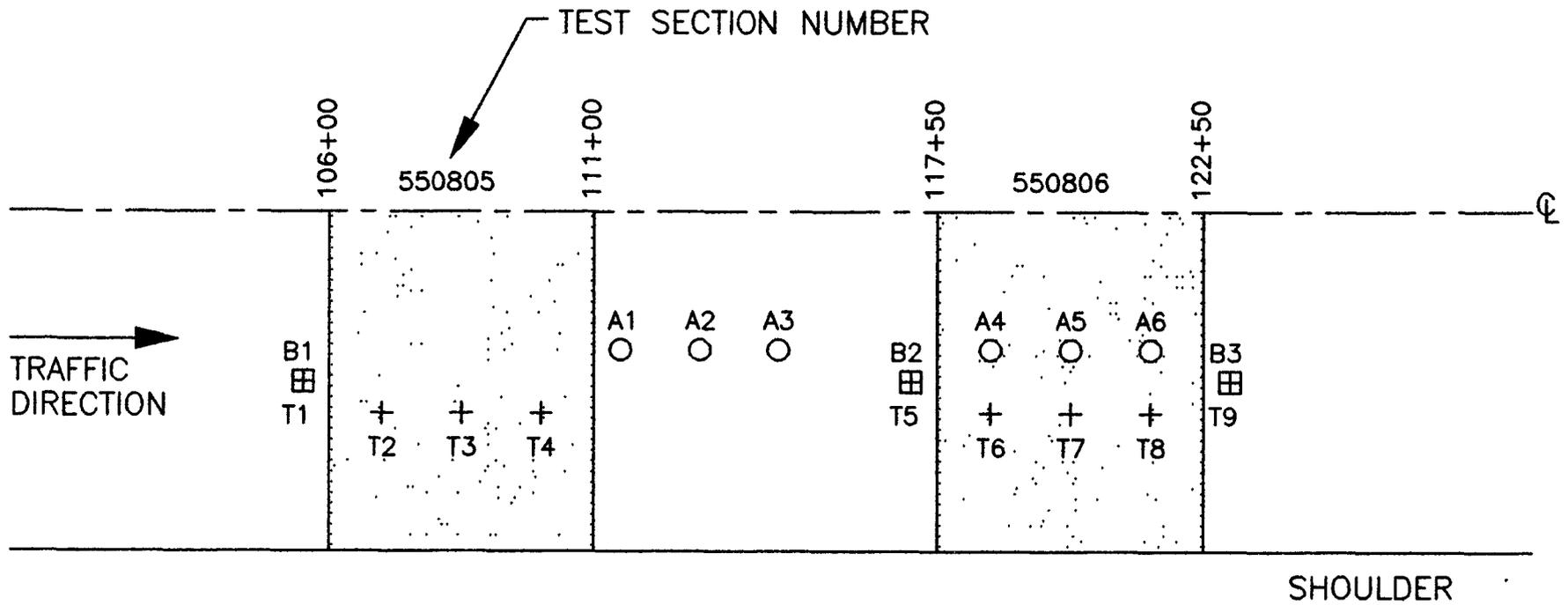
Note: WIM location located on State Highway 29.

Revised 6-12-00

Figure B-1. Wisconsin SPS-8 site layout.

