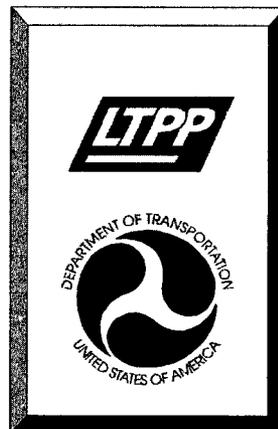
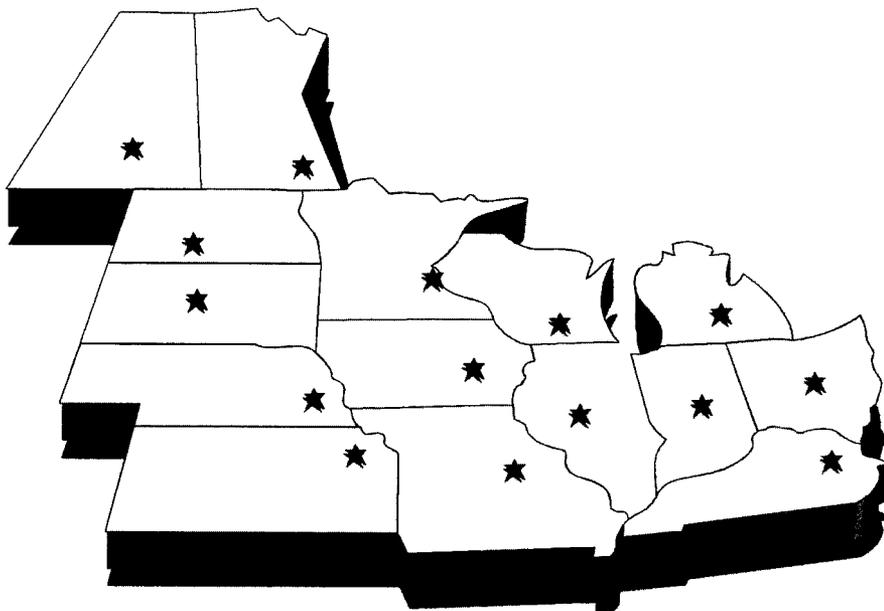


Construction Report for Wisconsin SPS-9A

DTFH61-96-C-00013

June 27, 2001



**SPS-9A Construction Report
State Highway 29 WB
Marathon County, Wisconsin
4.8 km east of Hatley, Wisconsin**

Sections 55C901, 55C902, 55C903, 55C959, and 55C960

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

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June 27, 2001

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ATTACHMENT A: PROJECT LOCATION

ATTACHMENT B: SITE LAYOUT

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1 Project Overview

The Strategic Highway Research Program (SHRP) SPS-9A project investigates the further development and refinement of performance-based specifications for asphalt binder and asphalt-aggregate mixtures. In order to be successful, it is necessary to validate the binder and mixture properties as important determinants of in-place pavement performance. The evaluation of innovative asphalt pavement materials also requires in-service testing under actual traffic and climate conditions.

The study objectives are to

- Compare the SHRP binder selected based on the average maximum and minimum temperatures and the annual precipitation
- Compare to local agency mix designs
- Compare the alternate binder selected to evaluate cases of thermal cracking or rutting.
- Study additional (supplemental) test sections, such as stone matrix asphalt (SMA).

The comparisons should involve three test sections in the core experiment with the same pavement cross-section.

This report summarizes the “as-built” pavement layers of the Wisconsin SPS-9A site consisting of three SHRP test sections and two supplemental sections. One test section incorporates the State’s current mixture design, one incorporates the SHRP mix, and one uses the SHRP alternate binder mix. The other two sections are supplemental State sections (55C959 and 55C960). 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 outer lane.

1.1 Experiment Cell

The Wisconsin SPS-9A experiment is located in the wet-freeze environmental zone and was constructed on a coarse-grained subgrade. Annual precipitation at the site is less than 825 mm. The average 7-day maximum pavement design temperature is less than 58°C. The minimum pavement design temperature is greater than -34°C.

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 229 mm of asphalt concrete (AC) placed on 330 mm of crushed rock base over 122 mm of subbase (soil-aggregate mixture, predominantly coarse-grained soil) placed on a silty-sand subgrade.

1.2 Project Location

The Wisconsin SPS-9A project is located on westbound State Route 29. This site is approximately 4.8 km east of the town of Hatley. The sections are located 0.45 km west of Bass Lake Road to 0.9 km east of Hilltop Road between the SPS-1 and the SPS-2 sites. Attachment A is a project location map.

1.3 Project Layout

The Marathon County SPS-9A site incorporates five SHRP sections. The monitoring sections are 152.4 m long with 304.8-m construction limits. Attachment B contains the test section layout and summarizes the AC thickness and layer descriptions.

1.4 Roadway and Traffic Characteristics

This two-lane divided test section of State Route 29 is located 4.8 km east of Hatley. Table 1 shows traffic data submitted in the nomination form for this site.

Table 1. Traffic data for Wisconsin SPS-9A

Annual average daily traffic, two way (1996)	6650 vehicles
% heavy trucks and combinations (of AADT)	29.5%
1996 est. 18K ESAL rate in study lane (1000 ESAL/yr.)	300 ESAL/yr
Total design 18K ESAL applications in design lane	6 million ESAL
Design Period (years)	20

The five test sections are located on a 0.42 percent downgrade and horizontal tangent. The lanes are 12 ft wide with a 10-ft outside shoulder. Two of the test sections are in fill and the other three are in cut sections.

1.5 Limits of Test Sections

Table 2 shows the limits of the test sections at the SPS-9A site. Each test section includes a monitoring section of 152.4 m and 76.2 m at each end of the monitoring section to be used as sampling areas.

Table 2. Limits of Wisconsin SPS-9A test sections.

Test Section #	1000-ft Test Section		500-ft Monitoring Section	
	Beginning Station	End Station	Beginning Section	End Station
55C901	1105+00	1015+00	1007+50	1012+50
55C959	1015+00	1025+00	1017+50	1022+50
55C902	1025+00	1035+00	1027+50	1032+50
55C903	1035+00	1045+00	1037+50	1042+50
55C960	1045+00	1055+00	1047+50	1052+50

1.6 Weather Monitoring

During construction, a site was prepared for a weather monitoring station. The installation of the automatic weather station (AWS) for site 550200, just east of 55C900, was completed on April 24, 1998. The AWS site is located in the right-of-way of highway US-29, approximately 150 ft across from the 550200 site.

1.7 Traffic Monitoring

A weigh-in-motion (WIM) system was installed August 29, 1997, to classify all individual axles by wheel in all lanes of this section 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 near the intersection of State Highway 29 and County Highway D, approximately 1.6 km east of section 55C960.

1.8 Personnel

North Central Regional Coordination Office

ERES Consultants
Tom Wilson
Principal Investigator
505 West University Avenue
Champaign, Illinois 61820 (800) 344-7477

Material Testing

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Madison, WI 53713 (608) 288-4100

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Kapur & Associates, Inc
Joel Weber
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Milwaukee, WI 53217 (715) 253-3827

American Asphalt of Wisconsin
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Mosinee, WI 5455-0098 (715) 693-5200

Stork Southwestern Laboratories, Inc
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Skokie, IL 60077-1030 (847) 965-7500

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LTPP Design Review

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Scott Schwandt (Nomination form)
Steve Shober, PE (chief pavement & research engineer)
Wisconsin Department of Transportation
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Contractors

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

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920 10TH Ave N
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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

Dense Graded Aggregate Base Preparation

- Single drum vibrator (8 0-ton)
- Asphalt concrete drum mix plant
- Blaw-Knox (model PF-172) paver
- 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 vibr./min)
- Asphalt concrete drum mix plant-Mosinee

2 Project Details

Weekly project meetings were held on-site from the initial meeting, May 1997, through the end of construction, November 1997. These meetings were attended by representatives from the contractor, subcontractors, LTPP, and Wisconsin DOT and were an effective way of communicating changes or delays. The SPS-9A site is between the SPS-1 and the SPS-2 sites. All three sites were constructed at the same time along with an SPS-8 on a frontage road. Construction for this test section began in summer of 1997 and was completed by early fall of 1997.

The Wisconsin SPS-9A test site consists of five test sections. The asphalt overlay consisted of Superpave material for four of the five test sections. One of those sections also had recycled material for both the binder and surface course. Another section consisted of Wisconsin DOT mix for both the surface course and an HV for the binder.

2.1 Design Features

Table 3 summarizes the layer thickness for each section. There were no subsurface edge drains in any of the sections.

Table 3 Summary of the "as built" material type and thickness for each section.

