

**FEDERAL HIGHWAY ADMINISTRATION
Long Term Pavement Performance (LTPP)
Specific Pavement Studies**

**Materials Sampling, Field Testing
and Laboratory Testing Plan for
Montana SPS-1
(Site 300100)
and
Montana SPS-9A
(Site 300900)**

**Interstate Highway No. I-15
Cascade County
Montana**

FINAL

**Prepared for:
Montana Department of Transportation**

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Materials Sampling, Field Testing, and Laboratory Testing Plan SPS-1 Experimental Project on I-15 in Montana

This document presents materials sampling and testing plans for the experimental Long-Term Pavement Performance (LTPP) SPS-1 project on I-15 in Cascade County, Montana. The experimental test sections will be constructed in the northbound direction.

Background

The LTPP SPS-1 experiment entitled, "Strategic Study of Structural Factor for Flexible Pavements," consists of the construction of 12 test sections with asphalt concrete (AC) surface layers and base layers of varying thickness and material types.

Materials sampling, field tests, and laboratory test procedures developed by the Strategic Highway Research Program (SHRP) must be followed for the experimental test sections constructed on this project.

SPS-1 Sampling and Testing

This document presents the details of materials sampling, field testing, and laboratory testing for the SPS-1 experimental test sections to be constructed and monitored. Material sampling and testing on this project includes the following measurements, tests, and samples from the various pavement layers:

Existing Embankment

- Bulk and moisture sampling of the existing embankment
- Nuclear moisture and density tests on the existing embankment
- Auger probes through the shoulder to a depth of 20 ft below the existing embankment

Prepared Subgrade (Borrow)

- Bulk and moisture sampling of the prepared subgrade surface
- Nuclear moisture and density tests on the prepared subgrade surface
- Base line elevation surveys on the surface of the prepared subgrade to use as a reference in determining layer thickness
- Falling Weight Deflectometer (FWD) measurements (to be performed by the Western Regional Coordination Office Contractor (WRCOC))

Dense-Graded Aggregate Base

- Bulk and moisture sampling of the Dense-Graded Aggregate Base (DGAB)
- Nuclear moisture and density tests on the prepared DGAB surface

- Elevation measurements on the prepared DGAB surface
- FWD measurements on the prepared DGAB (to be performed by the WRCOC)

Permeable Asphalt-Treated Base

- Bulk sampling of the Permeable Asphalt-Treated Base (PATB) material
- Elevation measurements on the prepared PATB surface

Asphalt-Treated Base

- Bulk sampling of the Asphalt-Treated Base (ATB) material
- Bulk sampling of the asphalt cement used in the ATB
- Nuclear density tests on compacted ATB
- FWD deflection measurements on the compacted ATB (to be performed by the WRCOC)
- Coring of the ATB for laboratory testing
- Elevation measurements on the prepared ATB surface

Asphalt Concrete Surface

- Bulk sampling of the Asphalt Concrete (AC) mixture
- Bulk sampling of the Asphalt Cement used in the AC mixture
- Nuclear density tests on compacted AC
- Elevation measurements on the prepared AC surface
- Coring of the AC for laboratory testing
- FWD deflection measurements on the compacted AC (to be performed by the WRCOC)

Sampling for the Materials Reference Library (MRL)

- Bulk sampling of the Asphalt Concrete (AC) mixture and ATB mixture
- Bulk sampling of the Asphalt Cement used in the AC, ATB, and PATB
- Bulk sampling of the aggregate used in the AC and ATB

The development of the materials sampling plan was based upon an assumed continuous construction sequencing. Significant time delays between the construction of the test sections may require changes to this sampling plan. The details for these samples, tests, and measurements are presented in subsequent portions of this document, organized by material layer type.

Referenced Documents

In addition to the appropriate AASHTO and ASTM standards methods and tests referenced in this document, the following SHRP documents serve as reference material which contain greater details on the sampling and testing required for the SPS-1 project:

Specific Pavement Studies, Materials Sampling, and Testing Requirements for Experiment SPS-1, Strategic Study of Structural Factors for Flexible Pavements, Operational Memorandum No. SHRP-LTPP-OM-021, Strategic Highway Research Program, Revised January, 1994.

SHRP-LTPP Guide for Field Materials Sampling, Testing, and Handling, Version 2.0, Operational Guide No. SHRP-LTPP-OG-006, Strategic Highway Research Program, May 1990.

Specific Pavement Studies, Construction Guidelines for Experiment SPS-1, Strategic Study of Structural Factors for Flexible Pavements, Operational Memorandum No. SHRP-LTPP-OM-017, Strategic Highway Research Program, December, 1993.

SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing (AC, Bituminous Materials, Aggregates, and Soils), Operational Guide No. SHRP-LTPP-OG-004, Strategic Highway Research Program, November, 1989, (Revised and Amended July, 1993).

Test Section Layout

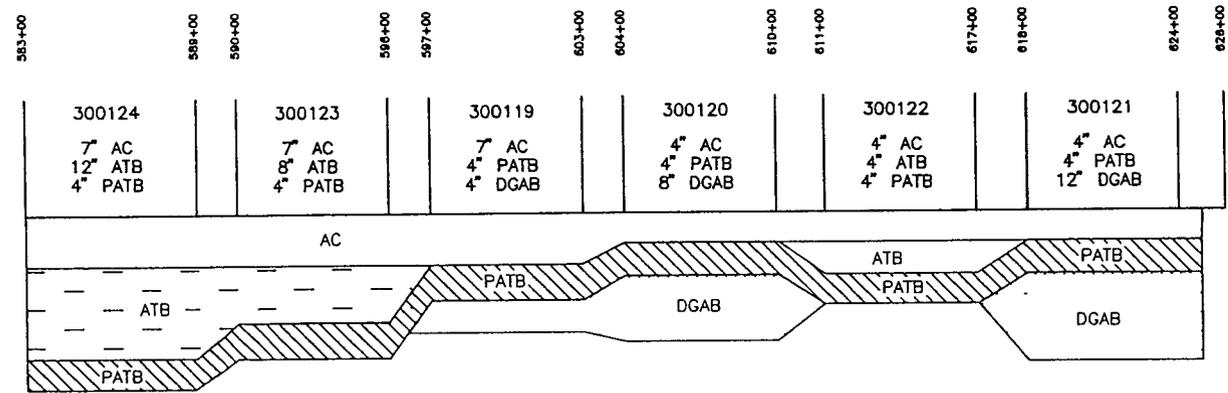
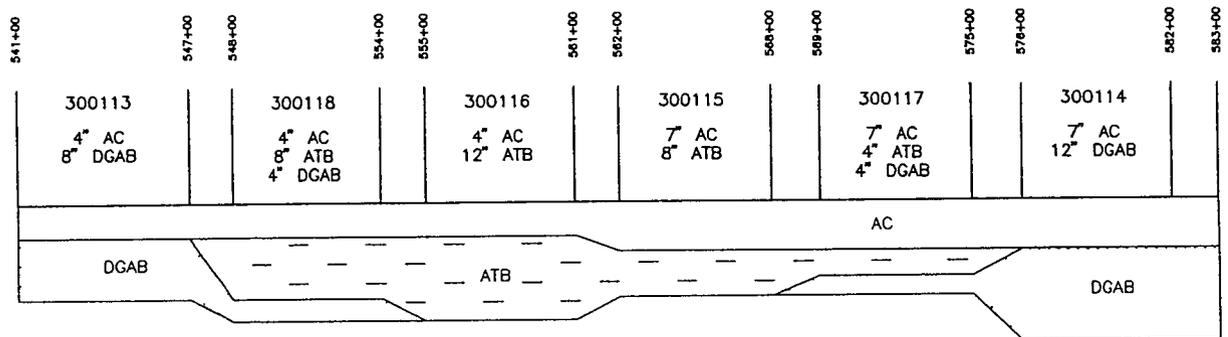
Figure 1 illustrates the ordering and combination of experimental SPS-1 test section pavement structures to be constructed. Construction stations are shown in this figure. Stylized transitions in the pavement structure are shown between the test sections.

The construction stationing and LTPP test section stationing for the location of the SPS-1 test sections are shown in table 1. Test section stationing refers to the method LTPP uses to reference locations within and adjacent to the ends of individual test sections. The LTPP test section stations are referenced to station 0+00 assigned to the beginning of the 500 ft monitoring portion of the test section, and station 5+00 at the end of the monitoring portion. In this table the six-digit LTPP test section numbers are also shown. The six-digit number is the official test section number for use on all data forms. The last two numbers of the six-digit number correspond to the LTPP test section designation. The relevant design features of each test section are shown in this table.

The limit of each test section is defined in table 1 as the area between, but including the destructive testing areas. Each test section consists of three portions, the destructive testing areas, the monitoring testing area and the transitions. The destructive sampling areas are located immediately before and after the monitoring portion. These locations are listed in table 1, designated as the area between "begin" and "begin monitoring" and between "end monitoring" and "end." The monitoring area is a 500 ft length within which no destructive testing on the surfacing is allowed. This monitoring area is designated as the area between the "begin monitoring" and "end monitoring" stations in table 1. Transition areas are those designated for the transition from differing materials, differing thicknesses or differing cross-sections. No sampling, testing, or monitoring will be performed within the transition areas.

All changes in materials, thicknesses, or properties should occur within the designated transition zones.

In general, all sampling of compacted material should occur outside of the monitoring portion, but between the start and end of the test section. The only samples and tests performed within the 500 ft monitoring portion are elevation measurements, nuclear moisture-density tests, and FWD measurements.



AC - Asphalt Concrete
 PATB - Permeable Asphalt Treated Base
 ATB - Asphalt Treated Base
 DGAB - Dense Graded Aggregate Base

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Figure 1. Layout of Experimental Test Sections, Montana SPS-1 Project, I-15

Table 1 Test section location table showing SPS-1 construction and project stations

Site	Location	Construction Stationing	Test Section Stationing	Test Section	Notes
Transition		540+00 to 541+00		100'	
30013	Begin	541+00	0-50	4" AC 8" DGAB	
	Begin Monitoring	541+50	0+00		
	End Monitoring	546+50	5+00		
	End	547+00	5+50		
Transition		547+00 to 548+00		100'	
300118	Begin	548+00	0-50	4" AC 8" ATB 4" DGAB	
	Begin Monitoring	548+50	0+00		
	End Monitoring	553+50	5+00		
	End	554+00	5+50		
Transition		554+00 to 555+00		100'	
300116	Begin	555+00	0-50	4" AC 12" ATB	
	Begin Monitoring	555+50	0+00		
	End Monitoring	560+50	5+00		
	End	561+00	5+50		
Transition		561+00 to 562+00		100'	
300215	Begin	562+00	0-50	7" AC 8" ATB	
	Begin Monitoring	562+50	0+00		
	End Monitoring	567+50	5+00		
	End	568+00	5+50		
Transition		568+00 to 569+00		100'	
300117	Begin	569+00	0-50	7" AC 4" ATB 4" DGAB	
	Begin Monitoring	569+50	0+00		
	End Monitoring	574+50	5+00		
	End	575+00	5+50		
Transition		575+00 to 576+00		100'	
300114	Begin	576+00	0-50	7" AC 12" DGAB	
	Begin Monitoring	576+50	0+00		
	End Monitoring	581+50	5+00		
	End	582+00	5+50		
Transition		582+00 to 583+00		100'	
300124	Begin	583+00	0+50	7" AC 12" ATB 4" PATB	
	Begin Monitoring	583+50	0+00		
	End Monitoring	588+50	5+00		
	End	589+00	5+50		
Transition		589+00 to 590+00		100'	
300123	Begin	590+00	0-50	7" AC 8" ATB 4" PATB	
	Begin Monitoring	590+50	0+00		
	End Monitoring	595+50	5+00		
	End	596+00	5+50		
Transition		596+00 to 597+00		100'	
300119	Begin	597+00	0-50	7" AC 4" PATB 4" DGAB	
	Begin Monitoring	597+50	0+00		
	End Monitoring	602+50	5+00		
	End	603+00	5+50		
Transition		603+00 to 604+00		100'	

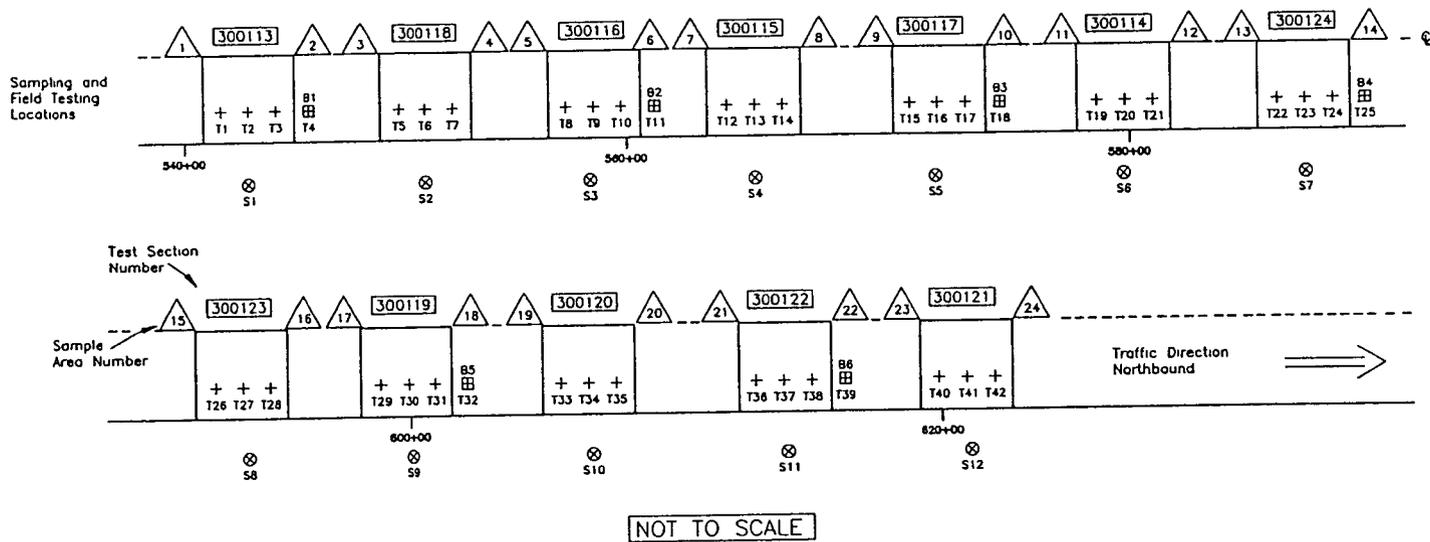
Table 1 Test section location table showing SPS-1 construction and project stations. (cont'd)

Site	Location	Construction Stationing	Test Section Stationing	Test Section	Notes
300120	Begin	604+00	0-50	4" AC 4" PATB 8" DGAB	
	Begin Monitoring	604+50	0+00		
	End Monitoring	609+50	5+00		
	End	610+00	5+50		
Transition		610+00 to 611+00		100'	
300122	Begin	611+00	0-50	4" AC 4" ATB 4" PATB	
	Begin Monitoring	611+50	0+00		
	End Monitoring	616+50	5+00		
	End	617+00	5+50		
Transition		617+00 to 618+00		100'	
300121	Begin	618+00	0-50	4" AC 4" PATB 12" DGAB	
	Begin Monitoring	618+50	0+00		
	End Monitoring	623+50	5+00		
	End	624+00	5+50		

Summary of Sampling and Testing on each Test Section

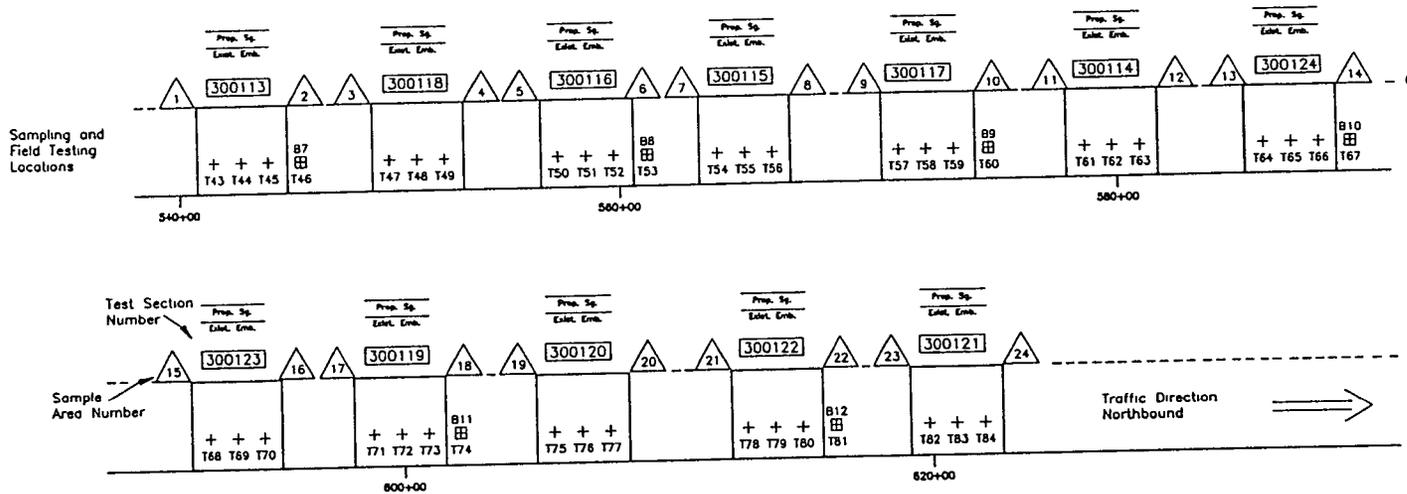
An overview of the materials sampling and testing to be performed on all test sections is shown in figures 2 through 7. Samples and tests on the existing embankment and all other pavement layers are illustrated in these figures.

Figures 8 through 19 illustrate the sampling and test details for each test section. In these figures, the surface material present during the various construction stages are shown starting with the surface of the existing embankment. Locations are specified by the test section stations relative to the beginning and end of the monitoring portion of each test section. The construction stations of the beginning and end of the monitoring portion of the test section are shown for reference. The only measurements not shown in these figures are the FWD deflection measurements and elevation surveys to be performed on the finished surface of each material layer. Further details associated with the sampling and testing shown in these figures are provided in the tables presented in the following portion of this document, arranged by layer material type.