**Attachment C**  
**Material Sampling and Testing Plan**

Figure C-1. Sampling and testing locations on the subgrade.  
14



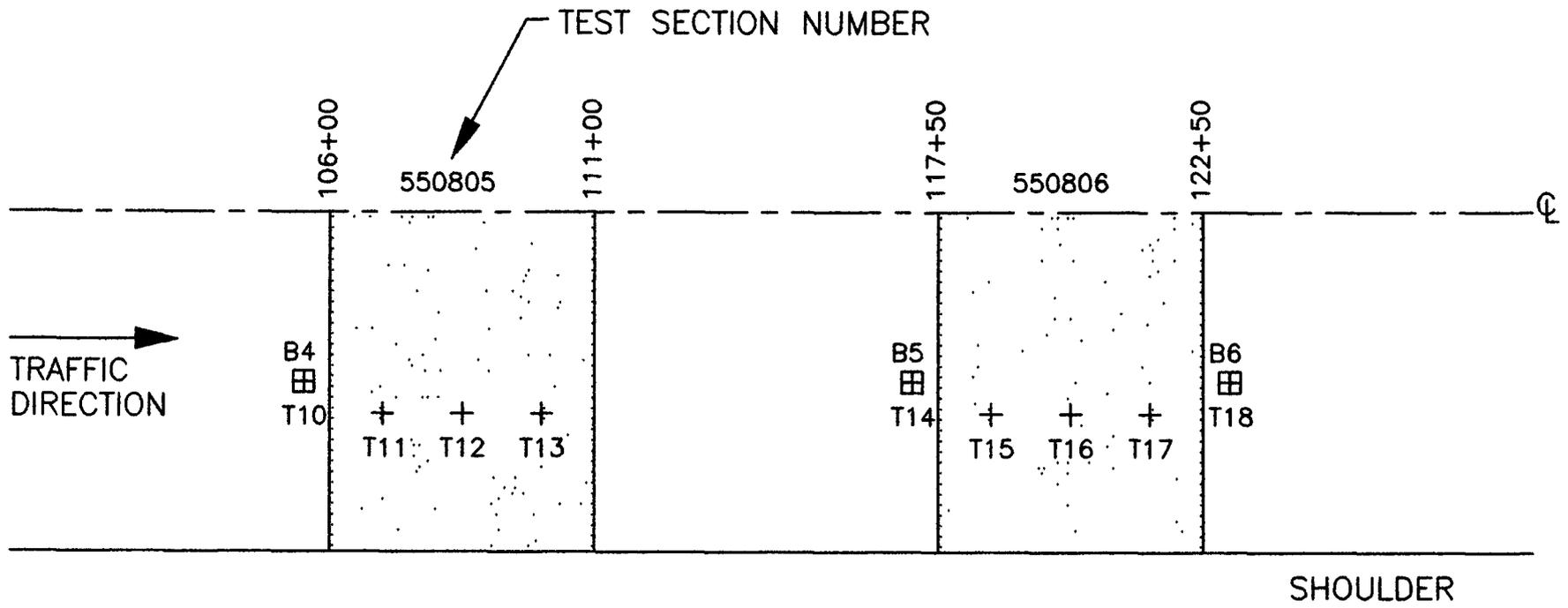
**LEGEND**

- + Location of field nuclear moisture/density testing
- 2' x 2' bulk sampling location to 1' below surface
- Splitspoon sampling to 4' below top of subgrade
- 55\*\*\*\* Test section number
- 1 ft. = 0.305m

**NOTES**

1. Conduct elevation measurements on both sections.
2. Conduct nuclear density tests on bulk sampling locations prior to sampling.