Test Section Number	AC Thickness (mm) (Surface)	Material and Thickness (mm) (Binder)
55C901	51 mm WI DOT Mix	198 mm HV
55C959	40 mm Superpave (PG58-28)	183 mm Superpave (PG58-28)
55C902	51 mm Superpave (PG58-34)	175 mm Superpave (PG58-34)
55C903	51 mm Superpave (PG58-22)	183 mm Superpave (PG58-22)
55C960	48 mm Superpave (PG58-28) w/ RAP	163 mm Superpave (PG58-28) w/ RAP

RAP = recycled asphalt pavement

2.2 Material Sampling and Testing

Locations of material sampling and field testing for each layer are given in attachment C. 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. Stork Southwestern Laboratories, Inc. completed interval laboratory testing (6, 18, 24 month). Samples for long-term storage were obtained from the asphalt concrete base layers.

Falling Weight Deflectometer (FWD) testing was performed on the old pavement in the SPS-1 site, adjacent to this site. This data was not included in the Inventory Management System (IMS), since the original pavement structure was not part of LTPP sections. FWD tests were performed in April 1998, after the site was constructed. Profile data and manual distress data were collected in December 1997, a couple of months after completion of the site.

2.3 Construction Activities

The FWD tests provided proof of the relative strength of the subgrade. When sampling using Shelby tubes, remnants of old portland cement concrete (PCC) pavement were found well below the top of the subgrade. PCC slabs were removed and subgrade was reworked to bring it back to the required elevation. Removal of the existing pavement for this project began in early July 1997. Subgrade preparation followed shortly thereafter. This reconstruction accommodated the new pavement structure while maintaining the existing grade. Sections 55C901 and 55C959 were built mostly as part of a new AC roadway, and the other three sections were mostly reconstruction of an existing roadway. Paving operations were completed by mid-October 1997.

Subgrade Preparation

Scrapers, bulldozers, and pushcats were used to compact the subgrade. For the sections requiring fill (55C901, 55C959), the embankment thickness was typically 610 mm.

Base Layer Placement

Preparation of the dense graded aggregate base (DGAB) layer was performed in late September 1997. An 8-ton single drum vibrator roller was used for compaction. Two lifts were typically used for a 330-mm desired thickness. A base trimmer was used to maintain the desired elevation and to trim the excess off the top of the DGAB.

Asphalt Paving

Five different asphalt concrete mixes were used in this test section. The asphalt concrete plant used was a drum mix from Mosinee located a haul distance of 35.4 km (haul time of 30 minutes) from the test site. Placement of the asphalt concrete paving operations for the binder and surface courses were completed in three days (October 26-28, 1997).

The AC binder course was placed before the final AC surface layer. The binder and surface course consisted of two lifts of 58.4 mm. The longitudinal surface joint was located within the lane for all test sections. Compaction was achieved in three steps: breakdown, intermediate, and final. The binder and surface course were paved using a Blaw-Knox, model PF-172, with a single pass laydown width of 4.6 m. The mean laydown temperature of the asphalt was 134.4°C.

2.4 Initial Performance

In June 2000, the most recent manual distress survey was performed on all five sections. Section 55C903 exhibited only high severity bleeding in 3.4 square meters. Section 55C902 and 55C959 had no distresses. Low-severity longitudinal cracking (69.4 m) was the only distress in Section 55C901. Section 55C960 exhibited both fatigue cracking (46.3 m) and longitudinal cracking outside the wheel path.

Attachment A
Project Location

Wisconsin (55)

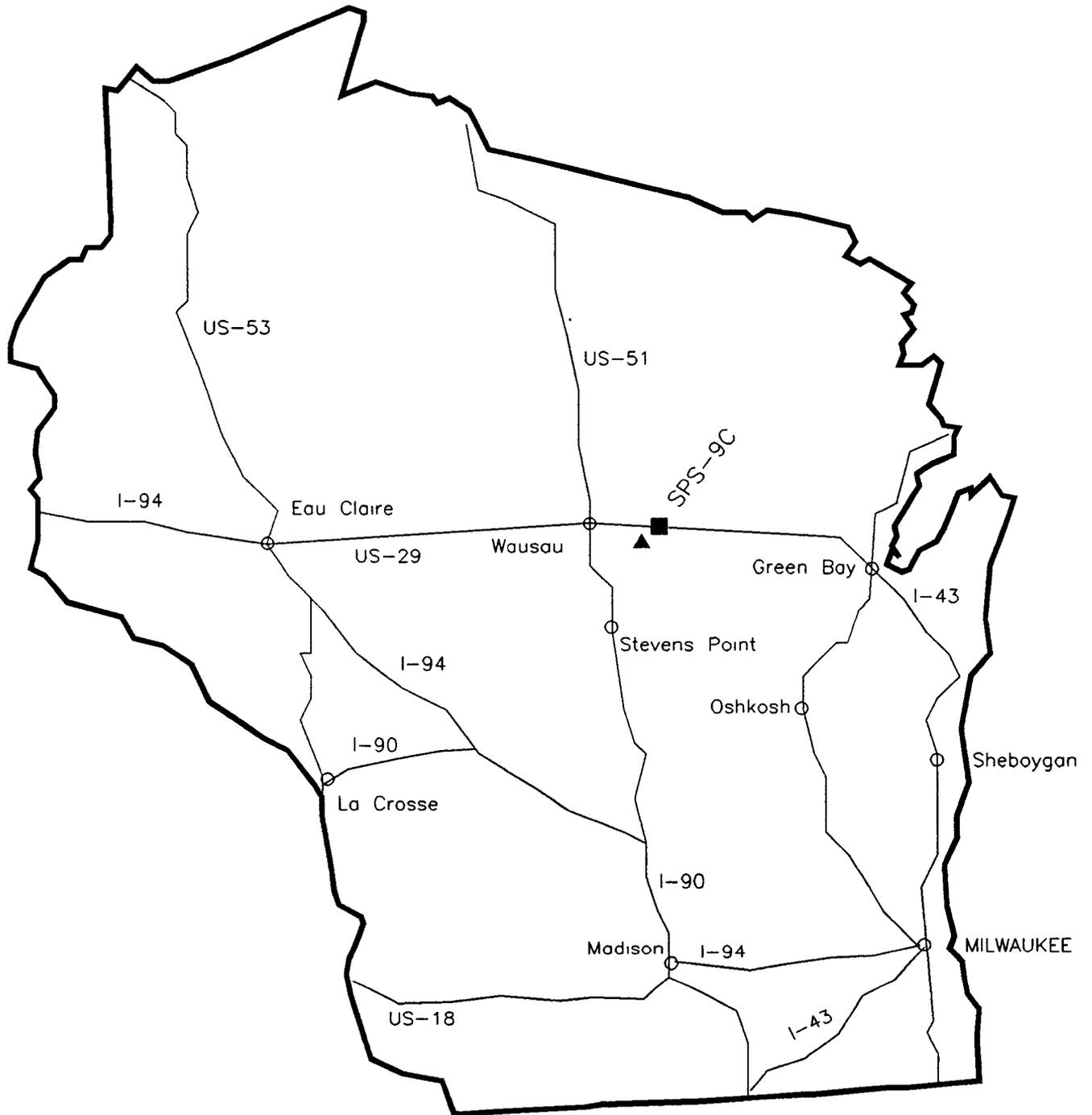
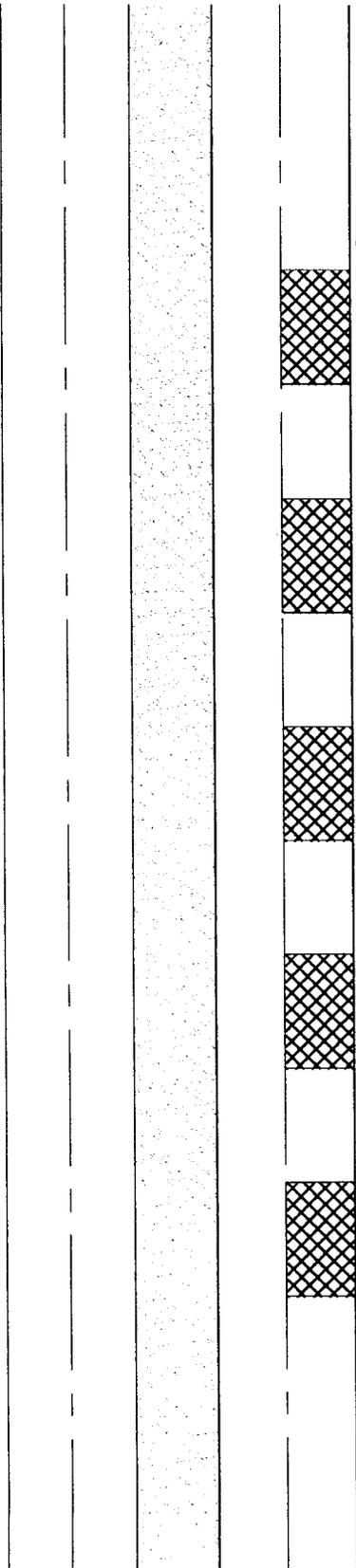
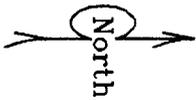


Figure A-1. General Project Location.