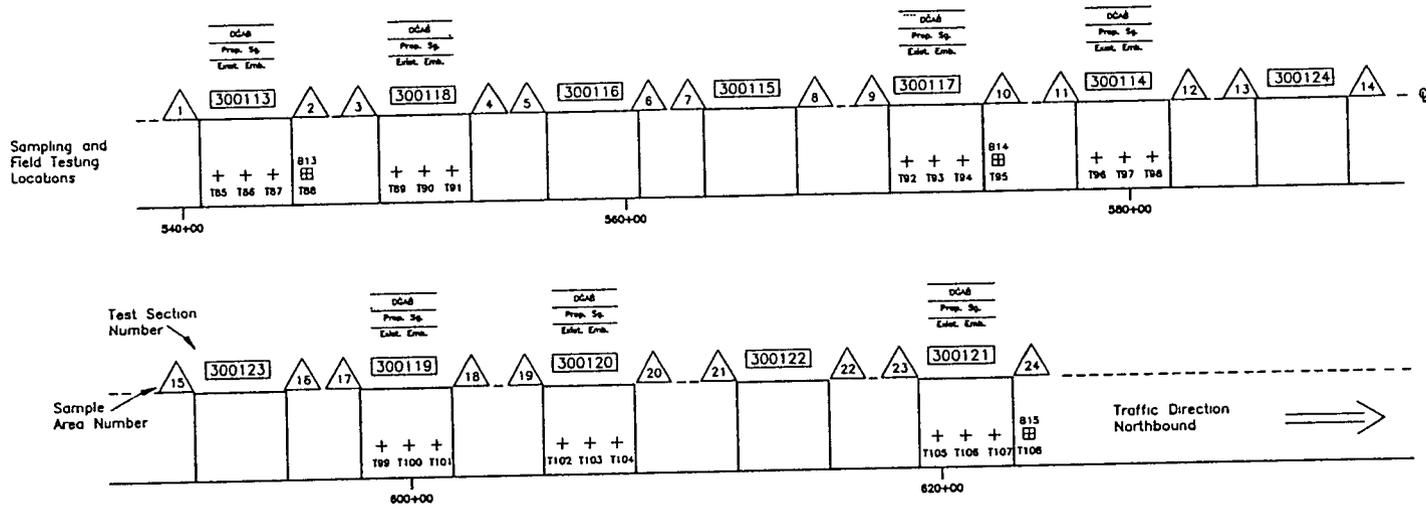
- 2' x 2' bulk sampling location (B1–B6) to 12" below top of Existing Embankment
- ⊗ Shoulder probe (S1–S12)
- + Location of nuclear moisture–density tests (T1–T42)
- △ Sample areas

Figure 2. Overview of material sampling and testing on Existing Embankment, SPS–1 Montana.



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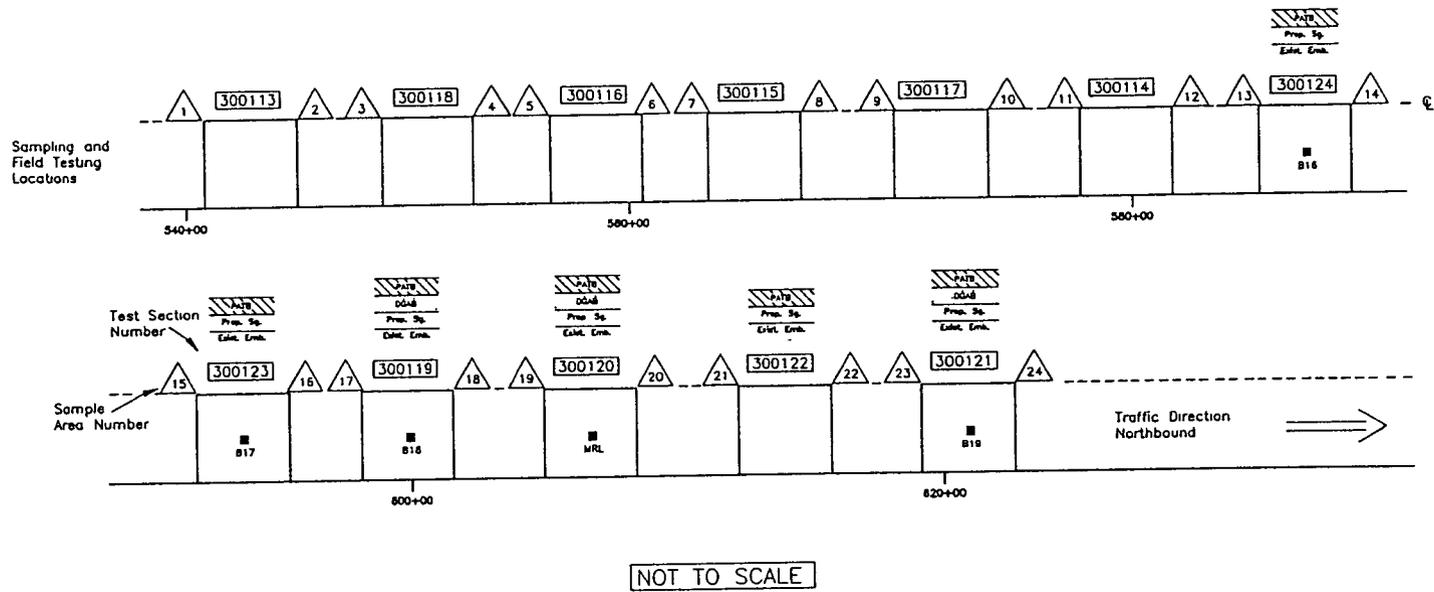
Figure 3 Overview of material sampling and testing on Prepared Subgrade, SPS-1 Montana



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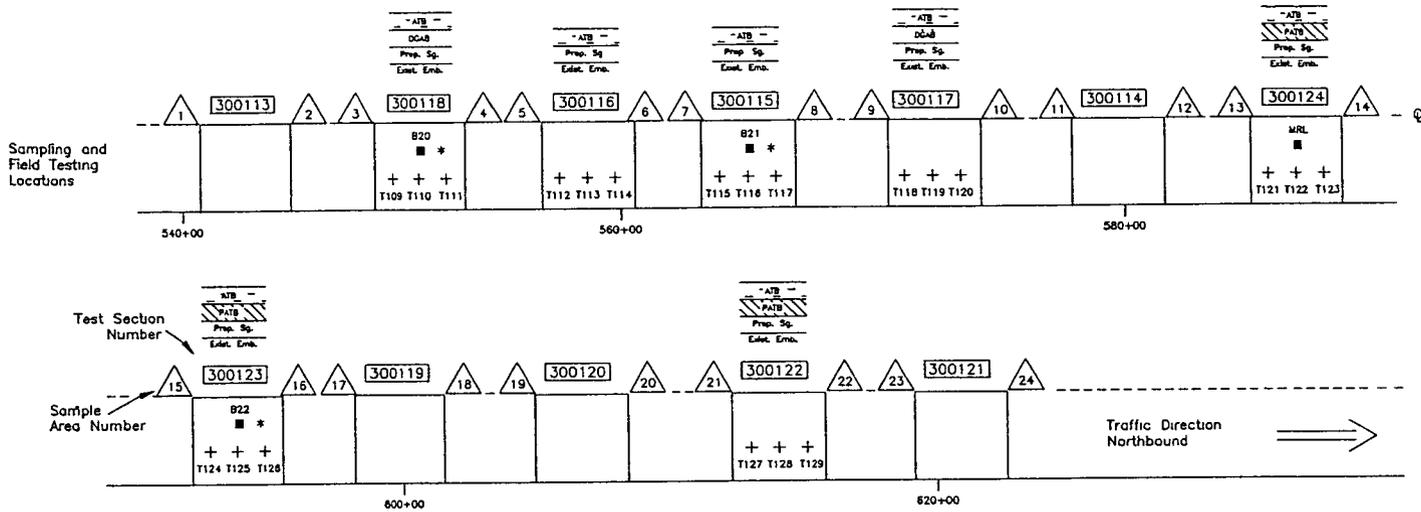
- 2' x 2' bulk sampling location (B13-B15) to 12" below top of Dense Graded Aggregate Base
- + Location of nuclear moisture-density tests (T85-T108)
- Prep Sg - Prepared Subgrade
- Exist. Emb - Existing Embankment
- DGAB - Dense Graded Aggregate Base
- △ Sample areas

Figure 4 Overview of material sampling and testing on Dense Graded Aggregate Base, SPS-1 Montana



- Bulk sample of PATB (B16–B19)
- Exist. Emb – Existing Embankment
- Prep Sg – Prepared Subgrade
- DGAB – Dense Graded Aggregate Base
- PATB – Permeable Asphalt Treated Base
- MRL Bulk mixture sample
- △ Sample areas

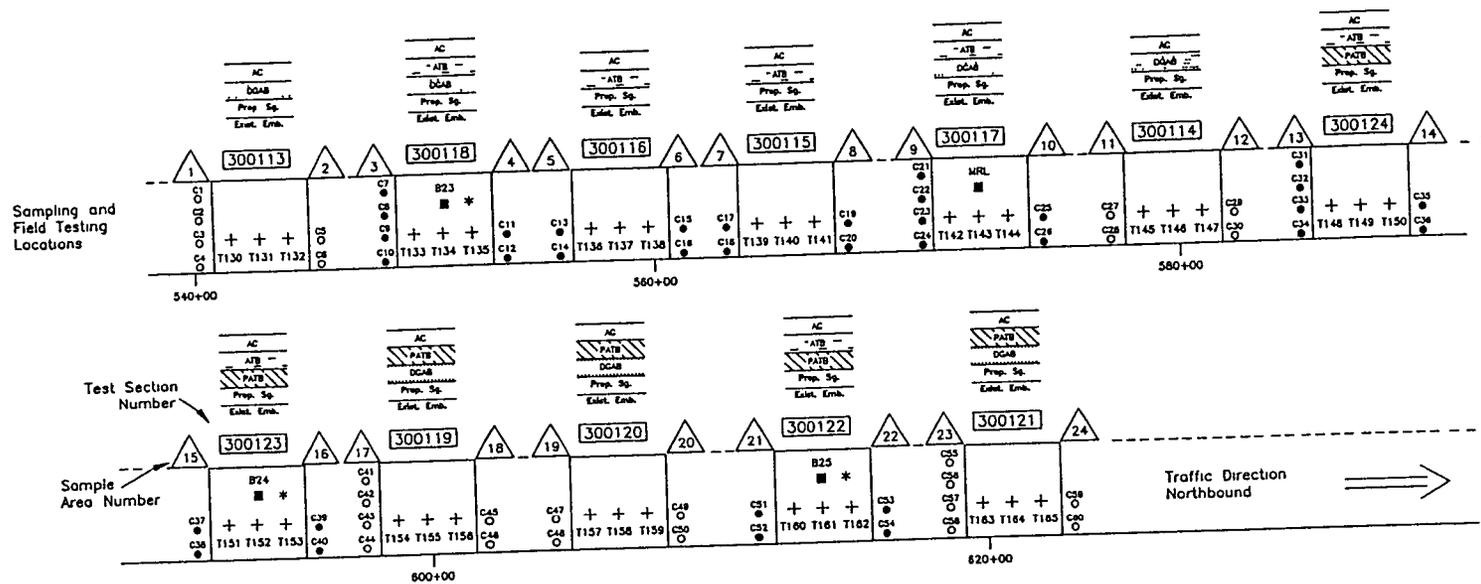
Figure 5 Overview of material sampling and testing on Permeable Asphalt Treated Base, SPS-1 Montana



- + Location of nuclear moisture-density tests (T109–T129)
- Bulk sample of ATB (B20–B22)
- Prep. Sg – Prepared Subgrade
- Exist. Emb – Existing Embankment
- DGAB – Dense Graded Aggregate Base
- ATB – Asphalt Treated Base
- PATB – Permeable Asphalt Treated Base
- △ Sample areas
- * Asphalt cement from plant (B26–B28)
- MRL Bulk mixture sample

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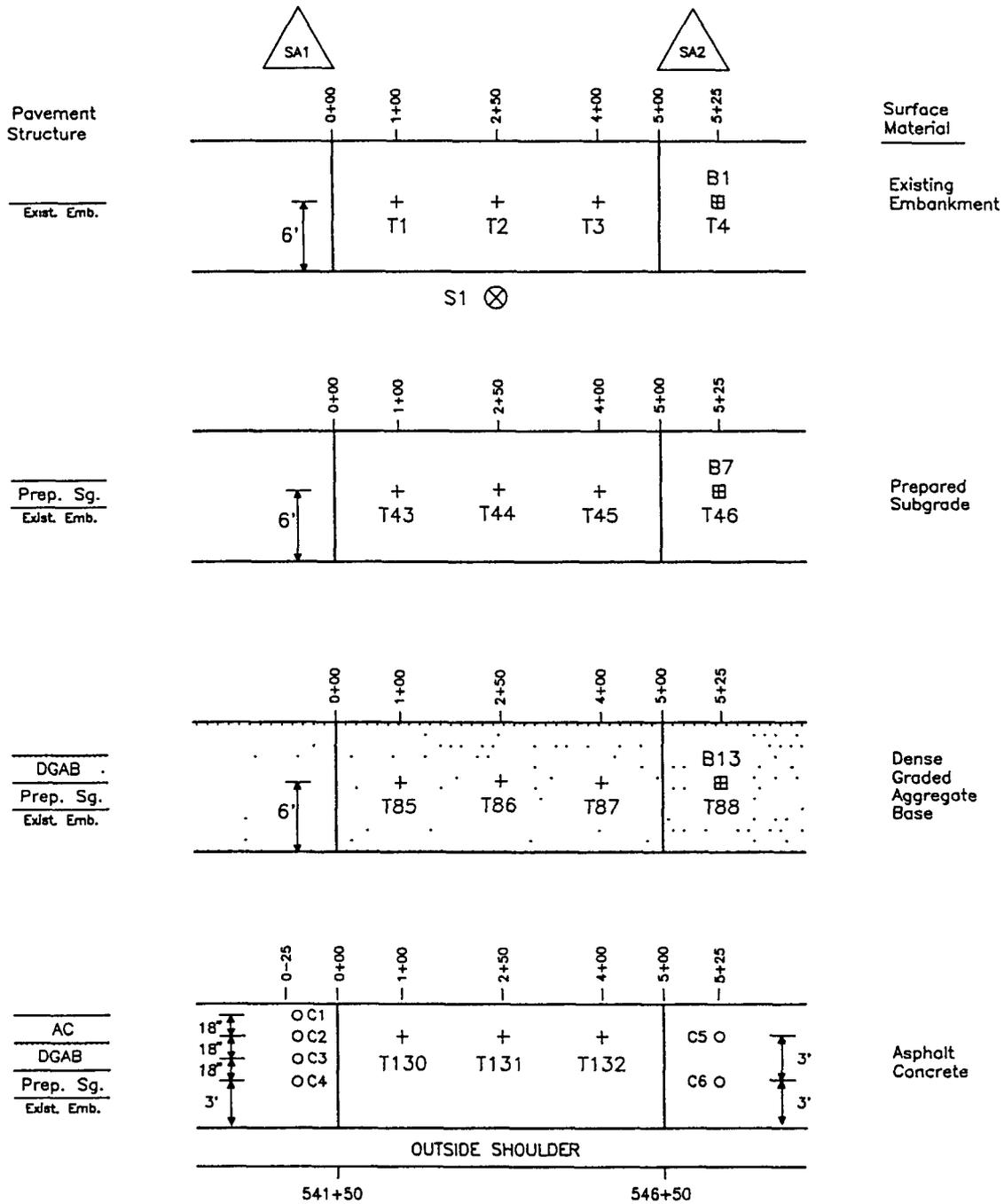
Figure 6 Overview of material sampling and testing on Asphalt Treated Base, SPS-1 Montana



- 4" OD Core of AC Surface (C1–C6, C27–C30, C41–C50, C55–C60)
- 4" OD Core of AC Surface and Asphalt Treated Base layers (C7–C26, C31–C40, C51–C54)
- + Location of nuclear moisture–density tests (T130–T165)
- Bulk sample of AC Surface (B23–B25)
- Prep. Sg – Prepared Subgrade
- Exist. Emb – Existing Embankment
- DGAB – Dense Graded Aggregate Base
- ATB – Asphalt Treated Base
- PATB – Permeable Asphalt Treated Base
- AC – Asphalt Concrete Surface
- MRL Bulk mixture sample
- △ Sample areas
- * Asphalt cement samples from plant (B29–B31)

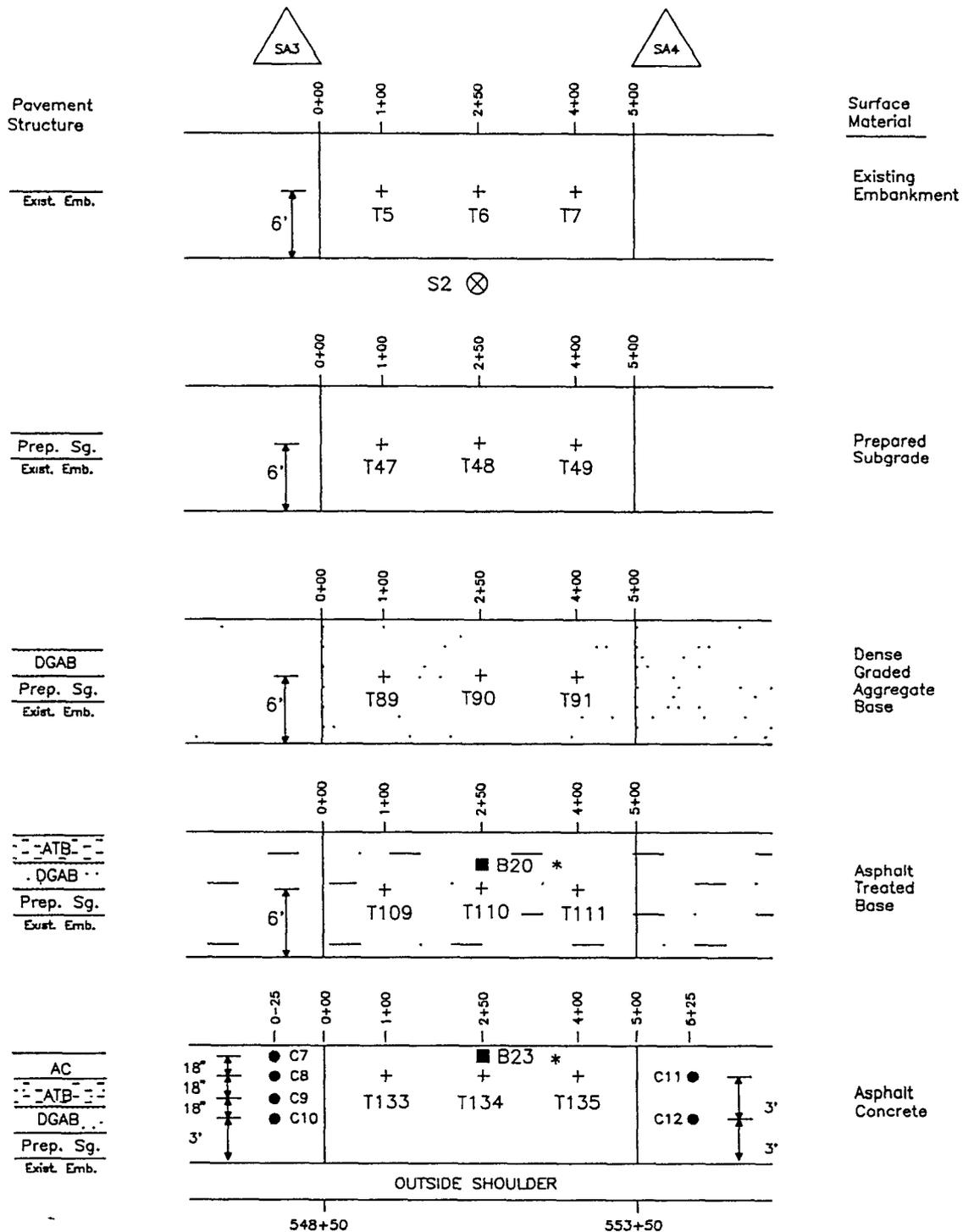
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Figure 7. Overview of material sampling and testing on Asphalt Concrete, SPS-1 Montana