Figure C-2. Sampling and testing locations on the uncrushed gravel base.  
15



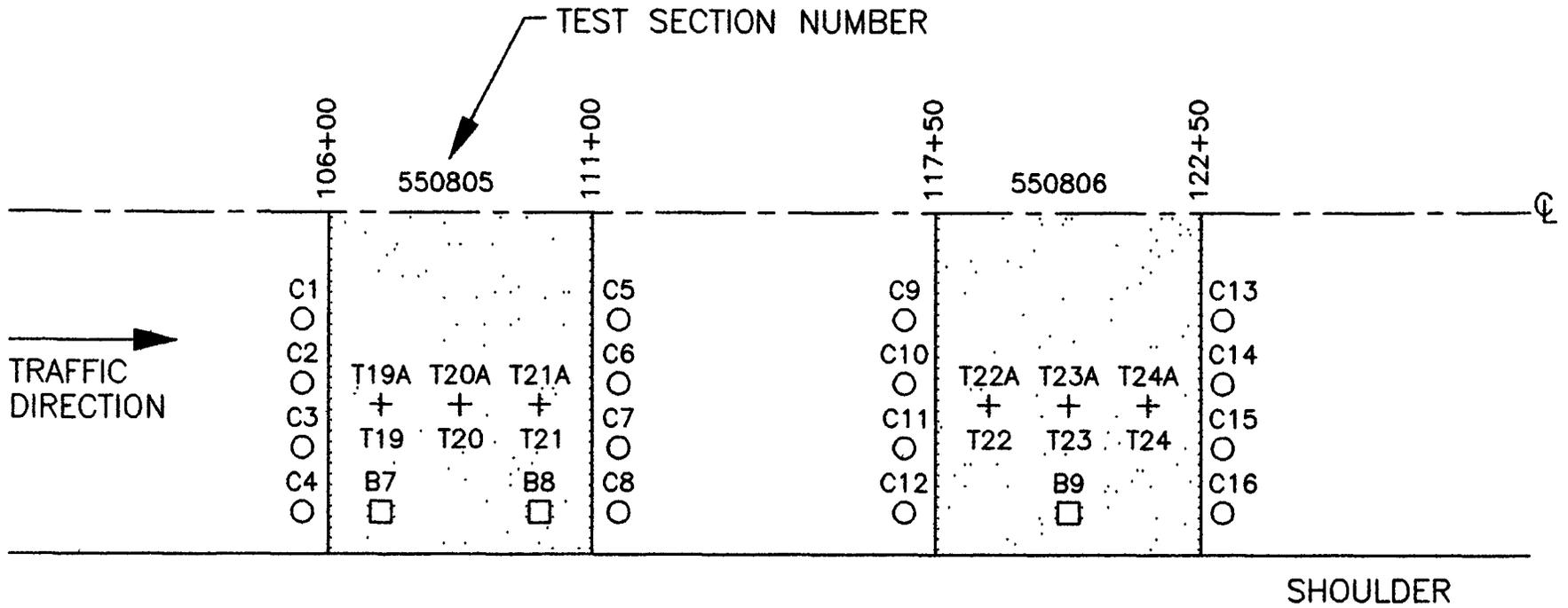
**LEGEND**

- + Location of field nuclear moisture/density testing
- 1' x 1' bulk sampling location - full layer thickness
- 55\*\*\*\* Test section number
- 1 ft. = 0.305m

**NOTES**

1. Conduct elevation measurements on both sections.
2. Conduct nuclear density tests on bulk sampling locations prior to sampling.

Figure C-3. Sampling and testing on the asphalt concrete surface.  
16



LEGEND

- + Location of field nuclear/density testing
- Bulk sampling location
- 4" diameter core of AC  
1 in. = 25.4mm

NOTES

1. Obtain bulk samples from the intermediate course and surface course from the paver or haul vehicle
2. Obtain 3, 5-gal samples of asphalt cement from plant
3. Conduct nuclear density tests after completion of intermediate and surface course
4. Conduct elevation measurements on the finished AC surface

## **Attachment D**

### **Layer Description and Thickness for Each Section**

<b>LTPP SRS Project Deviation Report</b> <b>Data Collection and Materials Sampling and</b> <b>Testing Deviations</b>	State Code _____ Project Code <u>  0  </u> <u>  8  </u> <u>  5  </u> <u>  5  </u>
--	--

- Comments Pertain to All Test Sections on Project
- Comments Pertain Only to Section(s): (Specify) \_\_\_\_\_

Data Collection & Material Sampling and Testing Deviation Comments

Auger samples were taken where the "planned" section 550805 was to be located before the section was relocated.

Cores, density tests, and bulk samples were relocated in relation to 550805's new location.

Local soil boring records were submitted by Kapur & Associates, this allowed eliminating the 6.1-m shoulder probes. The depth to rigid layer exceeded 6.1 m.

FWD was not performed before the test section was constructed.