Attachment B
Site Layout

WISCONSIN SPS-9C
US-29 WB
Marathon County
Frontage Road/4.8km East of Hatley



To the SPS-1



55C901
DOT Standard Mix
229mm AC/330mm DGAB



55C959
Superpave PG 58-28
229mm AC/330mm DGAB



55C902
Superpave PG 58-34
229mm AC/330mm DGAB



55C903
Superpave PG58-22
229mm AC/330mm DGAB



55C960
Superpave PG58-28 with RAP
229mm AC/330mm DGAB

To the SPS-2

Legend

AC-	Asphalt Concrete
DGAB-	Dense Graded Aggregate Base (WSDOT Crushed Aggregate Base Course)
RAP-	Recycled Asphalt Pavement

Note: WIM location approximately 1.6km east of 55C960

Figure B-1. Wisconsin SPS-9C site layout.

Revised 6-13-00

Attachment C
Material Sampling and Testing Plan

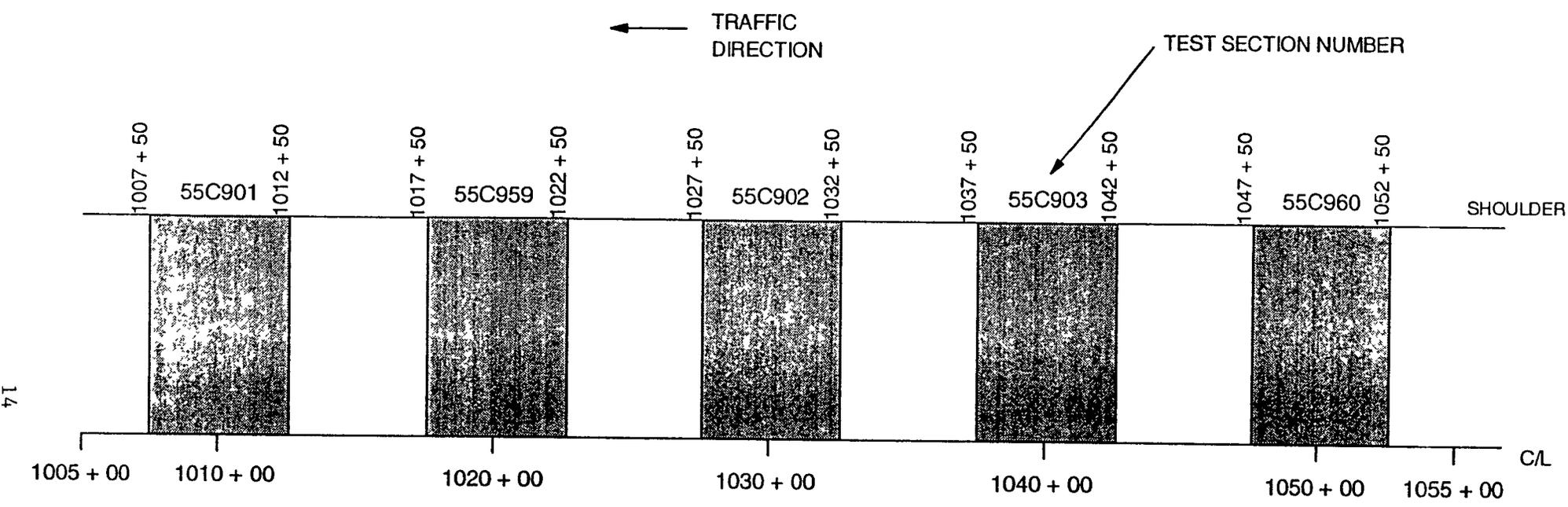
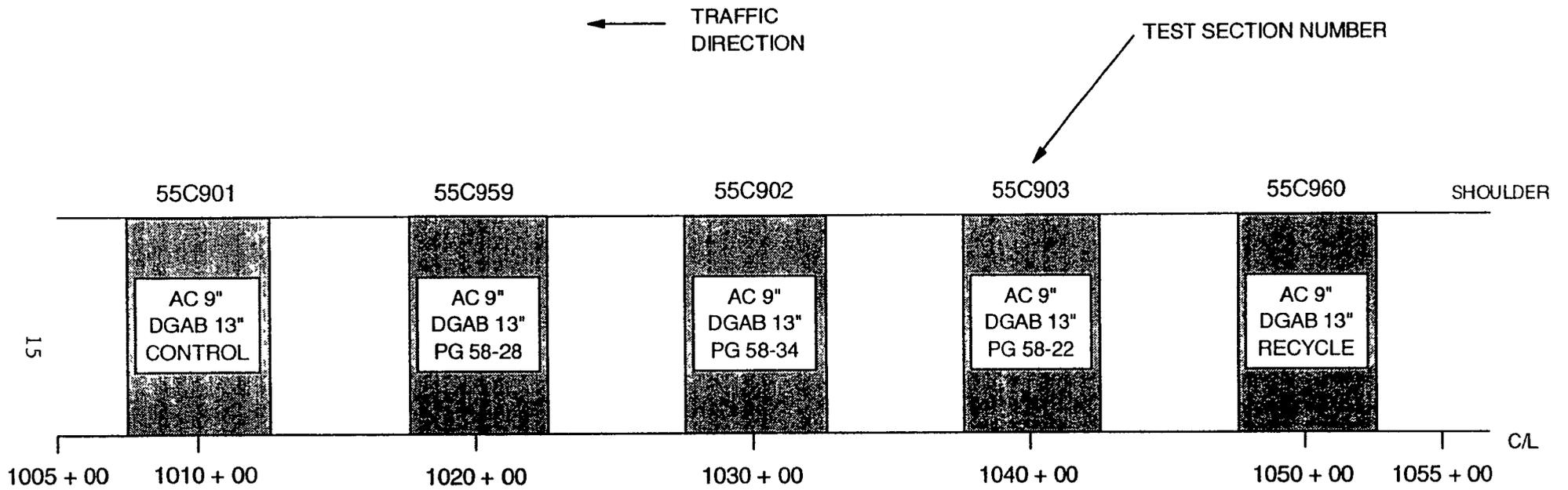


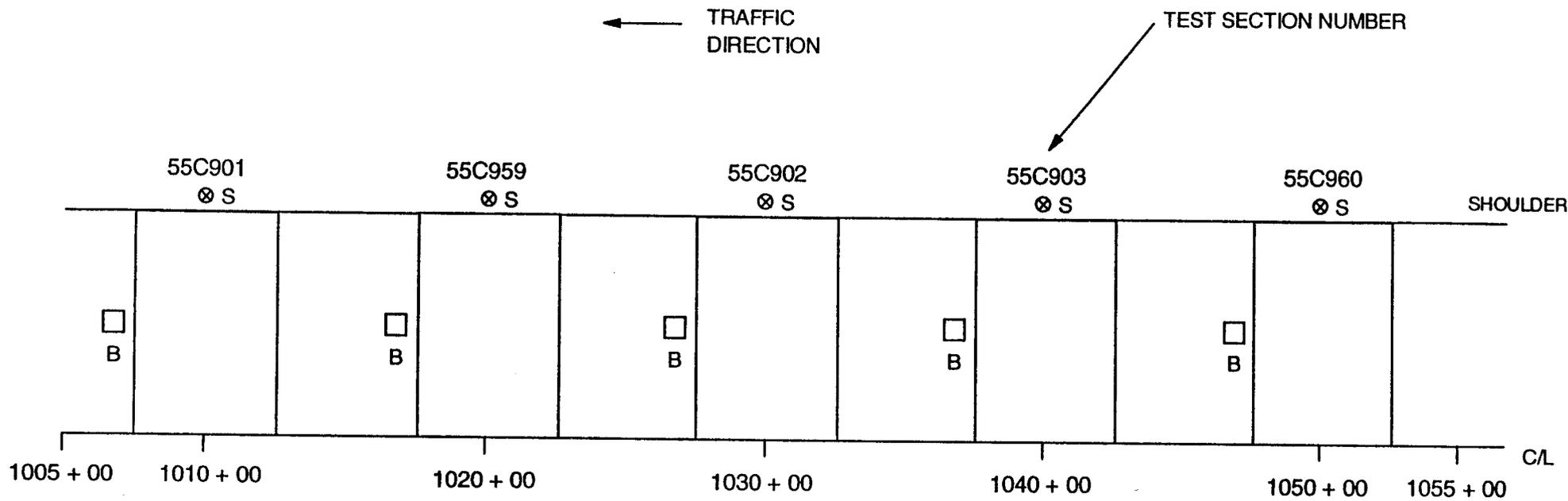
Figure 1. Layout of Test Sections.