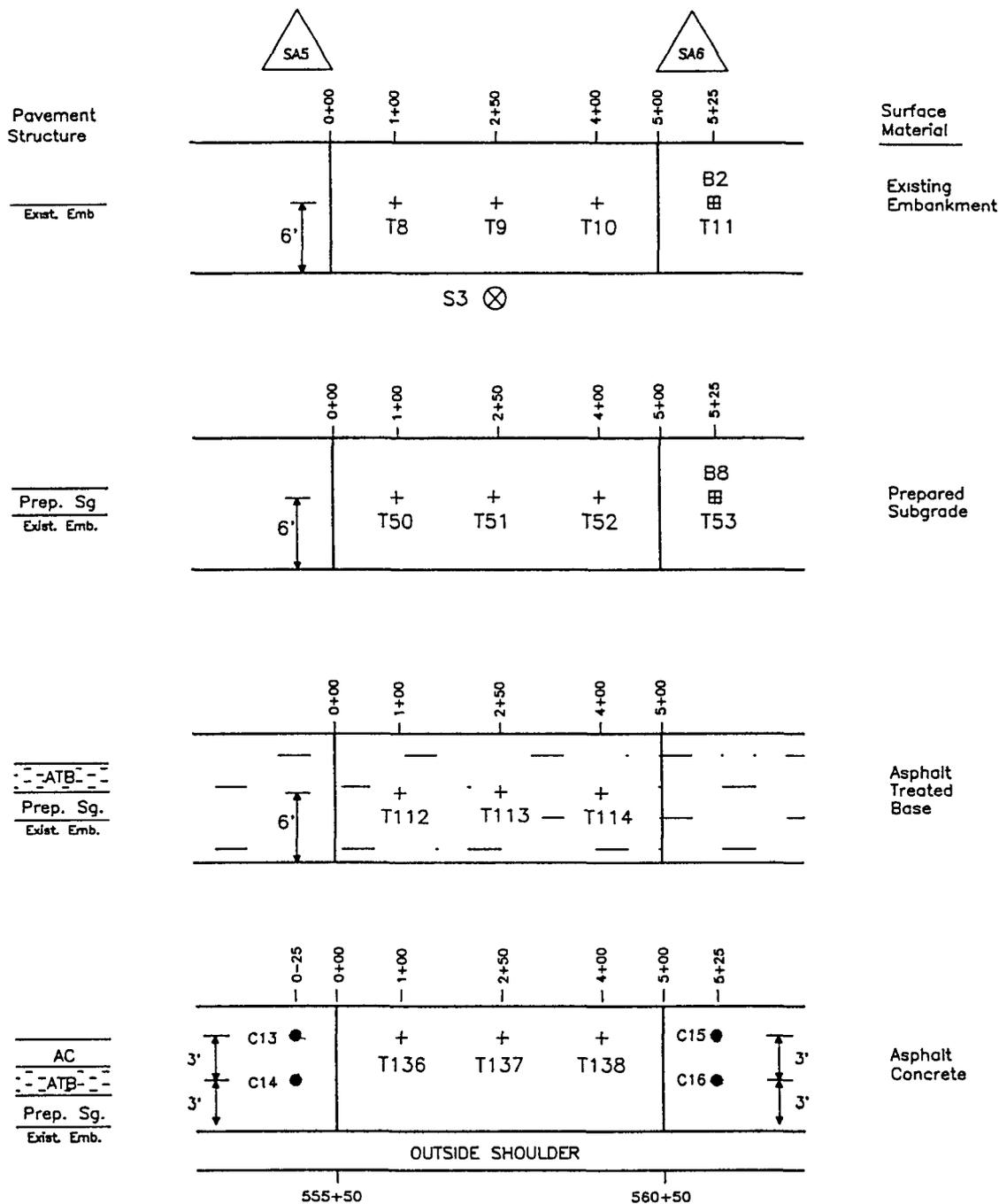
- ⊗ S1 - 20' shoulder probe
- + T1-T4 - Moisture-density tests on Existing Embankment
- B1 - Bulk sample of Existing Embankment
- + T43-T46 - Moisture-density tests on Prepared Subgrade
- B7 - Bulk sample of Prepared Subgrade
- + T85-T88 - Moisture-density tests on DGAB
- B13 - Bulk sample of DGAB
- + T130-T132 - Density tests on AC
- C1-C6 - Cores of AC surface

Figure 8. Sampling and test plan for test section 300113, SPS-1 Montana.



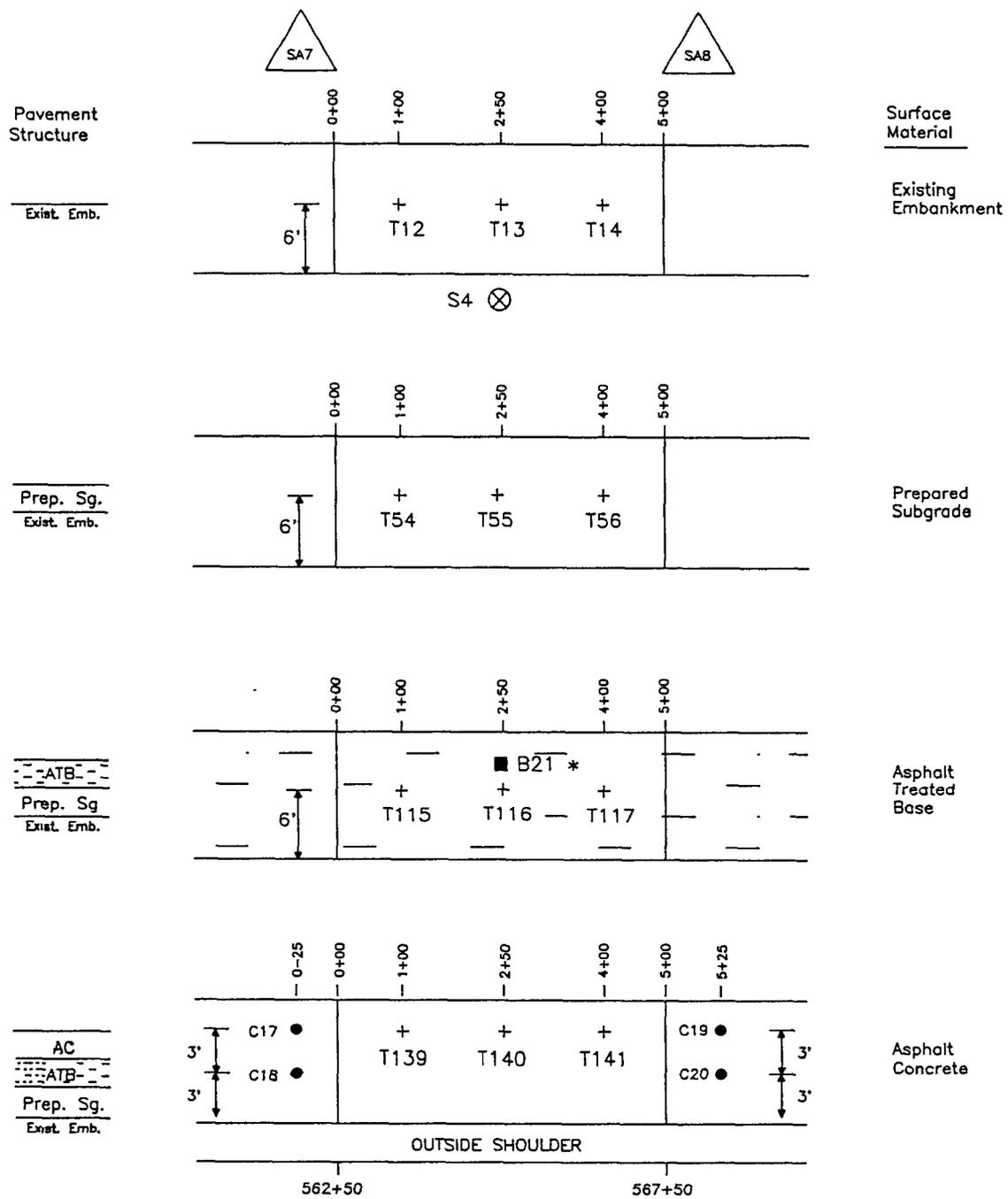
- ⊗ S2 - 20' shoulder probe
- + T5-T7 - Moisture-density tests on Existing Embankment
- + T47-T49 - Moisture-density tests on Prepared Subgrade
- + T89-T91 - Moisture-density tests on DGAB
- + T109-T111 - Density tests on ATB
- B20 - Bulk sample of ATB
- + T133-T135 - Density tests on AC
- B23 - Bulk sample of AC
- C7-C12 - Cores of AC surface and bound layer
- * B26 & B29 - Asphalt cement from plant

Figure 9. Sampling and test plan for test section 300118, SPS-1 Montana.



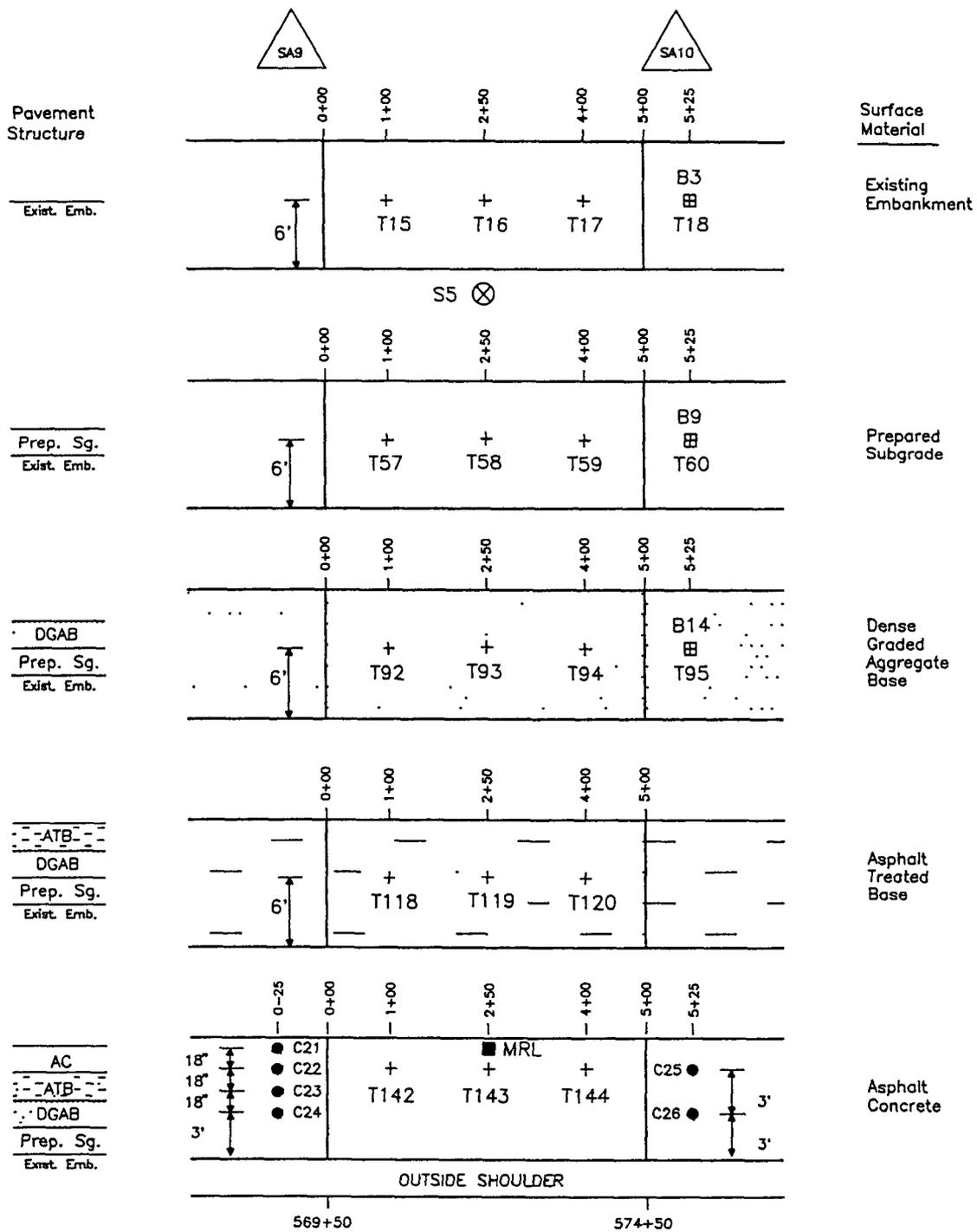
- ⊗ S3 - 20' shoulder probe
- + T8-T11 - Moisture-density tests on Existing Embankment
- B2 - Bulk sample of Existing Embankment
- + T50-T53 - Moisture-density tests on Prepared Subgrade
- B8 - Bulk sample of Prepared Subgrade
- + T112-T114 - Density tests on ATB
- + T136-T138 - Density tests on AC
- C13-C16 - Cores of AC surface and bound layer

Figure 10. Sampling and test plan for test section 300116, SPS-1 Montana.



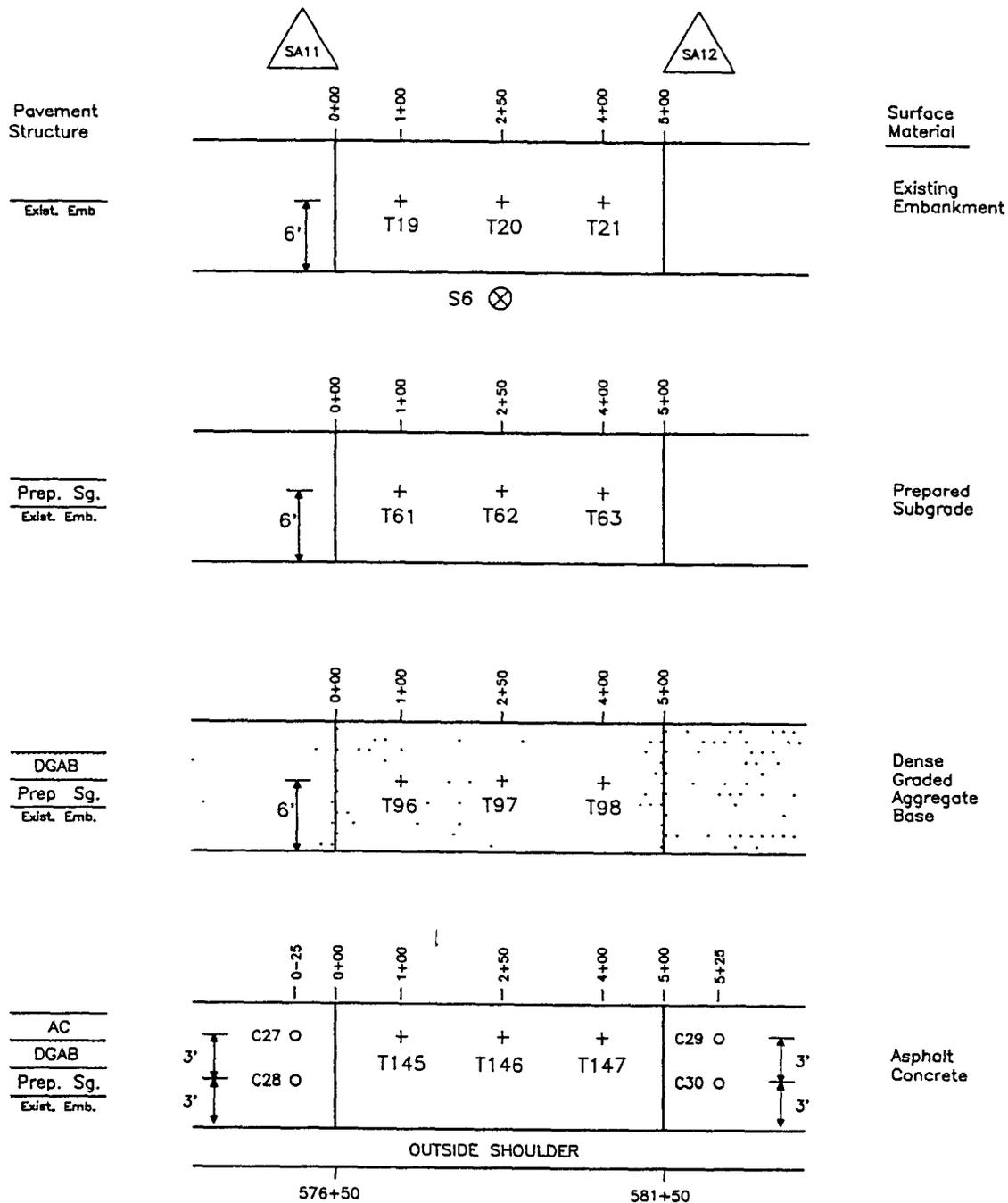
- ⊗ S4 - 20' shoulder probe
- + T12-T14 - Moisture-density tests on Existing Embankment
- + T54-T56 - Moisture-density tests on Prepared Subgrade
- B21 - Bulk sample of ATB
- + T115-T117 - Density tests on ATB
- + T139-T141 - Density test on AC
- C17-C20 - Cores of AC surface and bound layer
- * B27 - Asphalt cement from plant

Figure 11. Sampling and test plan for test section 300115, SPS-1 Montana.