**Attachment E**  
**Project Deviation Reports**

<b>LTPP SPS Project Deviation Report Project Summary Sheet</b>		State Code			<u>5</u>	<u>5</u>
		Project Code	<u>0</u>	<u>8</u>	<u>0</u>	<u>0</u>
<b>Project Classification Information</b>						
SPS Experiment Number: SPS-8		State or Province: Wisconsin				
LTPP Region:		<input type="checkbox"/> North Atlantic <input checked="" type="checkbox"/> North Central <input type="checkbox"/> Southern <input type="checkbox"/> Western				
Climate Zone:		<input type="checkbox"/> Dry-Freeze <input type="checkbox"/> Dry-No Freeze <input checked="" type="checkbox"/> Wet-Freeze <input type="checkbox"/> Wet-No Freeze				
Subgrade Classification:		<input type="checkbox"/> Fine Grain <input checked="" type="checkbox"/> Coarse Grain <input type="checkbox"/> Active (SPS-8 Only)				
Project Experiment Classification Designation (SPS 1, 2, & 8): SPS-8						
Construction Start Date: June 1997		Construction End Date: November 1997				
FHWA Incentive Funds Provided to Agency for this Project:						<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
<b>Deviation Summary</b>						
Site Location Deviations:		<input type="checkbox"/> No Deviations <input checked="" type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations				
Construction Deviations:		<input checked="" type="checkbox"/> No Deviations <input type="checkbox"/> Minor Deviations <input type="checkbox"/> Significant Deviations				
<b>Data Collection and Processing Status Summary</b>						
Inventory Data (SPS 5,6,7, & 9):		<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:		<input type="checkbox"/> All Required Historical Estimates Submitted (SPS 5, 6, 7, & 9) <input type="checkbox"/> Required Estimates Not Submitted				
Traffic Monitoring Equipment:		<input type="checkbox"/> WIM Installed On-Site <input type="checkbox"/> AVC Installed On-Site <input type="checkbox"/> ATR Installed On-Site <input checked="" type="checkbox"/> No Equipment Installed				
Traffic Monitoring:		<input type="checkbox"/> Preferred <input type="checkbox"/> Continuous <input type="checkbox"/> Minimum <input type="checkbox"/> Below Minimum <input type="checkbox"/> Site Related				
Traffic Monitoring Data:		<input type="checkbox"/> Monitoring Data Submitted <input checked="" type="checkbox"/> No Monitoring Data Submitted				
FWD Measurements:		<input type="checkbox"/> Pre-construction Tests Performed <input type="checkbox"/> Construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed				
Profile Measurements:		<input type="checkbox"/> Pre-construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed				
Distress Measurements		<input type="checkbox"/> Pre-construction Tests Performed <input checked="" type="checkbox"/> Post-construction Tests Performed				
Maintenance and Rehab. Data:		<input type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input checked="" type="checkbox"/> Data Not Available				
Friction Data:		<input type="checkbox"/> Complete Submission <input type="checkbox"/> Incomplete <input checked="" type="checkbox"/> Data Not Available				
<b>Report Status</b>						
Materials Sampling and Test Plan:		<input type="checkbox"/> Document Prepared <input checked="" 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)		<input checked="" type="checkbox"/> AWS Installed <input type="checkbox"/> AWS Installation Report Submitted to FHWA				

**LTPP SPS Project Deviation Report  
Construction Guidelines Deviation**

State Code  
Project Code

  5     5    
  0     8     0     0  

Comments Pertain to All Test Sections on Project

Comments Pertain Only to Section(s): (Specify) \_\_\_\_\_

**Construction Guidelines Deviation Comments**

All sections: uncrushed gravel base layers cut to grade using a base trimmer with an allowable tolerance of 19 mm.

**LTPP SPS Project Deviation Report**  
**Other Deviations**

State Code  
Project Code

  5     5    
  0     8     0     0  



Comments Pertain to All Test Sections on Project



Comments Pertain Only to Section(s): (Specify) \_\_\_\_\_

Other Deviation Comments

None known.

**LTPP SPS Project Deviation Report  
Site Location Guidelines Deviations**

State Code  
Project Code

  5     5    
  0     8     0     0  



Comments Pertain to All Test Sections on Project



Comments Pertain Only to Section(s): (Specify) \_\_\_\_\_

**Site Location Guideline Deviation Comments**

Section 550805 was relocated 198 m (650 ft) to the west of where it was originally planned because old portland cement concrete was found 152 mm to 203 mm below the surface.

Shoulders were constructed with a minimum width of 1 m instead of the required 1.2 m.

<b>LTPP SRS Project Deviation Report Data Collection and Materials Sampling and Testing Deviations</b>	State Code _____ Project Code <u>  0  </u> <u>  8  </u> <u>  5  </u> <u>  5  </u>
--	--

- Comments Pertain to All Test Sections on Project
- Comments Pertain Only to Section(s): (Specify) \_\_\_\_\_

Data Collection & Material Sampling and Testing Deviation Comments

Auger samples were taken where the "planned" section 550805 was to be located before the section was relocated.

Cores, density tests, and bulk samples were relocated in relation to 550805's new location.

Local soil boring records were submitted by Kapur & Associates, this allowed eliminating the 6.1-m shoulder probes. The depth to rigid layer exceeded 6.1 m.

FWD was not performed before the test section was constructed.