NOTES

AC - ASPHALT CONCRETE
 DGAB - DENSE GRADED AGGREGATE BASE

Figure 2. Design Features of Test Sections.



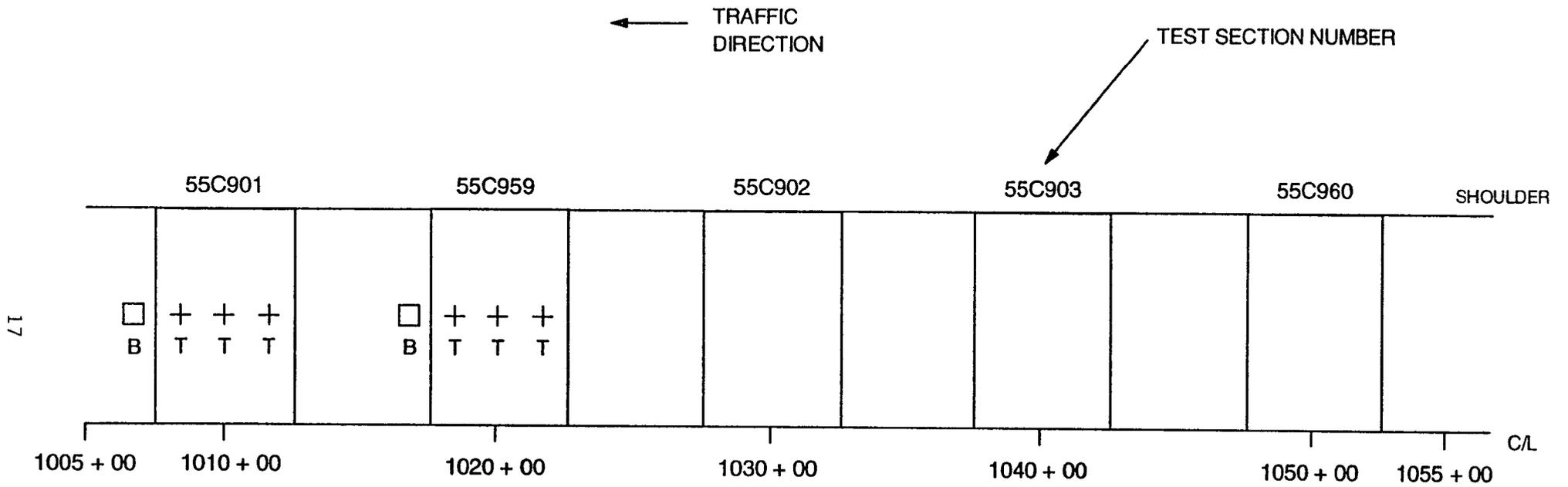
LEGEND

- ⊗ SHOULDER PROBE
- BULK SAMPLING LOCATION - 55 lb

NOTES

1. IF FILL MATERIAL IS NOT USED IN THE DRIVING LANE OF SECTIONS 55C901 AND 55C959, CONDUCT ELEVATION MEASUREMENTS AND DENSITY MEASUREMENTS ON THESE TWO SECTIONS IN LIEU OF EMBANKMENT TESTS.

Figure 3. Overview of Sampling and Testing Plan for Subgrade.



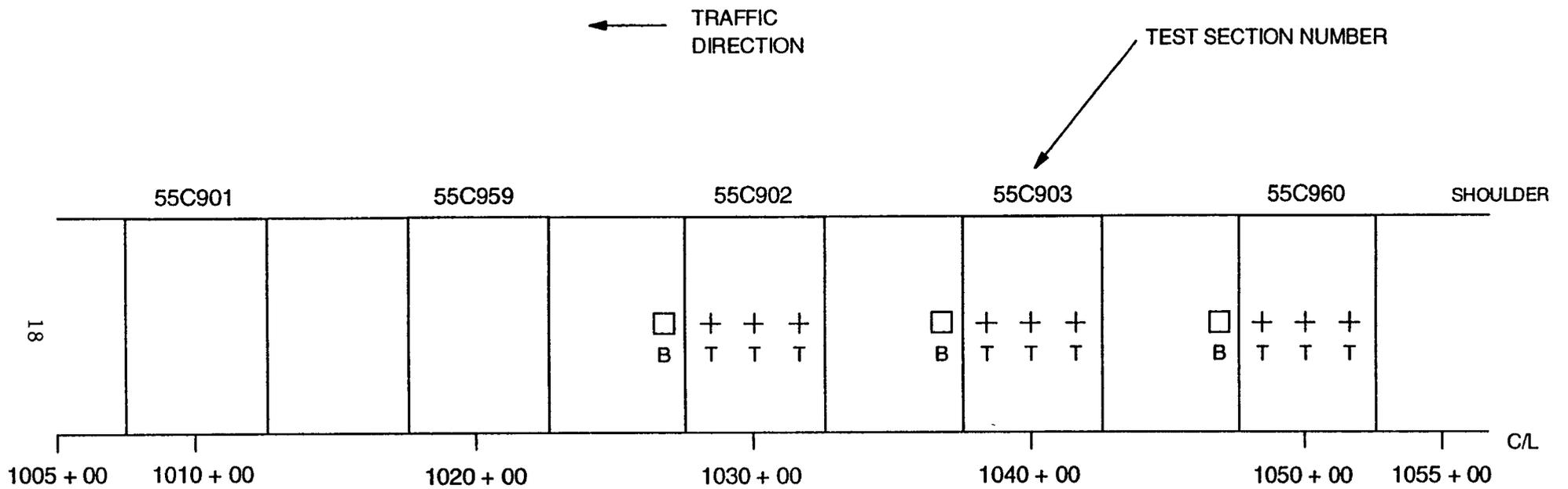
LEGEND

- + LOCATION OF FIELD NUCLEAR MOISTURE/DENSITY TESTING
- BULK SAMPLING LOCATION - 55 lb

NOTES

1. CONDUCT ELEVATION MEASUREMENTS ON SECTIONS 55C901 AND 55C959.

Figure 4. Overview of Sampling and Testing Plan for Embankment (Fill).



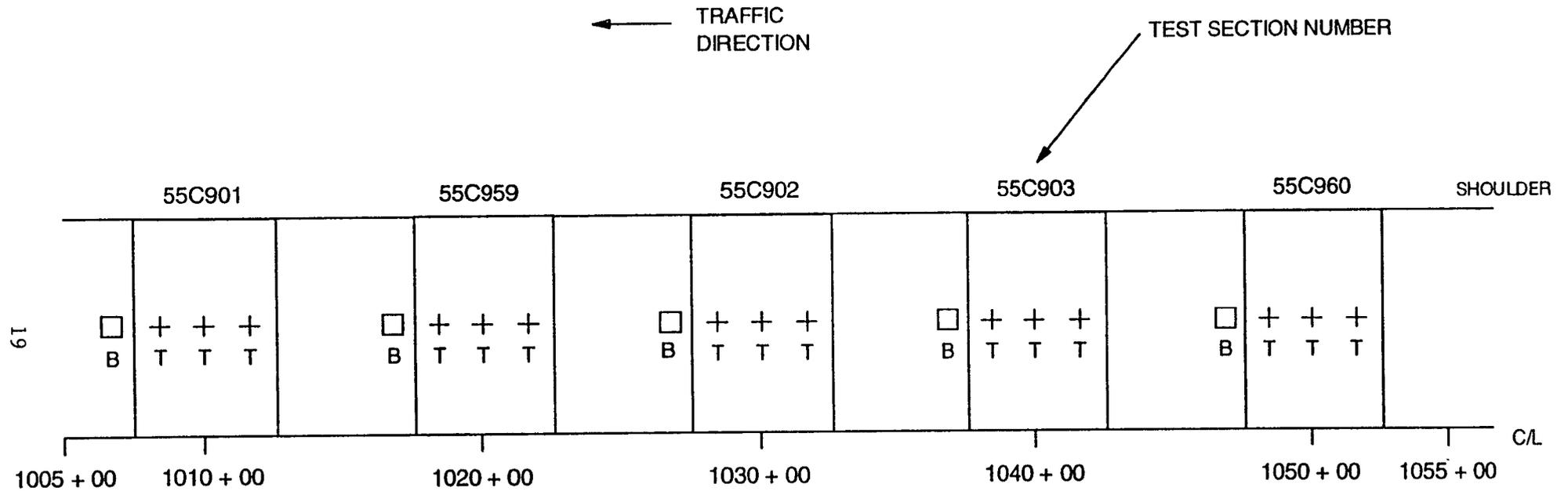
LEGEND

- + LOCATION OF FIELD NUCLEAR MOISTURE/DENSITY TESTING
- BULK SAMPLING LOCATION - 55 lb

NOTES

1. CONDUCT ELEVATION MEASUREMENTS ON SECTIONS 55C902, 55C903, AND 55C960.

Figure 5. Overview of Sampling and Testing Plan for Existing Subbase.