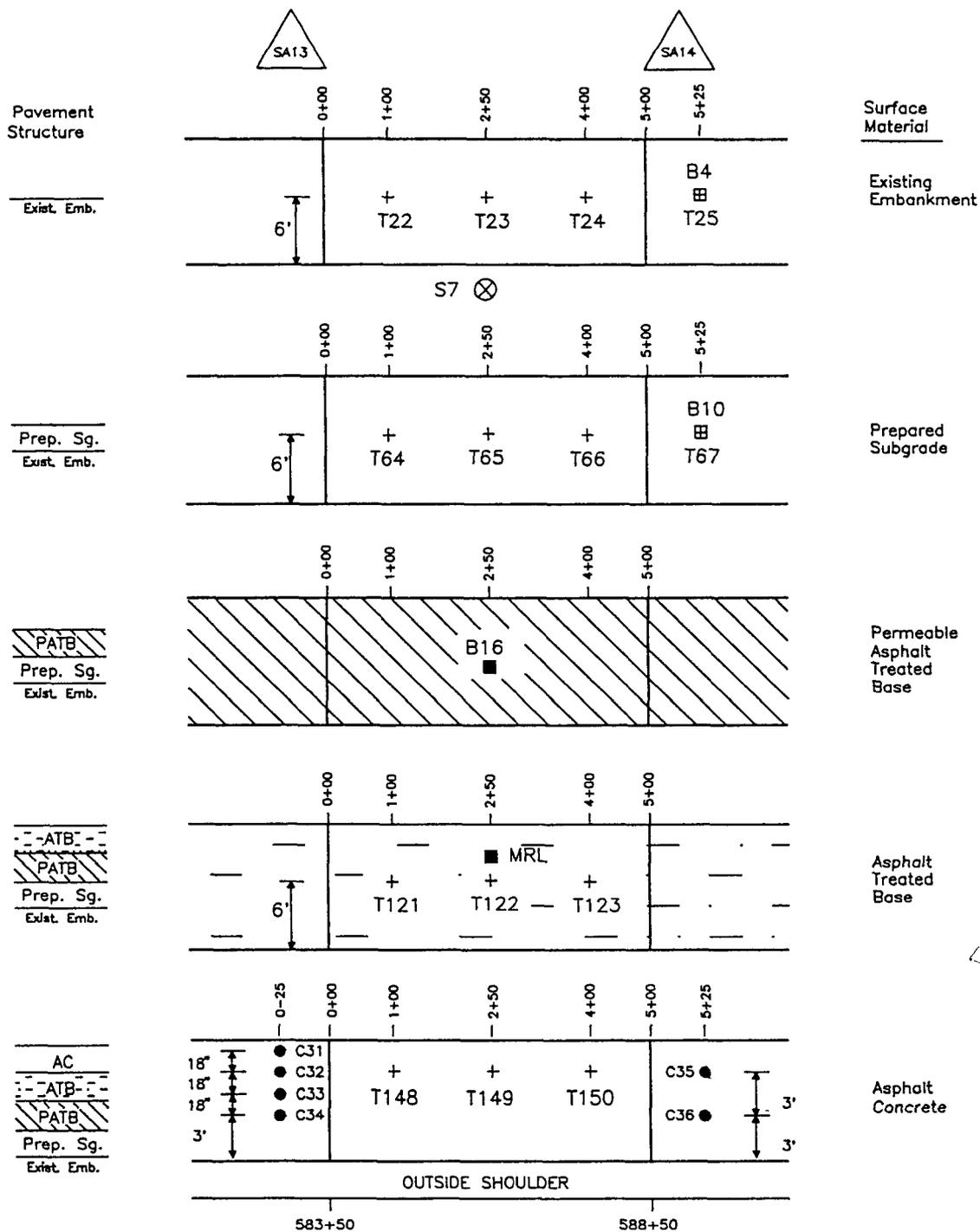
- ⊗ S5 - 20' shoulder probe
- + T15-T18 - Moisture-density tests on Existing Embankment
- B3 - Bulk sample of Existing Embankment
- + T57-T60 - Moisture-density tests on Prepared Subgrade
- B9 - Bulk sample of Prepared Subgrade
- + T92-T95 - Moisture-density tests on DGAB
- B14 - Bulk sample of DGAB
- + T118-T120 - Density tests on ATB
- + T142-T144 - Density tests on AC
- MRL - Bulk sample of AC for MRL
- C21-C26 - Cores of AC surface and bound layer

Figure 12. Sampling and test plan for test section 300117, SPS-1 Montana.



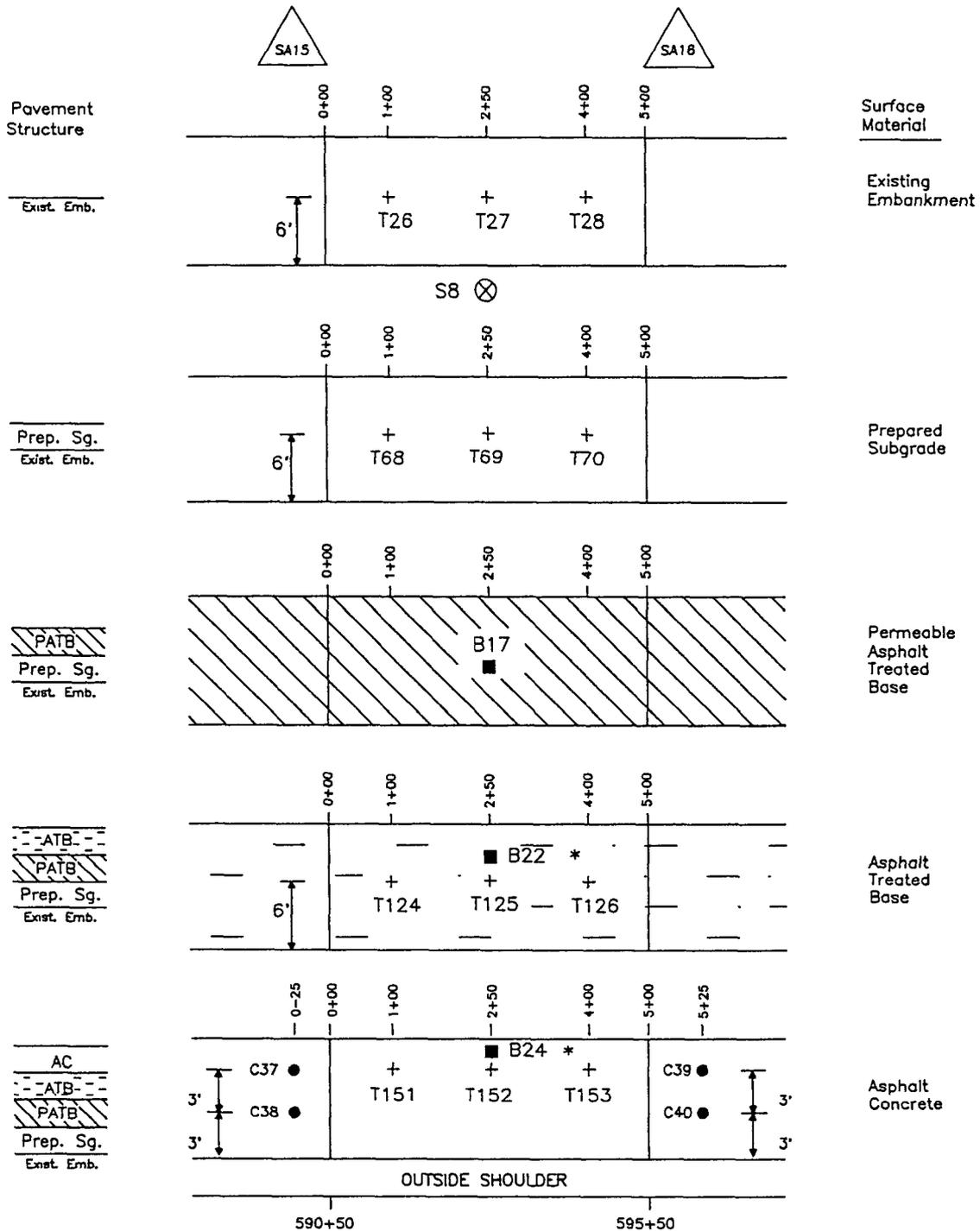
- ⊗ S6 - 20' shoulder probe
- + T19-T21 - Moisture-density tests on Existing Embankment
- + T61-T63 - Moisture-density tests on Prepared Subgrade
- + T96-T98 - Moisture-density tests on DGAB
- + T145-T147 - Density tests on AC
- C27-C30 - Cores of AC surface

Figure 13. Sampling and test plan for test section 300114, SPS-1 Montana.



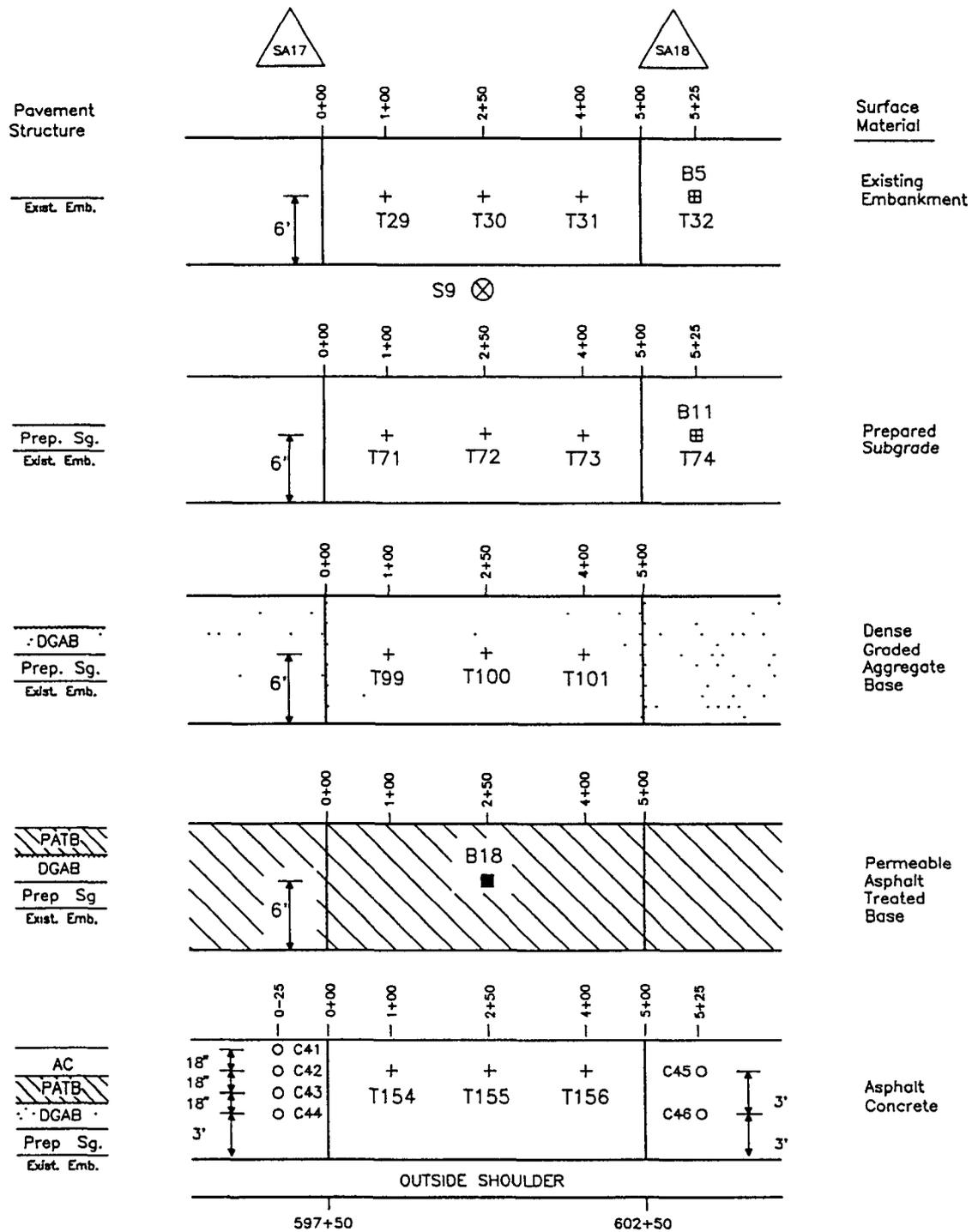
- ⊗ S7 - 20' shoulder probe
- + T22-T25 - Moisture-density tests on Existing Embankment
- B4 - Bulk sample of Existing Embankment
- + T64-T67 - Moisture-density tests on Prepared Subgrade
- B10 - Bulk sample of Prepared Subgrade
- B16 - Bulk sample of PATB
- + T121-T123 - Density test on ATB
- MRL - Bulk sample of ATB for MRL
- + T148-T150 - Density tests on AC
- C31-C36 - Cores of AC surface and bound layer

Figure 14. Sampling and test plan for test section 300124, SPS-1 Montana.



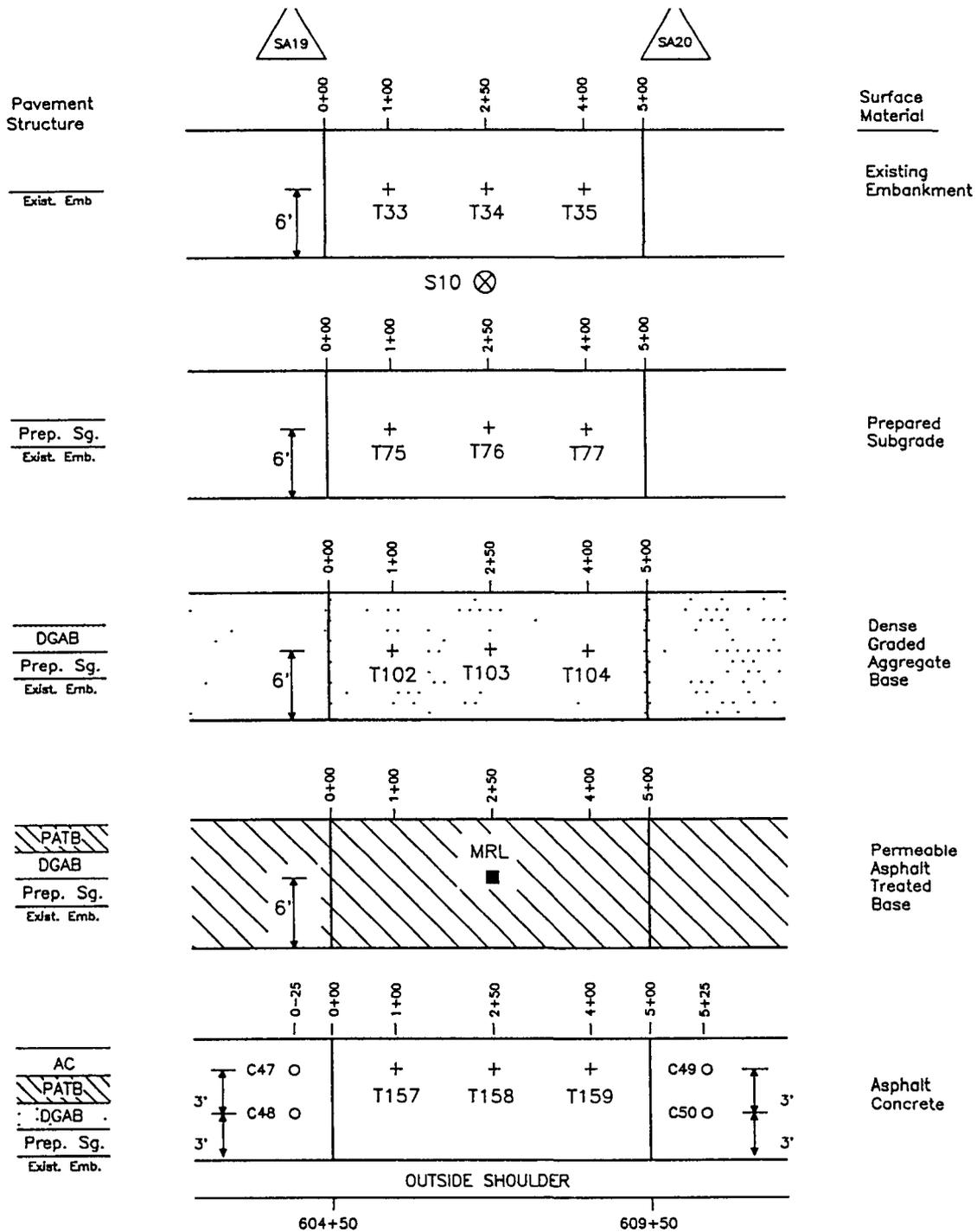
- ⊗ S8 - 20' shoulder probe
- + T26-T28 - Moisture-density tests on Existing Embankment
- + T68-T70 - Moisture-density tests on Prepared Subgrade
- B17 - Bulk sample of PATB
- + T124-T126 - Density tests on ATB
- B22 - Bulk sample of ATB
- + T151-T153 - Density tests on AC
- B24 - Bulk sample of AC
- C37-C40 - Cores of AC surface and bound layer
- * B27 & B30 - Asphalt cement from plant

Figure 15. Sampling and test plan for test section 300123, SPS-1 Montana.