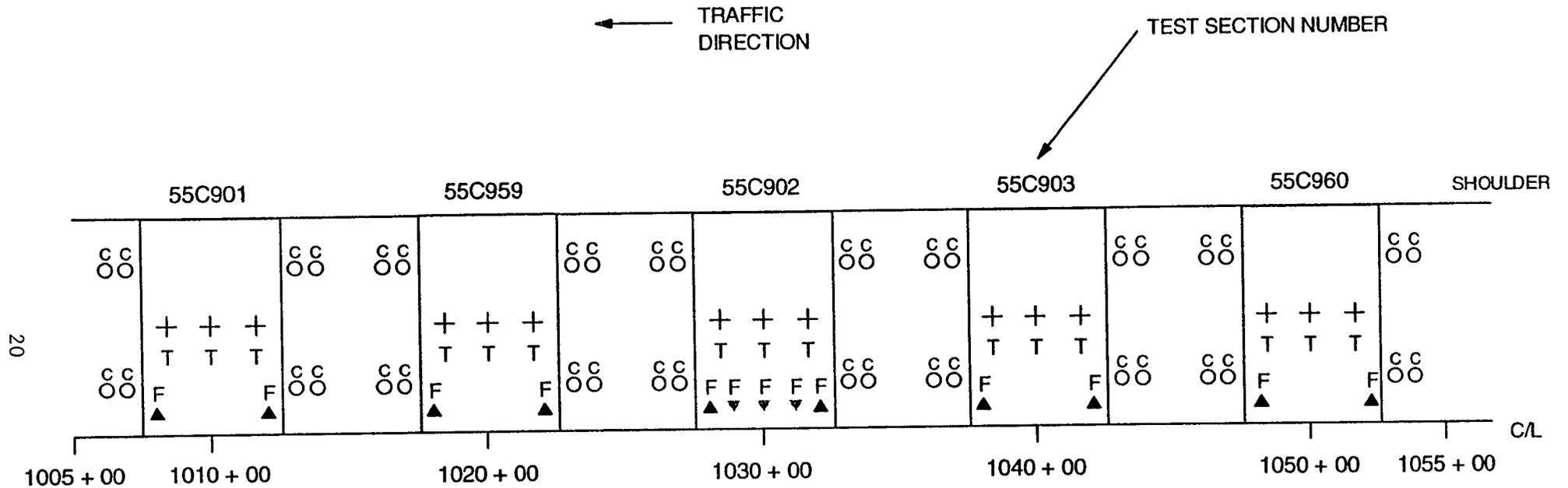
LEGEND

- + LOCATION OF FIELD NUCLEAR MOISTURE/DENSITY TESTING
- BULK SAMPLING LOCATION - 55 lb

NOTES

- 1 CONDUCT ELEVATION MEASUREMENTS ON ALL SECTIONS

Figure 6. Overview of Sampling and Testing Plan for Dense Graded Aggregate Base.



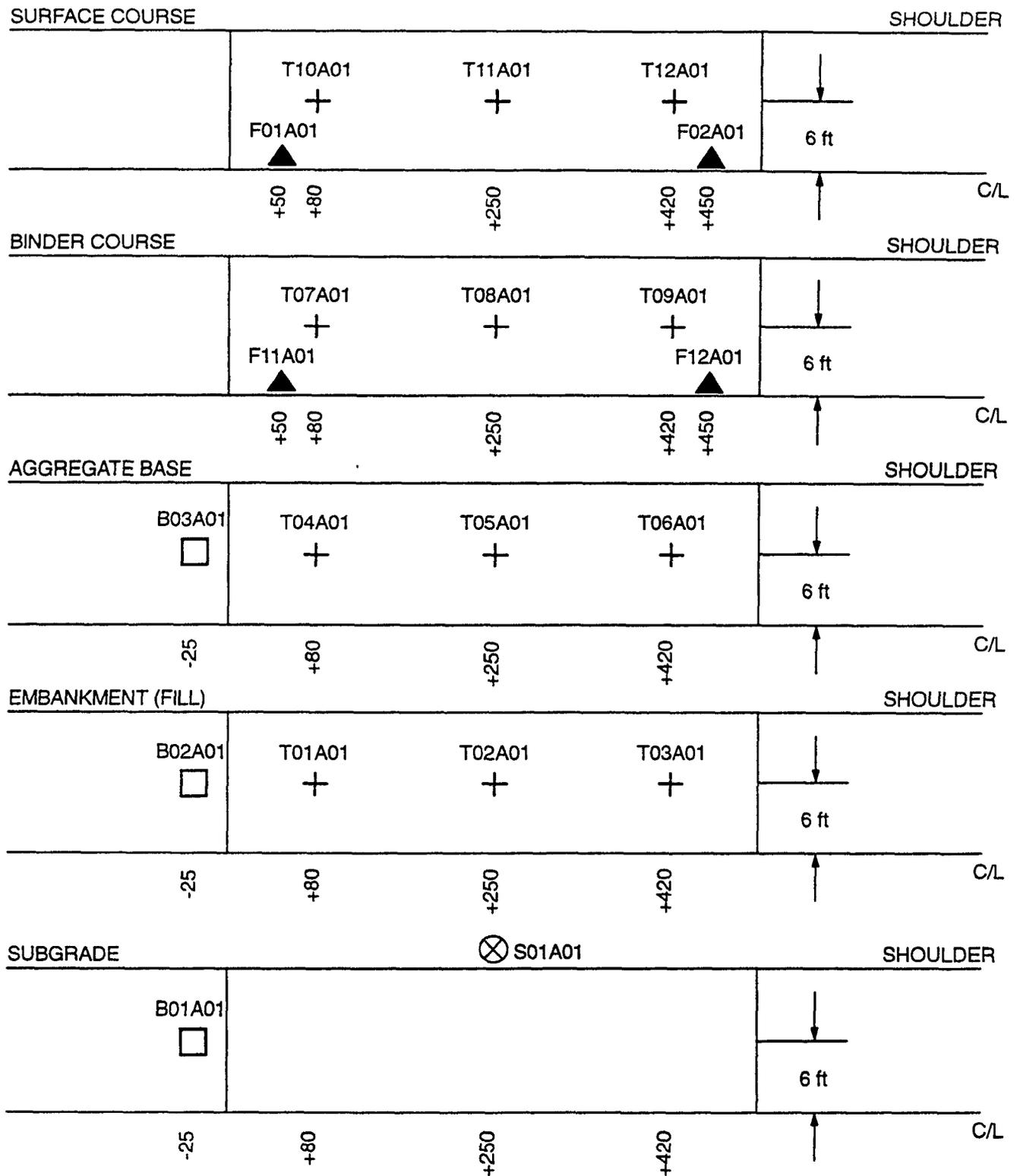
LEGEND

- + LOCATION OF FIELD NUCLEAR MOISTURE/DENSITY TESTING
- ▲ BULK SAMPLE LOCATION - 55 lb
- ▼ BULK SAMPLING LOCATION - 225 lb
- 6-IN CORE LOCATIONS