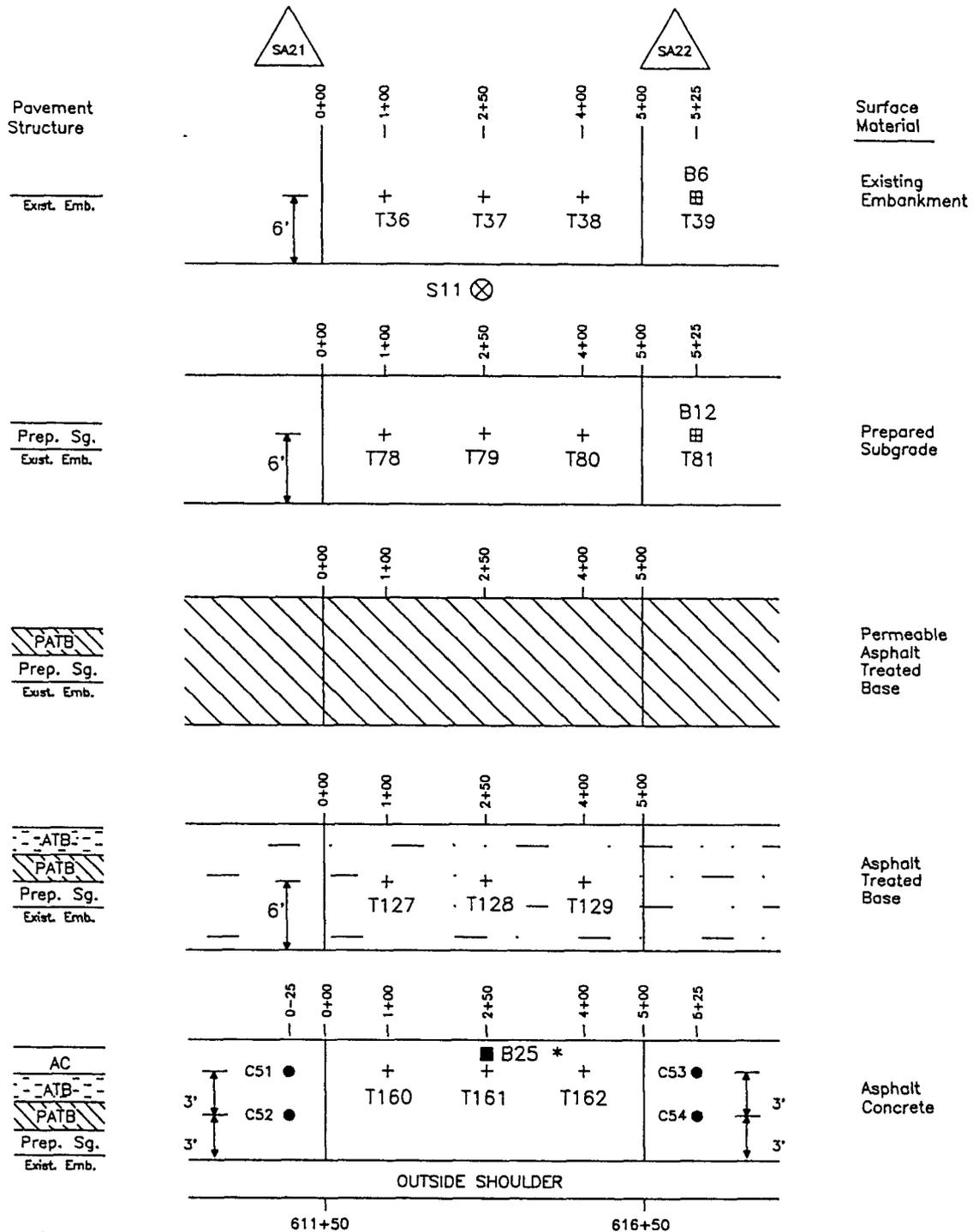
- ⊗ S9 - 20' shoulder probe
- + T29-T32 - Moisture-density tests on Existing Embankment
- B5 - Bulk sample of Existing Embankment
- + T71-T74 - Moisture-density tests on Prepared Subgrade
- B11 - Bulk sample of Prepared Subgrade
- + T99-T101 - Moisture-density tests on DGAB
- B18 - Bulk sample of PATB
- + T154-T156 - Density tests on AC
- C41-C46 - Cores of AC surface

Figure 16. Sampling and test plan for test section 300119, SPS-1 Montana.



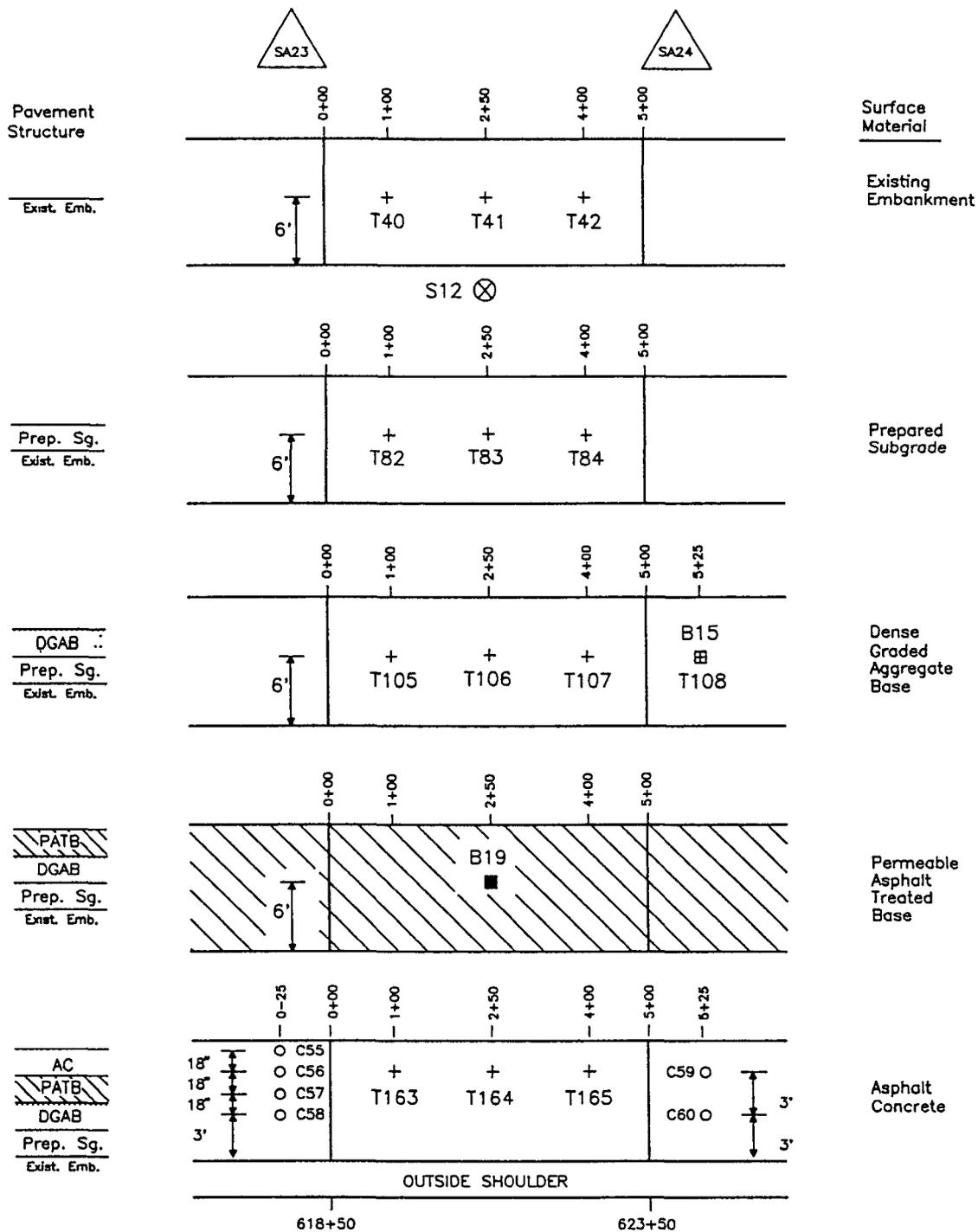
- ⊗ S10 – 20' shoulder probe
- + T33–T35 – Moisture–density tests on Existing Embankment
- + T75–T77 – Moisture–density tests on Prepared Subgrade
- + T102–T104 – Moisture–density tests on DGAB
- MRL – Bulk sample of PATB for MRL
- + T157–T159 – Density tests on AC
- C47–C50 – Cores of AC surface

Figure 17. Sampling and test plan for test section 300120, SPS-1 Montana.



- ⊗ S11 - 20' shoulder probe
- + T36-T39 - Moisture-density tests on Existing Embankment
- B6 - Bulk sample of Existing Embankment
- + T78-T81 - Moisture-density tests on Prepared Subgrade
- B12 - Bulk sample of Prepared Subgrade
- + T127-T129 - Density tests on ATB
- + T160-T162 - Density tests on AC
- B25 - Bulk sample of AC
- C51-C54 - Cores of AC surface and bound layer
- * B31 - Asphalt cement from plant

Figure 18. Sampling and test plan for test section 300122, SPS-1 Montana.



- ⊗ S12 - 20' shoulder probe
- + T40-T42 - Moisture-density tests on Existing Embankment
- + T82-T84 - Moisture-density tests on Prepared Subgrade
- + T105-T108 - Moisture-density tests on DGAB
- B15 - Bulk sample of DGAB
- B19 - Bulk sample of PATB
- + T163-T165 - Density tests on AC
- + C55-C60 - Cores of AC surface

Figure 19. Sampling and test plan for test section 300121, SPS-1 Montana.

Existing Embankment and Prepared Subgrade (Borrow)

The existing embankment is that portion of the original fill which remains after removal of the composite surface, as shown in the plans. This material will be sampled in all instances. The prepared subgrade material consists of the material placed to restore the profile after removal of the composite surface. This material should be at least 1 ft thick and will always be sampled and tested.

A summary of the samples, laboratory, and field tests on the existing embankment and prepared subgrade materials is presented in table 2. In this table, B-type samples are bulk samples of the existing embankment and prepared subgrade materials.

Bulk Samples

Bulk sampling will need to be performed by digging test pits in the existing embankment and subgrade material. Excavation of the pits must be performed cautiously to ensure the proper materials are sampled and are not contaminated. Bulk samples of each material should be obtained from the locations listed in tables 3 and 4. Approximately 400 lb of each material should be obtained from each sampling location. The sampling operation should be performed following the procedures contained in section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing, and Handling, as appropriate. Separate jar samples for gravimetric moisture tests should be collected at each bulk sample location. These sampling locations must be repaired by placing and compacting similar material.

Density and Moisture Measurements

In-place density and moisture measurements should be performed on the existing embankment and prepared subgrade surface at the locations specified in tables 5 and 6. These tests shall be performed using a recently calibrated nuclear moisture-density gauge in accordance with the procedures in **AASHTO T238-86, Method B-Direct Transmission, AASHTO T239-86, and ASTM D2950-82**. Each measurement shall be the result of the average of four readings made during each 90° rotation of the nuclear gauge through a full 360°.

FWD Measurements

FWD measurements will be performed on the finished prepared subgrade surface at each test section following the procedures and at the locations contained in SHRP Protocol P59, "Deflection Testing of Subgrade and Base Layers." FWD testing will be performed by the WRCCO.

Auger Probes

Auger probes to a depth of 20 ft from the surface of the finished existing embankment surface should be performed at the shoulder locations specified in table 7. The primary purpose of these probes is to determine if bedrock or other significantly dense layers exist within 20 ft of

the pavement surface elevation. General changes in the material stratum and the depth to ground water table can also be identified from these probes. Auguring shall be performed using a truck mounted drill rig using 4 in or 6 in, continuous flight, solid, helical augers.

Table 2 Field and laboratory test plan for Existing Embankment and Prepared Subgrade materials, SPS-1 Montana

Test Name	LTPP Test Designation	LTPP Protocol	Number of Tests	Material Source/ Test Location
Sieve Analysis	SS01	Ship to FHWA Lab	12	B1 - B12
Hydrometer to 0.01 mm	SS02	Ship to FHWA Lab	12	B1 - B12
Atterberg Limits	SS03	Ship to FHWA Lab	12	B1 - B12
Subgrade Classification and Type	SS04	Ship to FHWA Lab	12	B1 - B12
Moisture-Density Relations	SS05	Ship to FHWA Lab	12	B1 - B12
Resilient Modulus	SS07	Ship to FHWA Lab	12	B1 - B12
Natural Moisture Content	SS09	Ship to FHWA Lab	12	B1 - B12
Permeability	UG09	P48	6	B1, B3, B6, B7, B9, B12
In-Place Density		LTPP Method	84	T1 - T84
Depth to Rigid Layer		LTPP Method	12	S1 - S12

Note From each 400 lb bulk sample, split and quarter 300 lb for the FHWA lab and keep 100 lb for P48 test

Table 3 Locations of Existing Embankment bulk sampling, SPS-1 Montana.

Sample Location Designation	Station	Offset, ft		Test Section	Sample Area
		Centerline, Rt.	Outside Lane Edge, Lt.		
B1	546+75	6	6	300113	2
B2	560+75	6	6	300116	6
B3	574+75	6	6	300117	10
B4	588+75	6	6	300124	14
B5	602+75	6	6	300119	18
B6	616+75	6	6	300122	22

Table 4 Locations of prepared Subgrade bulk sampling, SPS-1 Montana.

Sample Location Designation	Station	Offset, ft		Test Section	Sample Area
		Centerline, Rt.	Outside Lane Edge, Lt.		
B7	546+75	6	6	300113	2
B8	560+75	6	6	300116	6
B9	574+75	6	6	300117	10
B10	588+75	6	6	300124	14
B11	602+75	6	6	300119	18
B12	616+75	6	6	300122	22

Table 5 Locations for in-place density and moisture tests on Existing Embankment, SPS-1 Montana

Sample Location Designation	Station	Offset, ft		Test Section
		Centerline, Rt.	Outside Lane Edge, Lt.	
T1	542+50	6	6	300113
T2	544+00	6	6	303113
T3	545+50	6	6	300113
T4	546+75	6	6	300113
T5	549+50	6	6	300118
T6	551+00	6	6	300118
T7	552+50	6	6	300118
T8	556+50	6	6	300116
T9	558+00	6	6	300116
T10	559+50	6	6	300116
T11	560+75	6	6	300116
T12	563+50	6	6	300115
T13	565+00	6	6	300115
T14	566+50	6	6	300115
T15	570+50	6	6	300117
T16	572+00	6	6	300117
T17	573+50	6	6	300117
T18	574+75	6	6	300117
T19	577+50	6	6	300114
T20	579+00	6	6	300114
T21	580+50	6	6	300114
T22	584+50	6	6	300124
T23	586+00	6	6	300124
T24	587+50	6	6	300124
T25	588+75	6	6	300124
T26	591+50	6	6	300123
T27	593+00	6	6	300123
T28	594+50	6	6	300123
T29	598+50	6	6	300119
T30	600+00	6	6	300119
T31	601+50	6	6	300119
T32	602+75	6	6	300119
T33	605+50	6	6	300120
T34	607+00	6	6	300120
T35	608+50	6	6	300120
T36	612+50	6	6	300122
T37	614+00	6	6	300122
T38	615+50	6	6	300122
T39	616+75	6	6	300122
T40	619+50	6	6	300121
T41	621+00	6	6	300121
T42	622+50	6	6	300121

Table 6 Locations for in-place density and moisture tests on prepared Subgrade, SPS-1 Montana.

Sample Location Designation	Station	Offset, ft		Test Section
		Centerline, Rt.	Outside Lane Edge, Lt.	
T43	542+50	6	6	300113
T44	544+00	6	6	303113
T45	545+50	6	6	300113
T46	546+75	6	6	300113
T47	549+50	6	6	300118
T48	551+00	6	6	300118
T49	552+50	6	6	300118
T50	556+50	6	6	300116
T51	558+00	6	6	300116
T52	559+50	6	6	300116
T53	560+75	6	6	300116
T54	563+50	6	6	300115
T55	565+00	6	6	300115
T56	566+50	6	6	300115
T57	570+50	6	6	300117
T58	572+00	6	6	300117
T59	573+50	6	6	300117
T60	574+75	6	6	300117
T61	577+50	6	6	300114
T62	579+00	6	6	300114
T63	580+50	6	6	300114
T64	584+50	6	6	300124
T65	586+00	6	6	300124
T66	587+50	6	6	300124
T67	588+75	6	6	300124
T68	591+50	6	6	300123
T69	593+00	6	6	300123
T70	594+50	6	6	300123
T71	598+50	6	6	300119
T72	600+00	6	6	300119
T73	601+50	6	6	300119
T74	602+75	6	6	300119
T75	605+50	6	6	300120
T76	607+00	6	6	300120
T77	608+50	6	6	300120
T78	612+50	6	6	300122
T79	614+00	6	6	300122
T80	615+50	6	6	300122
T81	616+75	6	6	300122
T82	619+50	6	6	300121
T83	621+00	6	6	300121
T84	622+50	6	6	300121

Table 7 Locations of 20 ft deep shoulder probes, SPS-1 Montana

Sample Location Designation	Station	Offset, ft		Test Section
		Centerline, Rt.	Outside Lane Edge, Lt.	
S1	544+00	18	6	300113
S2	551+00	18	6	300118
S3	558+00	18	6	300116
S4	565+00	18	6	300115
S5	572+00	18	6	300117
S6	579+00	18	6	300114
S7	586+00	18	6	300124
S8	593+00	18	6	300123
S9	600+00	18	6	300119
S10	607+00	18	6	300120
S11	614+00	18	6	300122
S12	621+00	18	6	300121

Dense-Graded Aggregate Base

The measurements, tests, and samples on the Dense-Graded Aggregate Base (DGAB) layer should be performed prior to placement of the next pavement layer. The objective is to characterize the properties of the prepared base at the time when the next pavement layer is placed. It is, therefore, desired that the moisture-density tests and elevation measurements be performed just prior to the time when the next pavement layer is placed. This is most important in instances when the aggregate base will be left exposed to the elements for a significant period, depending on climatic events, which might influence the properties of the material.

A summary of the samples to be taken from the DGAB material and tests to be conducted are presented in table 8. Only bulk samples, in-place moisture-density, and FWD deflection measurements are performed on the DGAB material.

Bulk Samples

Bulk samples of the DGAB material should be obtained at the approximate locations specified in table 9. Sampling may be performed prior to compaction to avoid interruptions to construction activities. Uncontaminated 400 lb samples shall be obtained from each location. The procedures similar to those contained in section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing, and Handling should be followed. A moisture jar sample of the prepared base immediately prior to placement of the next layer should be collected at each bulk sampling location.

Density and Moisture Measurements

Nuclear density and moisture measurements shall be performed on top of the prepared DGAB at the location specified in table 10. These measurements shall be performed following the same procedures used for subgrade soils.

FWD Measurements

FWD measurements will be performed on each test section following the procedures and at the locations contained in SHRP Protocol P59, "Deflection Testing of Subgrade and Base Layers." This testing will be performed by the WRCOC

Table 8. Field and laboratory test plan for Dense Graded Aggregate
Base materials, SPS-1 Montana

Test Name	LTPP Test Designation	LTPP Protocol	No. of Tests	Material Source/ Test Location
Particle Size Analysis	UG01	Ship to FHWA Lab	3	B13-B15
Sieve Analysis (washed)	UG02	Ship to FHWA Lab	3	B13-B15
Atterberg Limits	UG04	Ship to FHWA Lab	3	B13-B15
Moisture-Density Relations	UG05	Ship to FHWA Lab	3	B13-B15
Resilient Modulus	UG07	Ship to FHWA Lab	3	B13-B15
Classification	UG08	Ship to FHWA Lab	3	B13-B15
Permeability	UG09	P48	3	B13-B15
Natural Moisture Content	UG10	Ship to FHWA Lab	3	B13-B15
In-Place Density		LTPP Method	24	T85-T108

Note From each 400 lb bulk sample, split and quarter 300 lb for the FHWA lab and keep 100 lb for P48 tests

Table 9 Bulk sampling of uncompacted Dense Graded Aggregate Base,
SPS-1 Montana

Sample Location Designation	Station	Offset, ft		Test Section	Sample Area
		Centerline, Rt.	Outside Lane Edge, Lt.		
B13	546+75	6	6	300113	2
B14	574+75	6	6	300117	10
B15	623+75	6	6	300121	24

Table 10 Locations for in-place density and moisture tests on Dense Graded
Aggregate Base, SPS-1 Montana

Sample Location Designation	Station	Offset, ft		Test Section
		Centerline, Rt.	Outside Lane Edge, Lt.	
T85	542+50	6	6	300113
T86	544+00	6	6	300113
T87	545+50	6	6	300113
T88	546+75	6	6	300113
T89	549+50	6	6	300118
T90	551+00	6	6	300118
T91	552+50	6	6	300118
T92	570+50	6	6	300117
T93	572+00	6	6	300117
T94	573+50	6	6	300117
T95	574+75	6	6	300117
T96	577+50	6	6	300114
T97	579+00	6	6	300114
T98	580+50	6	6	300114
T99	598+50	6	6	300119
T100	600+00	6	6	300119
T101	601+50	6	6	300119
T102	605+50	6	6	300120
T103	607+00	6	6	300120
T104	608+50	6	6	300120
T105	619+50	6	6	300121
T106	621+00	6	6	300121
T107	622+50	6	6	300121
T108	623+75	6	6	300121

Permeable Asphalt-Treated Base

The field and laboratory test plan for the Permeable Asphalt-Treated Base (PATB) materials is presented in table 11. Sampling of this material includes bulk samples of the uncompacted mix.

Bulk Samples

Bulk sampling of the uncompacted mix should be performed at the test site from the paver or the roadway. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in figure 5. These samples shall be obtained in accordance with **AASHTO T168** and shipped to the laboratory in suitable containers. If sampling from the paver or roadway at the test site is not feasible, then bulk sampling can be performed at the mix plant, provided that the material sampled is the same material being placed in the designated test section. Each sample shall consist of 100 lb of material.

Table 11 Field and laboratory test plan for Permeable Asphalt Treated
Base (PATB) materials, SPS-1 Montana

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source/ Test Location
Asphalt Content (Extraction)	AC04	P04	4	B16-B19 from roadway
Extracted Aggregate				
Aggregate Gradation	AG04	P14	4	B16-B19 from roadway

Asphalt-Treated Base

The field and laboratory test plan for the Asphalt-Treated Base (ATB) materials is presented in table 12. Sampling of this material includes bulk samples of the uncompacted mix, bulk asphalt cement samples and cores obtained after placement of the AC surface material. Field measurements of the density of the compacted mix should also be performed.

Bulk Samples

Bulk sampling of the uncompacted mix should be performed at the test site from the paver or the roadway. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in figure 6. These samples shall be obtained in accordance with **AASHTO T168** and shipped to the laboratory in suitable containers. If sampling from the paver or roadway at the test site is not feasible, then bulk sampling can be performed at the mix plant, provided that the material sampled is the same material being placed in the designated test section. Each sample shall consist of 100 lb of material.

Samples of the asphalt cement used for the ATB mix should consist of three 5-gallon samples obtained from the mix plant. Collect samples from the mix plant after asphalt has been heated for mixing.

Cores

Cores of the ATB shall be obtained at the same time the AC surface material is cored. The core locations are listed in table 15. The cores of the ATB material designated for resilient modulus and indirect tensile strength tests must be shipped to the designated FHWA laboratory.

Density Measurements

Nuclear density measurements shall be performed on top of the prepared ATB at the location specified in table 13. These measurements shall be performed using **AASHTO T238-86** backscatter mode. As with unbound materials, each testing location shall have four readings with the density instrument rotated 90° between each reading.

FWD Measurements

FWD measurements will be performed on each test section following the procedures and at the locations contained in SHRP Protocol P59, "Deflection Testing of Subgrade and Base Layers." This testing will be performed by the WRCCOC.

Table 12 Field and laboratory test plan for Asphalt Treated Base materials, SPS-1 Montana

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source/ Test Location
Core Examination/ Thickness	AC01	Ship to FHWA Lab	15	C7,C8,C9,C10,C15,C21, C22,C23,C24,C31,C32, C33,C34,C35,C53
Core Examination/ Thickness	AC01	P01	19	C11,C12,C13,C14,C16, C17,C18,C19,C20,C25, C26,C36,C37,C38,C39, C40,C51,C52,C54
Bulk Specific Gravity	AC02	Ship to FHWA Lab	15	C7,C8,C9,C10,C15,C21, C22,C23,C24,C31,C32, C33,C34,C35,C53
Bulk Specific Gravity	AC02	P02	19	C11,C12,C13,C14,C16, C17,C18,C19,C20,C25, C26,C36,C37,C38,C39, C40,C51,C52,C54
Maximum Specific Gravity	AC03	P03	3	B20-B22 from roadway
Asphalt Content (Extraction)	AC04	P04	3	B20-B22 from roadway
Moisture Susceptibility	AC05	P05	3	B20-B22 from roadway
Resilient Modulus	AC07	Ship to FHWA Lab	9	C8,C9,C10,C22,C23,C24, C32,C33,C34
Indirect Tensile Strength	AC07	Ship to FHWA Lab	12	C7,C8,C9,C10,C21,C22, C23,C24,C31,C32,C33,C34
In-Place Density		SHRP-LTPP Method	21	T109-T129
Extracted Aggregate				
Specific Gravity Coarse Aggregate	AG01	P11	3	B20-B22 from roadway
Specific Gravity Fine Aggregate	AG02	P12	3	B20-B22 from roadway
Aggregate Gradation	AG04	P14	3	B20-B22 from roadway
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	3	B20-B22 from roadway
Asphalt Cement				
Abson Recovery	AE01	P21	3	B20-B22 from roadway
Penetration @ 50°F, 77°F 90°F	AE02	P22	3	B20-B22 from roadway
Specific Gravity (60°F)	AE03	P23	3	B20-B22 from roadway
Viscosity @ 77°F	AE04	P24	3	B20-B22 from roadway
Viscosity @ 140°F, 275°F	AE05	P25	3	B20-B22 from roadway
Asphalt Cement (from plant)				
Penetration @ 50°F 77°F 90°F	AE02	P22	3	B26-B28 from plant
Specific Gravity (60°F)	AE03	P23	3	B26-B28 from plant
Viscosity @ 77°F	AE04	P24	3	B26-B28 from plant
Viscosity @ 104°F, 275°F	AE05	P25	3	B26-B28 from plant

Table 13. Locations for in-place density measurements on compacted
Asphalt Treated Base, SPS-1 Montana

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt	Outside Lane Edge, Lt	
T109	549+50	6	6	300118
T110	551+00	6	6	300118
T111	552+50	6	6	300118
T112	556+50	6	6	300116
T113	558+00	6	6	300116
T114	559+50	6	6	300116
T115	563+50	6	6	300115
T116	565+00	6	6	300115
T117	566+50	6	6	300115
T118	570+50	6	6	300117
T119	572+00	6	6	300117
T120	573+50	6	6	300117
T121	584+50	6	6	300124
T122	586+00	6	6	300124
T123	587+50	6	6	300124
T124	591+50	6	6	300123
T125	593+00	6	6	300123
T126	594+50	6	6	300123
T127	612+50	6	6	300122
T128	614+00	6	6	300122
T129	615+50	6	6	300122

Asphalt Concrete

The field and laboratory test plan for the Asphalt Concrete (AC) materials is presented in table 14. Sampling of this material includes bulk samples of the asphalt cement, aggregate, uncompacted mix, cores obtained after placement, and compaction of the AC surface material.

Bulk Samples

Bulk sampling of the uncompacted mix should be performed at the test site from the paver or the roadway. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in figure 7. These samples shall be obtained in accordance with **AASHTO T168** and shipped to the laboratory in suitable containers. If sampling from the paver or roadway at the test site is not feasible, then bulk sampling can be performed at the mix plant provided that the material sampled is the same material being placed in the designated test section. Each sample shall consist of 100 lb of material.

Samples of the asphalt cement used for the asphalt concrete mix should consist of three 5-gallon samples obtained from the mix plant. Collect samples from the mix plant after asphalt has been heated for mixing.

Cores

All cores of the asphalt concrete and underlying asphalt-treated base materials shall have a 4 in diameter and be obtained from the same core hole. The core locations are listed in table 15. The cores of the AC material designated for resilient modulus, indirect tensile strength, and creep modulus must be shipped to the designated FHWA laboratory.

Care shall be taken to ensure that cores are obtained at a 90° angle to the pavement surface and that the edges are straight, intact, smooth, and suitable for laboratory testing. Details on tolerances and quality control of coring operations are contained in section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Testing, and Handling.

Care shall be taken to package all cores for transport and shipping in suitable containers to prevent damage or degradation of the cores during transport.

Density Measurements

Nuclear density measurements shall be performed on top of the prepared AC at the locations specified in table 16. These measurements shall be performed using **AASHTO T238-86** backscatter mode. As with unbound materials, each testing location shall have four readings with the density instrument rotated 90° between each reading.

Table 14 Field sampling and laboratory test plan for Asphalt Concrete
surface materials, SPS-1 Montana

Test Name	SHRP Test Designation	SHRP Protocol	No. of Tests	Material Source/ Test Location
Core Examination/Thickness	AC01	Ship to FHWA Lab	27	C1,C2,C3,C4,C7,C8,C9,C10,C15, C21,C22,C23,C24,C31,C32,C33, C34,C35,C41,C42,C43,C44,C53, C55,C56,C57,C58
Core Examination/Thickness	AC01	P01	33	C5,C6,C11,C12,C13,C14,C16, C17,C18,C19,C20,C25,C26,C27, C28,C29,C30,C36,C37,C38,C39, C40,C45,C46,C47,C48,C49,C50, C51,C52,C54,C59,C60
Bulk Specific Gravity	AC02	Ship to FHWA Lab	27	C1,C2,C3,C4,C7,C8,C9,C10,C15, C21,C22,C23,C24,C31,C32,C33, C34,C35,C41,C42,C43,C44,C53, C55,C56,C57,C58
Bulk Specific Gravity	AC02	P02	33	C5,C6,C11,C12,C13,C14,C16, C17,C18,C19,C20,C25,C26,C27, C28,C29,C30,C36,C37,C38,C39, C40,C45,C47,C48,C49,C50,C51, C52,C54,C59,C60
Maximum Specific Gravity	AC03	P03	3	B23-B25 from roadway
Asphalt Content (Extraction)	AC04	P04	3	B23-B25 from roadway
Moisture Susceptibility	AC05	P05	3	B23-B25 from roadway
Creep Modulus	AC06	Ship to FHWA Lab	3	C15,C35,C53
Resilient Modulus	AC07	Ship to FHWA Lab	18	C2,C3,C4,C8,C9,C10,C22,C23, C24,C32,C33,C34,C42,C43,C44, C56,C57,C58
Indirect Tensile Strength	AC07	Ship to FHWA Lab	24	C1,C2,C3,C4,C7,C8,C9,C10,C21, C22,C23,C24,C31,C32,C33,C34, C41,C42,C43,C44,C55,C56,C57, C58
In-Place Density		SHRP-LIPP Method		T130-T165
Extracted Aggregate				
Bulk Specific Gravity of CA	AG01	P11	3	B23-B25 from roadway
Bulk Specific Gravity of FA	AG02	P12	3	B23-B25 from roadway
Aggregate Gradation	AG04	P14	3	B23-B25 from roadway
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	3	B23-B25 from roadway
Asphalt Cement				
Asph Recovery	AE01	P21	3	B23-B25 from roadway
Penetration @ 50°F 77°F 90°F	AE02	P22	3	B23-B25 from roadway
Specific Gravity (60°F)	AE03	P23	3	B23-B25 from roadway
Viscosity @ 77°F	AE04	P24	3	B23-B25 from roadway
Viscosity @ 140°F,275°F	AE05	P25	3	B23-B25 from roadway
Asphalt Cement (from plant)				
Penetration @ 50°F 77°F 90°F	AE02	P22	3	B29-B31 from plant
Specific Gravity (60°F)	AE03	P23	3	B29-B31 from plant
Viscosity @ 77°F	AE04	P24	3	B29-B31 from plant
Viscosity @ 140°F,275°F	AE05	P25	3	B29-B31 from plant

Table 15. Asphalt Concrete and Bound Base core locations, SPS-1 Montana.

Sample Location Designation	Station	Offset, Feet		Test Section	Sample Area
		Center Line, Rt	Outside Lane Edge, Lt		
C1	541+25	4.5	7.5	300113	1
C2	541+25	6.0	6.0	300113	1
C3	541+25	7.5	4.5	300113	1
C4	541+25	9.0	3.0	300113	1
C5	546+75	6.0	6.0	300113	2
C6	546+75	9.0	3.0	300113	2
C7	548+25	4.5	7.5	300118	3
C8	548+25	6.0	6.0	300118	3
C9	548+25	7.5	4.5	300118	3
C10	548+25	9.0	3.0	300118	3
C11	553+75	6.0	6.0	300118	4
C12	553+75	9.0	3.0	300118	4
C13	555+25	6.0	6.0	300116	5
C14	555+25	9.0	3.0	300116	5
C15	560+75	6.0	6.0	300116	6
C16	560+75	9.0	3.0	300116	6
C17	562+25	6.0	6.0	300115	7
C18	562+25	9.0	3.0	300115	7
C19	567+75	6.0	6.0	300115	8
C20	567+75	9.0	3.0	300115	8
C21	569+25	4.5	7.5	300117	9
C22	569+25	6.0	6.0	300117	9
C23	569+25	7.5	4.5	300117	9
C24	569+25	9.0	3.0	300117	9
C25	574+75	6.0	6.0	300117	10
C26	574+75	9.0	3.0	300117	10
C27	576+25	6.0	6.0	300114	11
C28	576+25	9.0	3.0	300114	11
C29	581+75	6.0	6.0	300114	12
C30	581+75	9.0	3.0	300114	12
C31	583+25	4.5	7.5	300124	13
C32	583+25	6.0	6.0	300124	13
C33	583+25	7.5	4.5	300124	13
C34	583+25	9.0	3.0	300124	13
C35	588+75	6.0	6.0	300124	14
C36	588+75	9.0	3.0	300124	14
C37	590+25	6.0	6.0	300123	15
C38	590+25	9.0	3.0	300123	15
C39	595+75	6.0	6.0	300123	16
C40	595+75	9.0	3.0	300123	16
C41	597+25	4.5	7.5	300119	17
C42	597+25	6.0	6.0	300119	17

Table 15. Asphalt Concrete and Bound Base core locations, SPS-1 Montana. (cont'd)

Sample Location Designation	Station	Offset, Feet		Test Section	Sample Area
		Center Line, Rt	Outside Lane Edge, Lt		
C43	597+25	7.5	4.5	300119	17
C44	597+25	9.0	3.0	300119	17
C45	602+75	6.0	6.0	300119	18
C46	602+75	9.0	3.0	300119	18
C47	604+25	6.0	6.0	300120	19
C48	604+25	9.0	3.0	300120	19
C49	609+75	6.0	6.0	300120	20
C50	609+75	9.0	3.0	300120	20
C51	611+25	6.0	6.0	300122	21
C52	611+25	9.0	3.0	300122	21
C53	616+75	6.0	6.0	300122	22
C54	616+75	9.0	3.0	300122	22
C55	618+25	4.5	7.5	300121	23
C56	618+25	6.0	6.0	300121	23
C57	618+25	7.5	4.5	300121	23
C58	618+25	9.0	3.0	300121	23
C59	623+75	6.0	6.0	300121	24
C60	623+75	9.0	3.0	300121	24

Table 16 Locations for in-place density measurements on compacted
Asphalt Concrete Surfacing, SPS-1 Montana.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line, Rt.	Outside Lane Edge, Lt.	
T130	542+50	6	6	300113
T131	544+00	6	6	300113
T132	545+50	6	6	300113
T133	549+50	6	6	300118
T134	551+00	6	6	300118
T135	552+50	6	6	300118
T136	556+50	6	6	300116
T137	558+00	6	6	300116
T138	559+50	6	6	300116
T139	563+50	6	6	300115
T140	565+00	6	6	300115
T141	566+50	6	6	300115
T142	570+50	6	6	300117
T143	572+00	6	6	300117
T144	573+50	6	6	300117
T145	577+50	6	6	300114
T146	579+00	6	6	300114
T147	580+50	6	6	300114
T148	584+50	6	6	300124
T149	586+00	6	6	300124
T150	587+50	6	6	300124
T151	591+50	6	6	300123
T152	593+00	6	6	300123
T153	594+50	6	6	300123
T154	598+50	6	6	300119
T155	600+00	6	6	300119
T156	601+50	6	6	300119
T157	605+50	6	6	300120
T158	607+00	6	6	300120
T159	608+50	6	6	300120
T160	612+50	6	6	300122
T161	614+00	6	6	300122
T162	615+50	6	6	300122
T163	619+50	6	6	300121
T164	621+00	6	6	300121
T165	622+50	6	6	300121

Materials Reference Library (MRL)

During pavement construction, additional sampling of all asphalt layers will be conducted. This includes the asphalt-treated base layer, the permeable asphalt-treated layer and the finished asphalt concrete surface. It should be noted that this requirement refers to layers of asphalt materials. Different lifts of the same material are not to be considered independent layers. The samples obtained will be used as a record of the materials being used on the project and will be sent to a special facility for long-term storage. The material to be obtained for this purpose shall consist of the following samples from each mixture design:

- Three 5-gallon pails of asphalt cement (from the plant)
- One 55-gallon drum of the combined and graded coarse and fine aggregate for all different mixtures except PATB
- Three 5-gallon pails of the finished mix uncompacted (from the paver or roadway immediately prior to lay-down)

One sample of asphalt cement shall be obtained from the plant for each type of asphalt cement used on the project. Therefore, if only one type of asphalt cement was used for both the PATB and ATB layers on the project, only one sample unit (three 5-gallon pails) of the asphalt cement shall be sampled and this one sample will represent both asphalt-treated layers. The asphalt cement shall be sampled from the plant using AASHTO T40, "Sampling Bituminous Materials," after the asphalt has been heated for mixing. It should be noted that a sample for long-term storage of the graded aggregates for the PATB layer is not required

One sample of the combined and graded aggregates shall be obtained from the plant for each asphalt layer (mix design) of the project (except PATB). This material shall be sampled in conformance with applicable portions of AASHTO T2, "Sampling Aggregates." For drum plants, the aggregates should be obtained from the charging (inclined) conveyor using the bypass chute, if possible. Otherwise, the sample should be taken from the belt on the charging conveyor. For batch plants, the aggregates can be sampled from the inclined conveyor at the dryer.