NOTES

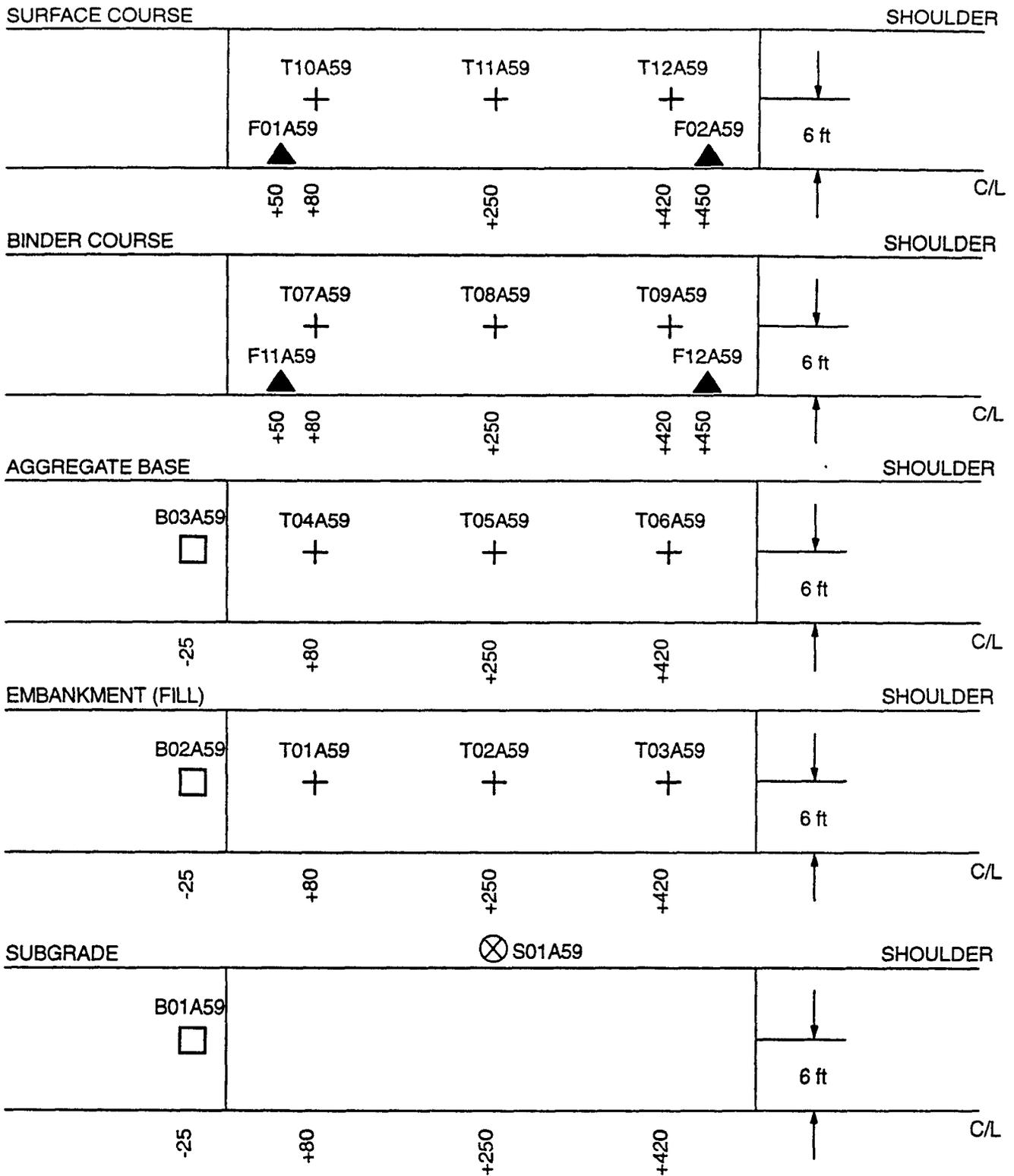
1. CONDUCT ELEVATION MEASUREMENTS ON FINAL LIFT OF BINDER COURSE AND ON SURFACE COURSE.
2. CONDUCT DENSITY MEASUREMENTS ON FINAL LIFT OF BINDER COURSE AND ON SURFACE COURSE.
3. OBTAIN BULK SAMPLES FROM FINAL LIFT OF BINDER COURSE AND FROM SURFACE COURSE FROM PAVER OR HAUL VEHICLE

Figure 7. Overview of Sampling and Testing Plan for Asphalt Concrete.



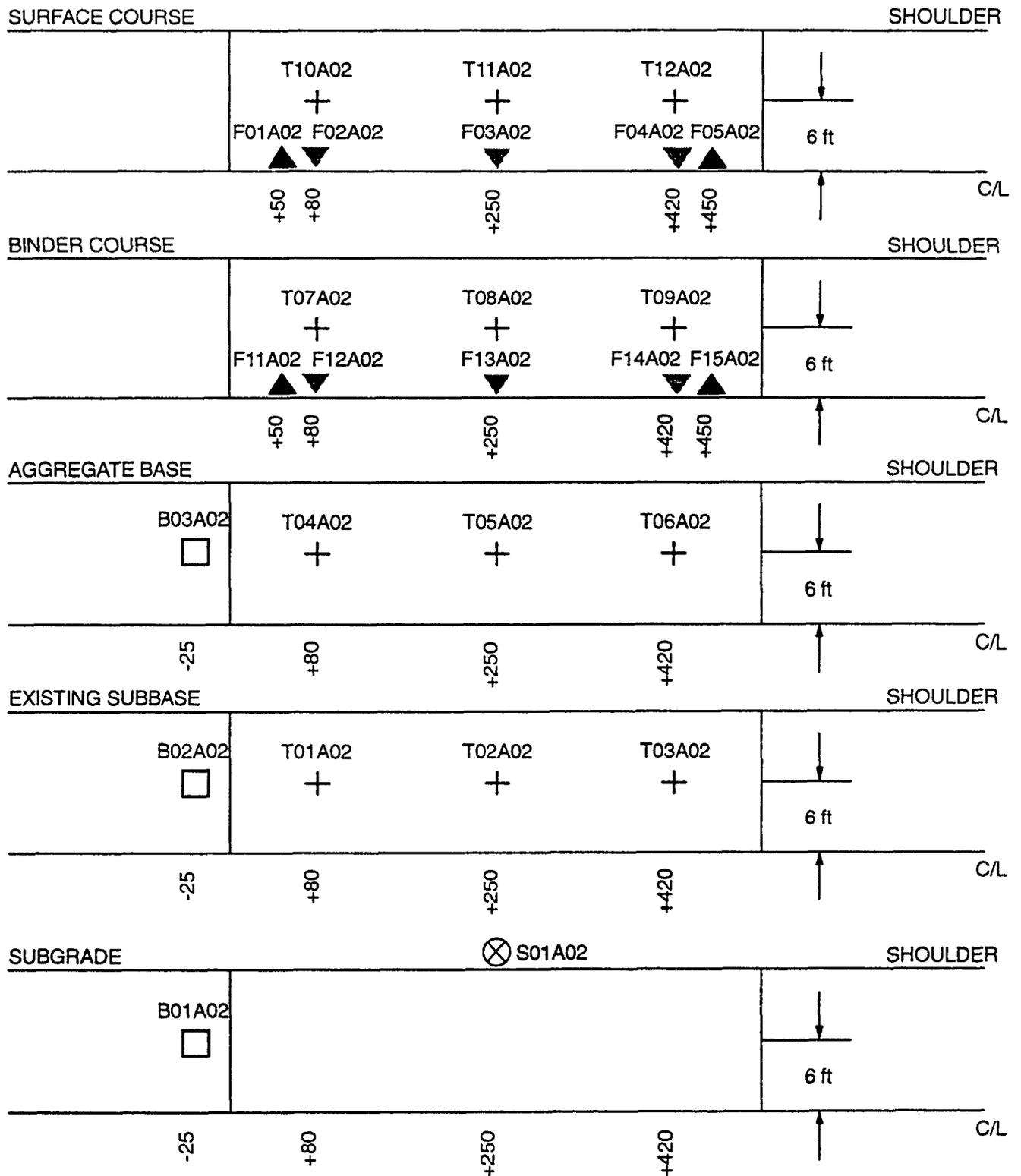
LEGEND			
⊗	SHOULDER PROBE LOCATION	+	DENSITY TEST LOCATION
□	BULK SAMPLE LOCATION (55 lb)	▲	BULK SAMPLE LOCATION (55 lb)

Figure 8. Construction Sampling and Testing - 55C901.



LEGEND			
⊗	SHOULDER PROBE LOCATION	+	DENSITY TEST LOCATION
□	BULK SAMPLE LOCATION (55 lb)	▲	BULK SAMPLE LOCATION (55 lb)

Figure 9. Construction Sampling and Testing - 55C959.



LEGEND	
⊗	SHOULDER PROBE LOCATION
□	BULK SAMPLE LOCATION (55 lb)
+	DENSITY TEST LOCATION
▲	BULK SAMPLE LOCATION (55 lb)
▼	BULK SAMPLE LOCATION (225 lb)

Figure 10. Construction Sampling and Testing - 55C902.