The sample of finished asphalt concrete mix used in the construction of the test sections shall be sampled from the paver or roadway immediately prior to lay-down. These materials shall be sampled in conformance with AASHTO T168, "Sampling Bituminous Paving Mixtures."

Containers (barrels and buckets) for the storage of these samples will be provided to the Montana Department of Transportation by the LTPP Materials Reference Library (MRL) at no cost to the State. These containers are of special manufacture to accommodate long-term storage. It will be necessary that scheduling information be furnished to the LTPP MRL contractor as soon as this information is available. This information should, at the minimum, contain:

- date containers needed
- State agency contact name

- shipping address
- telephone number

The contact names and telephone numbers for the LTPP MRL are as follows:

Contact Name	Affiliation	Phone No.
Mr. Rodney Soule	Nichols Consulting Engineers, Chtd.	702/329-4955
Mr. Jim Nichols	Nichols Consulting Engineers, Chtd.	702/329-4955

The SPS-1 samples to be shipped to the MRL will be by a common carrier and the cost will be borne by the MRL contractor (Nichols Consulting Engineers Chtd.). The participating agency should contact the MRL office for exact coordination and sample shipping details. Any of the three names listed above may be contacted but, it is preferable that Mr. Rodney Soule be the primary contact point for the participating agencies.

A copy of Field Operations Information Form 1 should be completed and included with the shipment and another copy of the form should be mailed separately. This will allow a trace of the shipment if it does not arrive in a timely manner.

Elevation Measurements

Elevation measurements shall be made on the surface of each pavement layer: prepared subgrade, base layers, and surface layers. Measurements should be made at five points located transversely across the outside lane (outside lane edge, wheelpath, center of the lane, inside wheelpath, and inside lane edge). These five transverse points should be at offsets from the centerline of 0, 3 ft, 6 ft, 9 ft, and 12 ft. Measurements should be made at 50 ft intervals starting at test section station 0+00 and extending to test section station 5+00 (eleven stations per test section). Test section station locations are specified in figure 20. Measurements must be made to an accuracy of 0.01 ft. Care must be taken to re-establish the same points on the surface of each succeeding material layer to ensure accurate determination of the thickness of each layer.

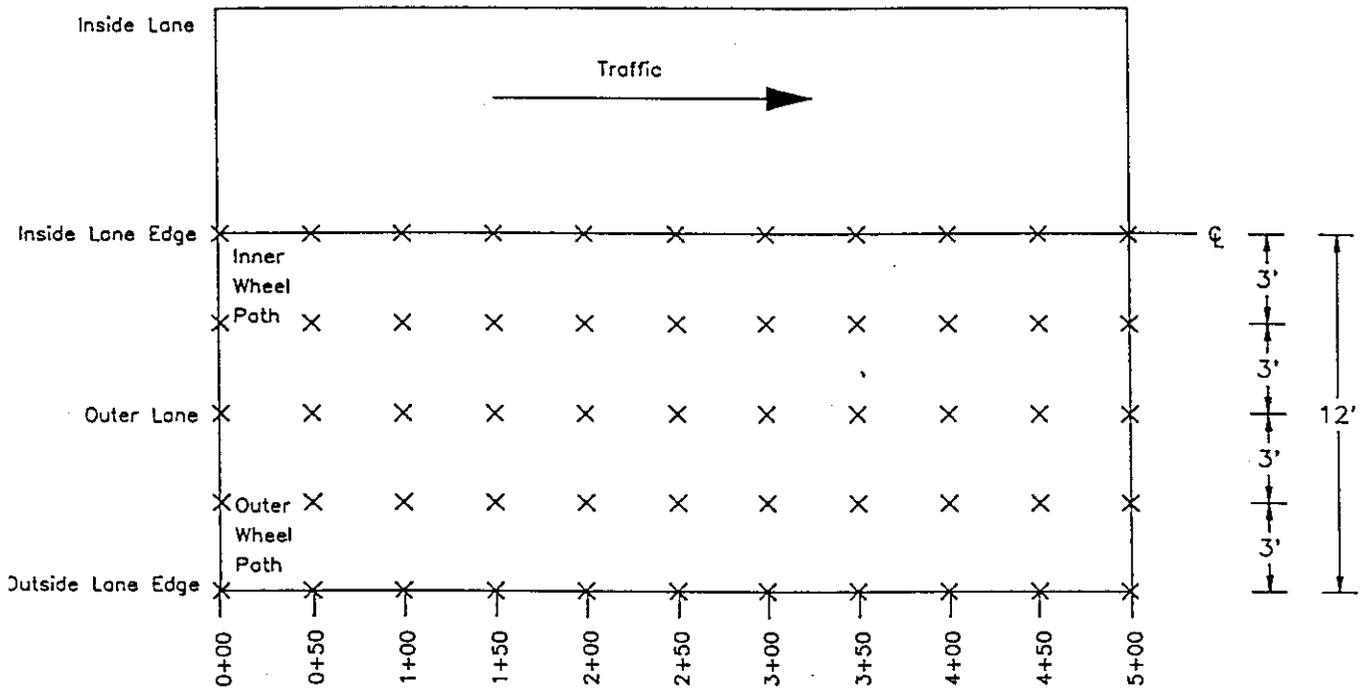


Figure 20. Test section elevation measurement location for SPS-1 Montana.

Shipping Tracking Tables

This section contains shipping tracking tables which contains instructions for disposition of samples retrieved from the field. Using these tracking tables (tables 17 and 18), sampling personnel can determine where each sample is to be shipped and tested.

Each sample (core, bulk, moisture, Shelby tube, splitspoon) shall be assigned a four-digit number that must be recorded on the appropriate data forms. The sample number will consist of two letters on the left side and up to three numbers on the right side.

The first letter on the left identifies the sample type in one of the following categories:

- C (core sample)
- B (bulk sample)
- M (moisture sample)
- J (splitspoon sample)

The second letter from the left identifies the material type of the material in the sample in one of the following categories.

- A (asphalt concrete)
- C (asphalt cement)
- T (treated material (base/subbase))
- G (untreated, unbound material (base/subbase))
- S (subgrade soil or fill material)

The numbers on the right will designate the sample number. The numbers shall be assigned consecutively for each sample type. For example, samples taken at C-type locations can be designated CT01, CT02, CT03, etc. for the ATB material. If a bulk sample of one layer is contained in more than one bag, then the number of bags and the same bulk sample number should be recorded on each bag.

The following is a list of valid combinations of letters and numbers making up sample code numbers:

- CA24 Asphalt concrete cores
- CT24 Treated base cores
- BG01 Bulk samples from granular base or subbase. BG01-BG10 for subgrade material, BG11-BG19 for existing embankment material and BG20-BG29 for dense-graded aggregate base.
- BA01 Bulk samples of uncompacted asphalt concrete. Assign numbers consecutively as samples are obtained, BA01 through BA19 for binder course material and BA20 or higher for surface course material.
- BT01 Bulk samples of uncompacted asphalt-treated base. Assign numbers consecutively as samples are obtained, BT01 through BT19 for permeable

asphalt-treated base and BT20 or higher for dense-graded asphalt- treated base.

- BS01 Bulk samples of subgrade material from different sampling areas within the test site. Assign sample numbers consecutively (BS01, BS02, etc.) as samples are obtained.
- MG01 Granular base samples obtained from bulk sampling locations solely for determining natural moisture content
- MS01 Subgrade samples obtained from bulk sampling locations for moisture content determination

Each sample shall be labeled before packing in boxes and cartons. As a minimum, the following information shall be included on tags and labels:

- State Code
- SPS Project Code
- Test Section Number
- Core/Sample Location (as marked on sample layout plans)
- Sample Number (four digit code)
- Date (mm-dd-yy, sampling date)
- Field Set (one digit number which will be 1 for the first round of sampling)

Table 17. Samples to be Shipped to the State Laboratory
(or their designee), SPS-1 Montana.

Sample Location Number	Sample Number	Lab Test Number	Type of Sample
C5	CA05	2	4" AC Core
C6	CA06	2	4" AC Core
C11	CA11	2	4" AC Core
C12	CA12	2	4" AC Core
C13	CA13	1	4" AC Core
C14	CA14	1	4" AC Core
C16	CA16	2	4" AC Core
C17	CA17	1	4" AC Core
C18	CA18	1	4" AC Core
C19	CA19	2	4" AC Core
C20	CA20	2	4" AC Core
C25	CA25	2	4" AC Core
C26	CA26	2	4" AC Core
C27	CA27	1	4" AC Core
C28	CA28	1	4" AC Core
C29	CA29	2	4" AC Core
C30	CA30	2	4" AC Core
C36	CA36	2	4" AC Core
C37	CA37	1	4" AC Core
C38	CA38	1	4" AC Core
C39	CA39	2	4" AC Core
C40	CA40	2	4" AC Core
C45	CA45	2	4" AC Core
C46	CA46	2	4" AC Core
C47	CA47	1	4" AC Core
C48	CA48	1	4" AC Core
C49	CA49	2	4" AC Core
C50	CA50	2	4" AC Core
C51	CA51	1	4" AC Core
C52	CA52	1	4" AC Core
C54	CA54	2	4" AC Core
C59	CA59	2	4" AC Core
C60	CA60	2	4" AC Core
C11	CT11	2	4" ATB Core
C12	CT12	2	4" ATB Core
C13	CT13	1	4" ATB Core
C14	CT14	1	4" ATB Core
C16	CT16	2	4" ATB Core
C17	CT17	1	4" ATB Core
C18	CT18	1	4" ATB Core
C19	CT19	2	4" ATB Core
C20	CT20	2	4" ATB Core

Table 17 Samples to be shipped to the State Laboratory
(or their designee), SPS-1 Montana (cont'd)

Sample Location Number	Sample Number	Lab Test Number	Type of Sample
C25	CT25	2	4" ATB Core
C26	CT26	2	4" ATB Core
C36	CT36	2	4" ATB Core
C37	CT37	1	4" ATB Core
C38	CT38	1	4" ATB Core
C39	CT39	2	4" ATB Core
C40	CT40	2	4" ATB Core
C51	CT51	1	4" ATB Core
C52	CT52	1	4" ATB Core
C54	CT54	2	4" ATB Core
B23	BA20	3	Bulk AC Mixture
B24	BA21	3	Bulk AC Mixture
B25	BA22	3	Bulk AC Mixture
B29	BC23	3	Bulk Asphalt Cement
B30	BC24	3	Bulk Asphalt Cement
B31	BC25	3	Bulk Asphalt Cement
B20	BT20	3	Bulk ATB Mixture
B21	BT21	3	Bulk ATB Mixture
B22	BT22	3	Bulk ATB Mixture
B26	BC20	3	Bulk Asphalt Cement - ATB
B27	BC21	3	Bulk Asphalt Cement - ATB
B28	BC22	3	Bulk Asphalt Cement - ATB
B16	BT01	3	Bulk PATB Mixture
B17	BT02	3	Bulk PATB Mixture
B18	BT03	3	Bulk PATB Mixture
B19	BT04	3	Bulk PATB Mixture
B13	BG13	2	Bulk DGAB (100 lbs)
B14	BG14	2	Bulk DGAB (100 lbs)
B15	BG15	2	Bulk DGAB (100 lbs)
B1	BS01	2	Bulk Existing Embankment (100 lbs)
B2	BS02	2	Bulk Existing Embankment (100 lbs)
B3	BS03	2	Bulk Existing Embankment (100 lbs)
B4	BS04	2	Bulk Existing Embankment (100 lbs)
B5	BS05	2	Bulk Existing Embankment (100 lbs)
B6	BS06	2	Bulk Existing Embankment (100 lbs)
B7	BS07	2	Bulk Prepared Subgrade (100 lbs)
B8	BS08	2	Bulk Prepared Subgrade (100 lbs)
B9	BS09	2	Bulk Prepared Subgrade (100 lbs)
B10	BS10	2	Bulk Prepared Subgrade (100 lbs)
B11	BS11	2	Bulk Prepared Subgrade (100 lbs)
B12	BS12	2	Bulk Prepared Subgrade (100 lbs)

Table 18. Samples to be shipped to the FHWA Contract Laboratory,
SPS-1 Montana.

Sample Location Number	Sample Number	Lab Test Number	Type of Sample
C1	CA01	1	4" AC Core
C2	CA02	1	4" AC Core
C3	CA03	1	4" AC Core
C4	CA04	1	4" AC Core
C7	CA07	1	4" AC Core
C8	CA08	1	4" AC Core
C9	CA09	1	4" AC Core
C10	CA10	1	4" AC Core
C15	CA15	2	4" AC Core
C21	CA21	1	4" AC Core
C22	CA22	1	4" AC Core
C23	CA23	1	4" AC Core
C24	CA24	1	4" AC Core
C31	CA31	1	4" AC Core
C32	CA32	1	4" AC Core
C33	CA33	1	4" AC Core
C34	CA34	1	4" AC Core
C35	CA35	2	4" AC Core
C41	CA41	1	4" AC Core
C42	CA42	1	4" AC Core
C43	CA43	1	4" AC Core
C44	CA44	1	4" AC Core
C53	CA53	2	4" AC Core
C55	CA55	1	4" AC Core
C56	CA56	1	4" AC Core
C57	CA57	1	4" AC Core
C58	CA58	1	4" AC Core
C7	CT07	1	4" ATB Core
C8	CT08	1	4" ATB Core
C9	CT09	1	4" ATB Core
C10	CT10	1	4" ATB Core
C15	CT15	2	4" ATB Core
C21	CT21	1	4" ATB Core
C22	CT22	1	4" ATB Core
C23	CT23	1	4" ATB Core
C24	CT24	1	4" ATB Core
C31	CT31	2	4" ATB Core
C32	CT32	1	4" ATB Core
C33	CT33	1	4" ATB Core
C34	CT34	1	4" ATB Core
C35	CT35	2	4" ATB Core

Table 18 Samples to be shipped to the FHWA Contract Laboratory,
SPS-1 Montana

Sample Location Number	Sample Number	Lab Test Number	Type of Sample
C53	CT53	2	4" ATB Core
B1	BS01	2	Bulk Existing Embankment (300 lbs)
B2	BS02	2	Bulk Existing Embankment (300 lbs)
B3	BS03	2	Bulk Existing Embankment (300 lbs)
B4	BS04	2	Bulk Existing Embankment (300 lbs)
B5	BS05	2	Bulk Existing Embankment (300 lbs)
B6	BS06	2	Bulk Existing Embankment (300 lbs)
B7	BS07	2	Bulk Prepared Subgrade Material (300 lbs)
B8	BS08	2	Bulk Prepared Subgrade Material (300 lbs)
B9	BS09	2	Bulk Prepared Subgrade Material (300 lbs)
B10	BS10	2	Bulk Prepared Subgrade Material (300 lbs)
B11	BS11	2	Bulk Prepared Subgrade Material (300 lbs)
B12	BS12	2	Bulk Prepared Subgrade Material (300 lbs)
B13	BG13	2	Bulk DGAB (300 lbs)
B14	BG14	2	Bulk DGAB (300 lbs)
B15	BG15	2	Bulk DGAB (300 lbs)
B1	MS01	2	Existing Embankment Moisture Content Samples
B2	MS02	2	Existing Embankment Moisture Content Samples
B3	MS03	2	Existing Embankment Moisture Content Samples
B4	MS04	2	Existing Embankment Moisture Content Samples
B5	MS05	2	Existing Embankment Moisture Content Samples
B6	MS06	2	Existing Embankment Moisture Content Samples
B7	MS07	2	Prepared Subgrade Moisture Content Samples
B8	MS08	2	Prepared Subgrade Moisture Content Samples
B9	MS09	2	Prepared Subgrade Moisture Content Samples
B10	MS10	2	Prepared Subgrade Moisture Content Samples
B11	MS11	2	Prepared Subgrade Moisture Content Samples
B12	MS12	2	Prepared Subgrade Moisture Content Samples
B13	MG13	2	DGAB Moisture Content Samples
B14	MG14	2	DGAB Moisture Content Samples
B15	MG15	2	DGAB Moisture Content Samples

Laboratory Tracking of Samples

This section contains Laboratory Sample Tracking Tables which contain instructions for sample handling and tracking throughout the laboratory testing process. Tables 19 through 23 detail the sample handling and testing for the State agency laboratory and tables 24 through 27 detail the sample handling and testing for the FHWA-LTPP Laboratory Materials Testing Contractor.

These tables provide the laboratories with the following information and directions:

- Tracking of samples as they are taken for the field and tested in the laboratory
- Laboratory test sequences for each pavement material type
- Dedicated sample(s) for each test
- Designation of extra samples for future use
- Instructions for sample storage
- Special instructions and other remarks

The following is a description of the column headings used for the tracking table:

- *Layer Number* - is assigned beginning with layer number 1. Layer number 1 is always assigned for the subgrade and the last layer number is always the pavement surface layer.
- *Layer Description Code* - is used to describe the material layer. Valid codes for this project are.
 - Original Surface Layer: 03
 - AC Layer Below Surface (Binder Coarse): 04
 - Base Coarse: 05
 - Subgrade: 07
 - Embankment (Fill): 11
- *Layer Type* - is used to classify the type of layer. Valid codes for this project are:
 - AC: for asphalt concrete layer
 - TB: for bound (treated) base layer
 - GB: for unbound (granular) base layer
 - GS: for unbound (granular) subbase layer
 - SS: for subgrade layer
- *Test Section Number* - is the number of the test section for which the sample pertains
- *Sample Location Number* - is the location the sample was taken and should be shown on sample tags and labels.

- *Sample Number* - is the number identifying each individual sample and should be shown on sample tags and labels.
- *Lab Test Number* - shall be assigned as per the following:
 - Beginning of the section (station 0-) samples of each layer that are retrieved from areas in the approach end of the test section (stations preceding 0+00) shall be assigned Laboratory Test Number '1'.
 - End of the section (stations 5+): samples of each layer that are retrieved from areas in the leave end of the test section (stations after 5+00) shall be assigned Laboratory Test Number '2'.
 - Middle of the section (stations 0+00 to 5+00): samples of each layer that are retrieved from areas in the middle of the test section (from the paver) shall be assigned Laboratory Test Number '3'.
- *Required Laboratory Tests Per Layer* - order in which testing shall proceed.
- *Extra Sample* - is the sample to be saved as a backup for other tests. A "yes" in this column implies that this is a dedicated extra sample saved for future use. A "no" indicates that a sample can be discarded after use.
- *Sample Storage* - the following codes are used to specify the sample storage conditions for samples
 - environmentally-protected and controlled storeroom at 5-21°C (40-70°F)
 - environmentally-protected and controlled storeroom at 5-38°C (40-100°F)
- *Sample Disposal?* - indicates whether or not a sample can be disposed of after testing. Generally all samples, or portions of samples that are not tested, are saved until further notice.

Tables 19 through 23 and tables 24 through 27 should be completed (layer number), checked and modified as necessary to reflect the actual samples received and then submitted to Nichols Consulting Engineers for approval before any testing commences by the State testing lab and the FHWA-LTPP testing lab, respectively.

Table 19 Tracking table of Asphaltic Concrete testing in the State Laboratory (or their designee), SPS-1 Montana.

Layer Number Note 1	Layer Description Code	Layer Type	Test Section No.	Sample Location No.	Sample No.	Lab Test No.	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	03	AC	300113	C05	CA05	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300113	C06	CA06	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300118	C11	CA11	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300118	C12	CA12	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300116	C13	CA13	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300116	C14	CA14	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300116	C16	CA16	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300115	C17	CA17	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300115	C18	CA18	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300115	C19	CA19	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300115	C20	CA20	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300117	C25	CA25	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300117	C26	CA26	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300114	C27	CA27	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300114	C28	CA28	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300114	C29	CA29	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300114	C30	CA30	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300124	C36	CA36	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300123	C37	CA37	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300123	C38	CA38	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300123	C39	CA39	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300123	C40	CA40	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300119	C45	CA45	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300119	C46	CA46	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300120	C47	CA47	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300120	C48	CA48	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300120	C49	CA49	2	AC01/P01	AC02/P02			Yes	(a)	No
	30	AC	300120	C50	CA50	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300122	C51	CA51	1	AC01/P01	AC02/P02			Yes	(a)	No

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs.

Table 19. Tracking table of Asphaltic Concrete testing in the State Laboratory
(or their designee), SPS-1 Montana. (cont'd)

Layer Number Note 1	Layer Description Code	Layer Type	Test Section No	Sample Location No.	Sample No.	Lab Test No	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	03	AC	300122	C52	CA52	1	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300122	C54	CA54	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300121	C59	CA59	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300121	C60	CA60	2	AC01/P01	AC02/P02			Yes	(a)	No
	03	AC	300118	B23	BA20	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	03	AC	300123	B24	BA21	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	03	AC	300122	B25	BA22	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	03	AC	300100	B29	BC23	3	AE02/P22	AE03/P23	AE04/P24	AE05/P25	No	(a)	Yes
	03	AC	300100	B30	BC24	3	AE02/P22	AE03/P23	AE04/P24	AE05/P25	No	(a)	Yes
	03	AC	300100	B31	BC25	3	AE02/P22	AE03/P23	AE04/P24	AE05/P25	No	(a)	Yes

Note 1 Layer number to be completed by testing lab after reviewing field sampling logs

Note 2 Run tests AE01/P21 - AE05/P25 on recovered asphalt cement and tests AG01/P11 - AG06/P14B on extracted aggregate

Note 1: Layer Number to be completed by testing lab after reviewing field sampling logs.

Table 20 Tracking table of Asphalt Treated Base in the State Laboratory (or their designee), SPS-1 Montana.

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	05	TB	300118	C11	CT11	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300118	C12	CT12	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300116	C13	CT13	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300116	C14	CT14	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300116	C16	CT16	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300115	C17	CT17	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300115	C18	CT18	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300115	C19	CT19	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300115	C20	CT20	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300117	C25	CT25	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300117	C26	CT26	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300124	C36	CT36	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300123	C37	CT37	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300123	C38	CT38	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300123	C39	CT39	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300123	C40	CT40	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300122	C51	CT51	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300122	C52	CT52	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300122	C54	CT54	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300118	B20	BT20	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	05	TB	300115	B21	BT21	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	05	TB	300123	B22	BT22	3	AC03/P03	AC04/P04	AC05/P05	Note 2	No	(a)	Yes
	05	TB	300100	B26	BC20	3	AE02/P22	AE03/P13	AE04/P24	AE05/P25	No	(a)	Yes
	05	TB	300100	B27	BC21	3	AE02/P22	AE03/P13	AE04/P24	AE05/P25	No	(a)	Yes
	05	TB	300100	B28	BC22	3	AE02/P22	AE03/P13	AE04/P24	AE05/P25	No	(a)	Yes

Note 1: Layer Number to be completed by testing lab after reviewing field sampling logs.

Note 2: Run tests AE01/P21 - AE05/P25 on recovered asphalt cement and tests AG01/P11 - AG06/P14B on extracted aggregate

Table 21 Tracking Table of Permeable Asphalt Treated Base in the State Laboratory (or their designee), SPS-1 Montana

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	05	TB	300124	B16	BT01	3	AC04/P04	AG04/P14			No	(a)	Yes
	05	TB	300123	B17	BT02	3	AC04/P04	AG04/P14			No	(a)	Yes
	05	TB	300119	B18	BT03	3	AC04/P04	AG04/P14			No	(a)	Yes
	05	TB	300121	B19	BT04	3	AC04/P04	AG04/P14			No	(a)	Yes

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs.

Table 22 Tracking Table of Dense Graded Aggregate Base in the State Laboratory (or their designee), SPS-1 Montana

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	05	GB	300113	B13	BG13	2	UG09/P48				No	(b)	Yes
	05	GB	300117	B14	BG14	2	UG09/P48				No	(b)	Yes
	05	GB	300121	B15	BG15	2	UG09/P48				No	(b)	Yes

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs

Table 23 Tracking Table of Existing Embankment and Prepared Subgrade Testing in the State Laboratory (or their designee), SPS-1 Montana

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	07	SS	300113	B1	BS01	2	UG09/P48				No	(b)	Yes
	07	SS	300116	B2	BS02	2	No testing - sample stored				Yes	(b)	No
	07	SS	300117	B3	BS03	2	UG09/P48				No	(b)	Yes
	07	SS	300124	B4	BS04	2	No testing - sample stored				Yes	(b)	No
	07	SS	300119	B5	BS05	2	No testing - sample stored				Yes	(b)	No
	07	SS	300122	B6	BS06	2	UG09/P48				No	(b)	Yes
	11	GS	300113	B7	BS07	2	UG09/P48				No	(b)	Yes
	11	GS	300116	B8	BS08	2	No testing - sample stored				Yes	(b)	No
	11	GS	300117	B9	BS09	2	UG09/P48				No	(b)	Yes
	11	GS	300124	B10	BS10	2	No testing - sample stored				Yes	(b)	No
	11	GS	300119	B11	BS11	2	No testing - sample stored				Yes	(b)	No
	11	GS	300122	B12	BS12	2	UG09/P48				No	(b)	Yes

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs.

Table 24. Tracking Table of Asphaltic Concrete Testing in the FHWA Contract Laboratory, SPS-1 Montana.

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	03	AC	300113	C1	CA01	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300113	C2	CA02	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300113	C3	CA03	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300113	C4	CA04	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300118	C7	CA07	1	AC01/P01	AC02/P02	AC06/P06		No	(a)	Yes
	03	AC	300118	C8	CA08	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300118	C9	C09	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300118	C10	CA10	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300116	C15	CA15	2	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300117	C21	CA21	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300117	C22	CA22	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300117	C23	CA23	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300117	C24	CA24	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300114	C31	CA31	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300114	C32	CA32	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300114	C33	CA33	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300114	C34	CA34	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300114	C35	CA35	2	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300119	C41	CA41	1	AC01/P01	AC02/P02	AC07/P07	AC07-P07 (ITS)	No	(a)	Yes
	03	AC	300119	C42	CA42	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300119	C43	CA43	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300119	C44	CA44	1	AC01/P01	AC02/P02	AC06/P06		No	(a)	Yes
	03	AC	300122	C53	CA53	2	AC01/P01	AC02/P2	AC07/P07 (ITS)		No	(a)	Yes
	03	AC	300121	C55	CA55	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300121	C56	CA56	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300121	C57	CA57	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	03	AC	300121	C58	CA58	1	AC01/P01	AC02/P02	AC06/P06		No	(a)	Yes

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs

Table 25 Tracking Table of Asphalt Treated Base in the FHWA Contract Laboratory, SPS-1 Montana.

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
							Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth			
	05	TB	300118	C7	CT07	1	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300118	C8	CT08	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	05	TB	300118	C9	CT09	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300118	C10	CT10	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300116	C15	CT15	2	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300117	C21	CT21	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	05	TB	300117	C22	CT22	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300117	C23	CT23	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300117	C24	CT24	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300114	C31	CT31	2	AC01/P01	AC02/P02			Yes	(a)	No
	05	TB	300114	C32	CT32	1	AC01/P01	AC02/P02	AC07/P07 (ITS)		No	(a)	Yes
	05	TB	300114	C33	CT33	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300114	C34	CT34	1	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300114	C35	CT35	2	AC01/P01	AC02/P02	AC07/P07	AC07/P07 (ITS)	No	(a)	Yes
	05	TB	300122	C53	CT53	2	AC01/P01	AC02/P02			Yes	(a)	No

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs

Table 26 Tracking Table of Dense Graded Aggregate Base in the FHWA Contract Laboratory, SPS-1 Montana

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence								
							Required Laboratory Tests Per Layer					Extra Sample	Sample Storage	Sample Disposed?	
							First	Second	Third	Fourth	Fifth				Sixth
	05	GB	300113	B13	BG13	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46	No	(b)	Yes
	05	GB	300117	B14	BG14	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46	No	(b)	Yes
	05	GB	300121	B15	BG15	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46	No	(b)	Yes
	05	GB	300113	B13	MG13	2	UG10/P49						No	(b)	Yes
	05	GB	300117	B14	MG14	2	UG10/P49						No	(b)	Yes
	05	GB	300121	B15	MG15	2	UG10/P49						No	(b)	Yes

Note 1 Layer Number to be completed by testing lab after reviewing field sampling logs

Table 27. Tracking Table of Existing Embankment and Prepared Subgrade Testing in the FHWA Contract Laboratory, SPS-1 Montana.

Layer Number (Note 1)	Layer Description Code	Layer Type	Test Section Number	Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence								
							Required Laboratory Tests Per Layer						Extra Sample	Sample Storage	Sample Disposed?
							First	Second	Third	Fourth	Fifth	Sixth			
	11	GS	300113	B7	BS07	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300116	B8	BS08	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300117	B9	BS09	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300124	B10	BS10	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300119	B11	BS11	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300122	B12	BS12	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	11	GS	300113	B7	MS07	2	SS09/P49						No	(b)	Yes
	11	GS	300116	B8	MS08	2	SS09/P49						No	(b)	Yes
	11	GS	300117	B9	MS09	2	SS09/P49						No	(b)	Yes
	11	GS	300124	B10	MS10	2	SS09/P49						No	(b)	Yes
	11	GS	300119	B11	MS11	2	SS09/P49						No	(b)	Yes
	11	GS	300122	B12	MS12	2	SS09/P49						No	(b)	Yes
	07	SS	300113	B1	BS01	2	SS01/P51	SS02/P52	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300116	B2	BS02	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300117	B3	BS03	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300124	B4	BS04	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300119	B5	BS05	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300122	B6	BS06	2	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46	No	(b)	Yes
	07	SS	300113	B1	MS01	2	SS09/P49						No	(b)	Yes
	07	SS	300116	B2	MS02	2	SS09/P49						No	(b)	Yes
	07	SS	300117	B3	MS03	2	SS09/P49						No	(b)	Yes
	07	SS	300124	B4	MS04	2	SS09/P49						No	(b)	Yes
	07	SS	300119	B5	MS05	2	SS09/P49						No	(b)	Yes
	07	SS	300122	B6	MS06	2	SS09/P49						No	(b)	Yes

Note 1: Layer Number to be completed by testing lab after reviewing field sampling logs

Data Forms

Data forms and instructions for all field sampling and measurements described in this document are contained in "**Specific Pavement Studies, Materials Sampling, and Testing Requirements for Experiment SPS-1, Strategic Study of Structural Factors for Flexible Pavements.**" Copies of blank data forms are included in attachment A. These data forms must be completed at the time of the work. Completed forms shall be submitted to the designated LTPP representative.

Sampling and Testing Quantities

The estimated quantities for materials sampling, field testing, and laboratory testing for the SPS-1 project are contained in table 28. It should be noted that the SHRP sampling and test procedures referenced in these tables and in other portions of this document must be followed in conducting this work. This includes completion and submission of all required data forms.

Table 28 Estimated quantities of laboratory materials testing, SPS-1 Montana

	<u>LTPP TEST Designation</u>	<u>LTPP Protocol</u>	<u>No.</u>
EXISTING EMBANKMENT			
Sieve Analysis	SS01	Ship to FHWA Lab	6
Hydrometer to 0.01 mm	SS02	Ship to FHWA Lab	6
Atterberg Limits	SS03	Ship to FHWA Lab	6
Classification and Type of Subgrade	SS04	Ship to FHWA Lab	6
Moisture-Density Relations	SS05	Ship to FHWA Lab	6
Resilient Modulus	SS07	Ship to FHWA Lab	6
Natural Moisture Content	SS09	Ship to FHWA Lab	6
Permeability	UG09	P48	3
In-Place Density		SHRP-LTPP Method	42
Depth to Rigid Layer		SHRP-LTPP Method	12
PREPARED SUBGRADE			
Sieve Analysis	SS01	Ship to FHWA Lab	6
Hydrometer to 0.01 mm	SS02	Ship to FHWA Lab	6
Atterberg Limits	SS03	Ship to FHWA Lab	6
Classification and Type of Subgrade	SS04	Ship to FHWA Lab	6
Moisture-Density Relations	SS05	Ship to FHWA Lab	6
Resilient Modulus	SS07	Ship to FHWA Lab	6
Natural Moisture Content	SS09	Ship to FHWA Lab	6
Permeability	UG09	P48	3
In-Place Density		SHRP-LTPP Method	42
DENSE GRADED AGGREGATE BASE			
Particle Size Analysis	UG01	Ship to FHWA Lab	3
Sieve Analysis (Washed)	UG02	Ship to FHWA Lab	3
Atterberg Limits	UG04	Ship to FHWA Lab	3
Moisture-Density Relations	UG05	Ship to FHWA Lab	3
Resilient Modulus	UG07	Ship to FHWA Lab	3
Classification	UG08	Ship to FHWA Lab	3
Permeability	UG09	P48	3
Natural Moisture Content	UG10	Ship to FHWA Lab	3
In-Place Density		SHRP-LTPP Method	24
PERMEABLE ASPHALT TREATED BASE			
Asphalt Content (Extraction)	AC04	P04	4
Aggregate Gradation	AG04	P14	4

Table 28 Estimated quantities of laboratory materials testing, SPS-1 Montana (cont'd)

BITUMINOUS TREATED BASE

Core Examination/Thickness	AC01	Ship to FHWA Lab	15
Core Examination/Thickness	AC01	P01	19
Bulk Specific Gravity	AC02	Ship to FHWA Lab	15
Bulk Specific Gravity	AC02	P02	19
Maximum Specific Gravity	AC03	P03	3
Asphalt Content (Extraction)	AC04	P04	3
Moisture Susceptibility	AC05	P05	3
Resilient Modulus	AC07	Ship to FHWA Lab	9
Indirect Tensile Strength	AC07	Ship to FHWA Lab	12
In-Place Density		SHRP-LTPP Method	21

Extracted Aggregate

Specific Gravity of Coarse Aggregate	AG01	P11	3
Specific Gravity of Fine Aggregate	AG02	P12	3
Aggregate Gradation	AG04	P14	3
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	3

Asphalt Cement

Abson Recovery	AE01	P21	3
Penetration @ 50°F, 77°F, 90°F	AE02	P22	3
Specific Gravity (60°F)	AE03	P23	3
Viscosity @ 77°F	AE04	P24	3
Viscosity @ 140°F, 275°F	AE05	P25	3

Asphalt Cement (from plant)

Penetration @ 50°F, 77°F, 90°F	AE02	P22	3
Specific Gravity (60°F)	AE03	P23	3
Viscosity @ 77°F	AE04	P24	3
Viscosity @ 140°F, 275°F	AE05	P25	3

ASPHALTIC CONCRETE SURFACE

Core Examination/Thickness	AC01	Ship to FHWA Lab	27
Core Examination/Thickness	AC01	P01	33
Bulk Specific Gravity	AC02	Ship to FHWA Lab	27
Bulk Specific Gravity	AC02	P02	33
Maximum Specific Gravity	AC03	P03	3
Asphalt Content (Extraction)	AC04	P04	3
Moisture Susceptibility	AC05	P05	3
Creep Modulus	AC06	Ship to FHWA Lab	3
Resilient Modulus	AC07	Ship to FHWA Lab	18
Indirect Tensile Strength	AC07	Ship to FHWA	24
In-Place Density		SHRP-LTPP Method	36

Table 28 Estimated quantities of laboratory materials testing, SPS-1 Montana (cont'd)

Extracted Aggregate

Bulk Specific Gravity of Coarse Aggregate	AG01	P11	3
Bulk Specific Gravity of Fine Aggregate	AG02	P12	3
Aggregate Gradation	AG04	P14	3
NAA Test for Fine Aggregate Particle Shape	AG05	P14A	3

Asphalt Cement

Abson Recovery	AE01	P21	3
Penetration @ 50°F, 77°F, 90°F	AE02	P22	3
Specific Gravity (60°F)	AE03	P23	3
Viscosity @ 77°F	AE04	P24	3
Viscosity @ 140°F, 275°F	AE05	P25	3

Asphalt Cement (from plant)

Penetration @ 50°F, 77°F, 90°F	AE02	P22	3
Specific Gravity (60°F)	AE03	P23	3
Viscosity @ 77°F	AE04	P24	3
Viscosity @ 140°F, 275°F	AE05	P25	3