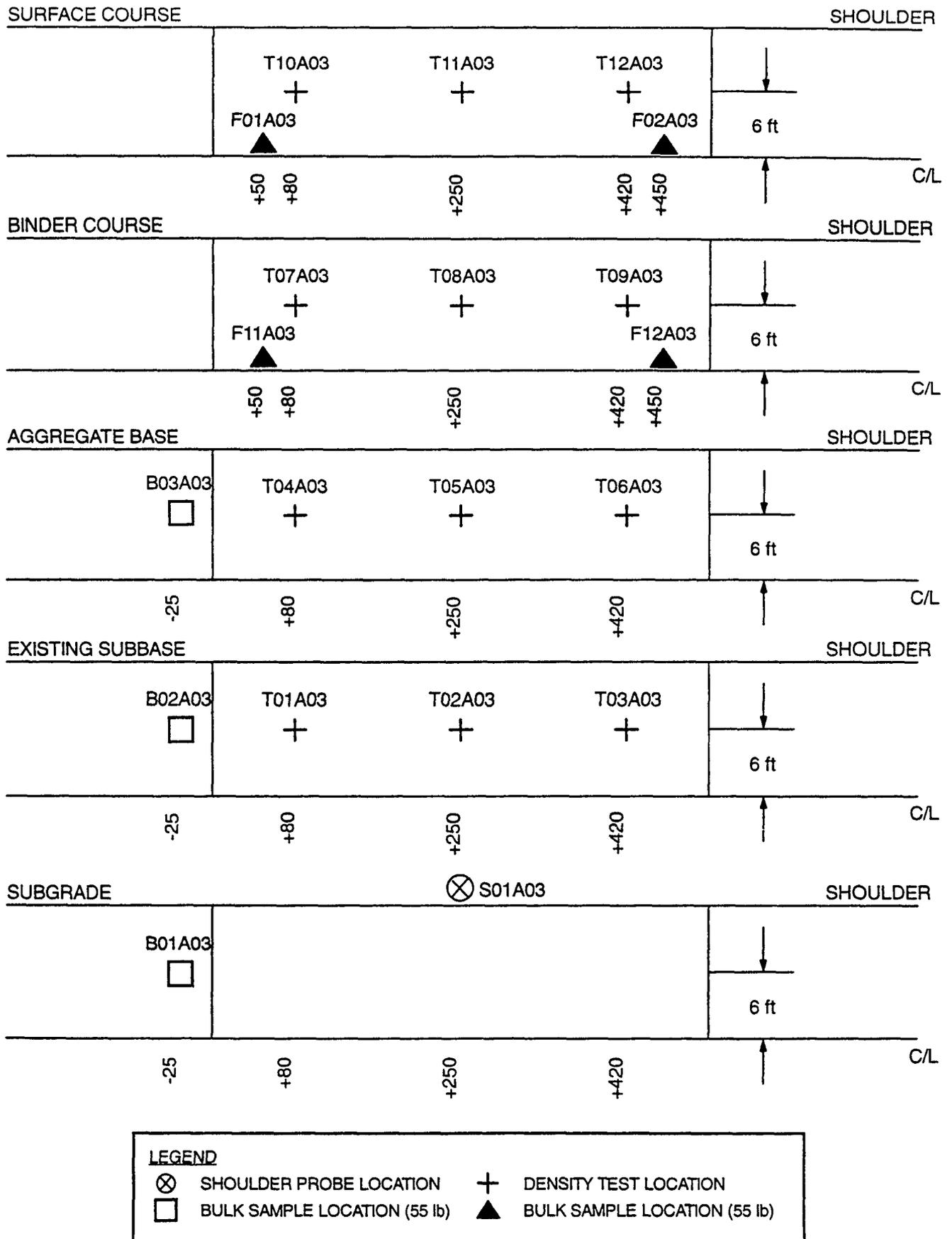


Figure 11. Construction Sampling and Testing - 55C903.

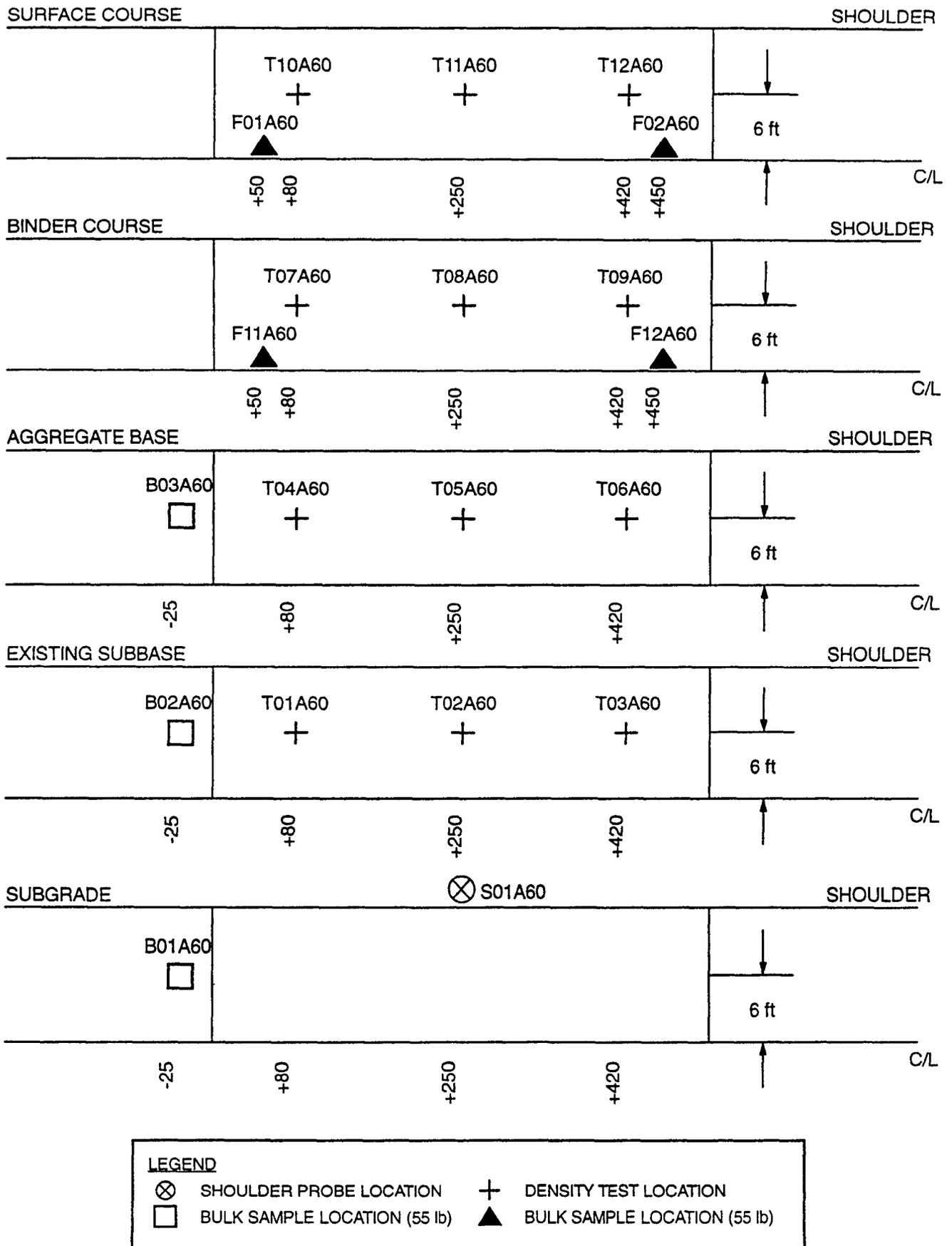


Figure 12. Construction Sampling and Testing - 55C960.

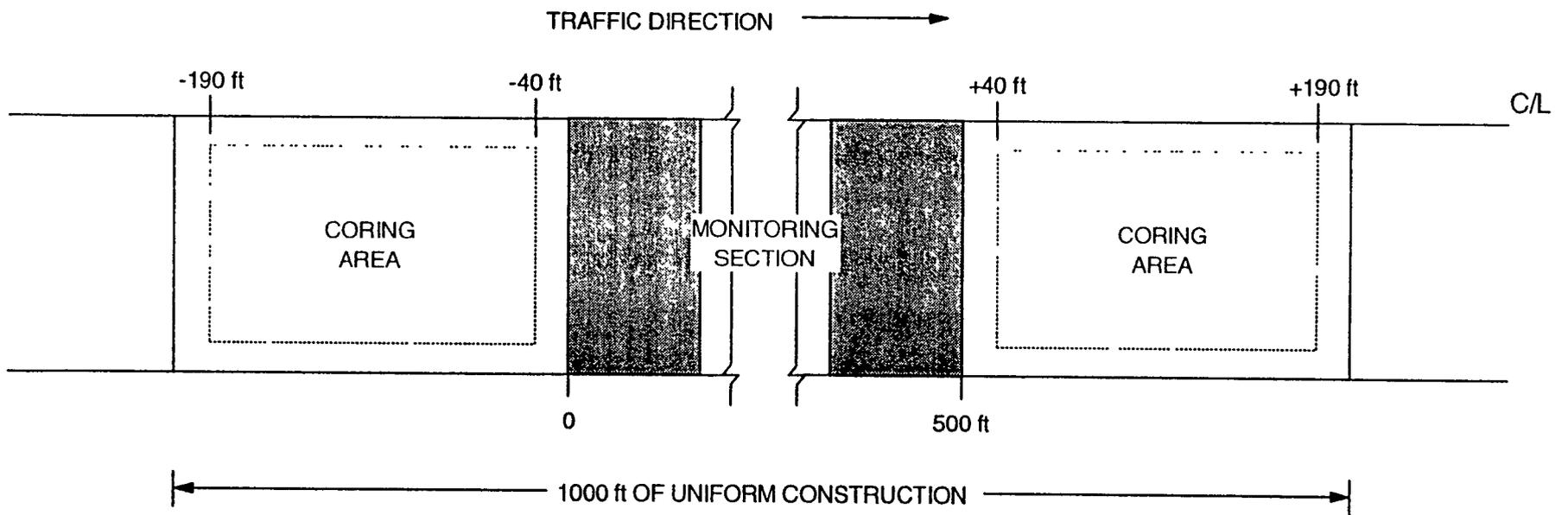
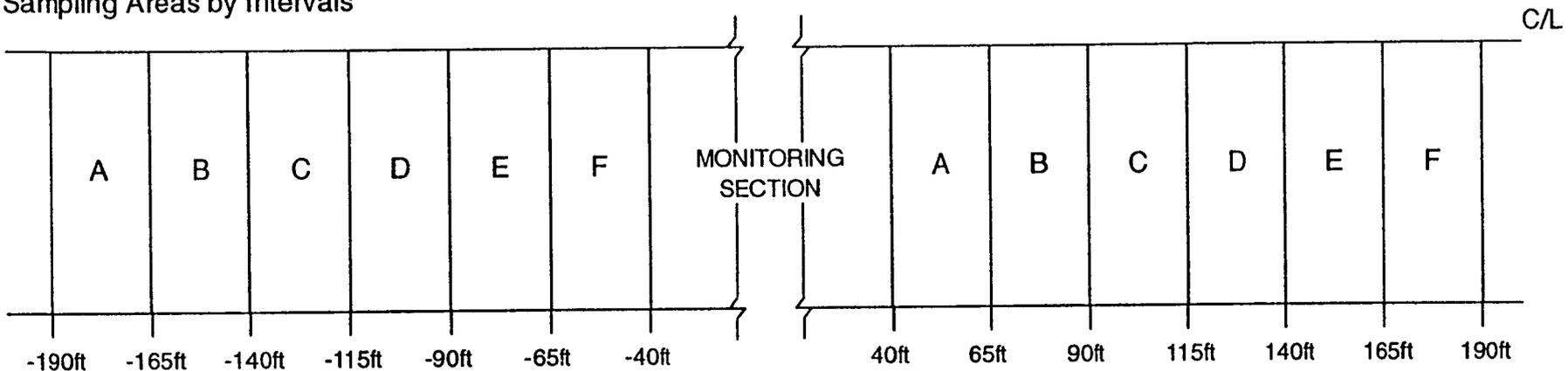


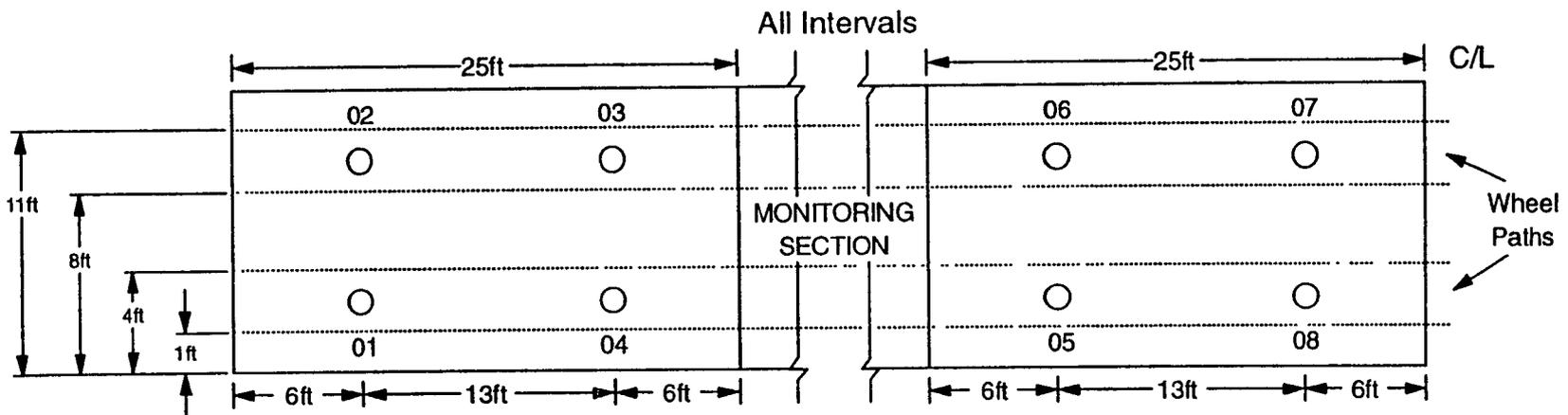
Figure 13. Coring Area for SPS-9A Test Sections.

TRAFFIC DIRECTION →

Sampling Areas by Intervals



27



NOT TO SCALE

Figure 14. Core Locations for SPS-9A Test Sections.

Attachment D

Layer Description and Thickness for Each Section

Table D-1 Layer description and thickness for each section.

Test Section	Layer Number	Material Code	Description	Average Layer Thickness (mm)
55C901 WB	1	211	Subgrade-well graded sand w/ silt & gravel	N/A
	2	210	Embankment-well graded sand w/ silt	610
	3	303	Base-crushed stone	330
	4	1	AC Binder-HV	198
	5	1	AC Surface-WI DOT mix	51
55C959 WB	1	214	Subgrade-silty sand	N/A
	2	210	Embankment-well graded sand w/ silt	610
	3	303	Base-crushed stone	330
	4	1	AC Binder-PG58-28	183
	5	1	AC Surface-PG58-28	41
55C902 EB	1	202	Subgrade-poorly graded sand	N/A
	2	308	Subbase-Soil-Aggregate Mixture	127
	3	303	Base-crushed stone	330
	4	1	AC Binder-PG58-34	175
	5	1	AC Surface-PG58-34	51
55C903 EB	1	205	Subgrade-poorly graded sand w/ silt & gravel	N/A
	2	308	Subbase-Soil-Aggregate Mixture	127
	3	303	Base-crushed stone	330
	4	1	AC Binder-PG58-22	183
	5	1	AC Surface-PG58-22	51
55C960 EB	1	214	Subgrade-silty sand	N/A
	2	210	Embankment-well-graded sand w/ silt	127
	3	303	Base-crushed stone	330
	4	13	AC Binder-PG58-28 w/RAP	163
	5	13	AC Surface-PG58-28 w/RAP	48

RAP = recycled asphalt pavement

Attachment E
Project Deviation Reports

LTPP SPS Project Deviation Report Project Summary Sheet		State Code Project Code	<u> 5 </u> <u> 5 </u>
		<u> 0 </u>	<u> 9 </u>
Project Classification Information			
SPS Experiment Number SPS-C9		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-C9			
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
Deviation Summary			
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
Data Collection and Processing Status Summary			
Inventory Data (SPS 5,6,7, & 9)	<input checked="" type="checkbox"/> Complete Submission	<input type="checkbox"/> Incomplete	<input type="checkbox"/> Data Not Available
Materials Data	<input type="checkbox"/> All Scheduled Samples Obtained and Tested	<input checked="" 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 checked="" type="checkbox"/> WIM Installed On-Site	<input 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 checked="" type="checkbox"/> Continuous	<input 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"/> 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 type="checkbox"/> Data Not Available
Friction Data:	<input type="checkbox"/> Complete Submission	<input type="checkbox"/> Incomplete	<input checked="" type="checkbox"/> Data Not Available
Report Status			
Materials Sampling and Test Plan	<input checked="" type="checkbox"/> Document Prepared	<input checked="" type="checkbox"/> Final Submitted To FHWA	
Construction Report	<input checked="" type="checkbox"/> Document Prepared	<input checked="" type="checkbox"/> Final Submitted To FHWA	
AWS (SPS 1, 2, & 8)	<input checked="" type="checkbox"/> AWS Installed	<input checked="" type="checkbox"/> AWS Installation Report Submitted to FHWA	

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

State Code
Project Code

 5 5
 0 9 0 0

Comments Pertain to All Test Sections on Project

Comments Pertain Only to Section(s) (Specify) 55C901

Construction Guidelines Deviation Comments

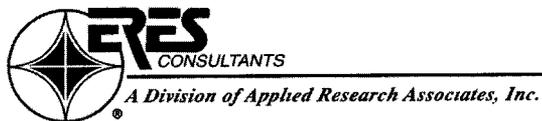
In all sections, except 55C901, only one AC mix was used instead of distinct binder and surface course mixes

Section 55C901 had a distinct binder and surface course

During the splitspoon testing, a number of existing concrete slabs were discovered beneath the old pavement structure. These areas of concrete were removed and fill was placed in these areas

Shoulders were 0.9 m wide instead of the 1.2 m called for in the guidelines

Submitted by



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