Colorado Department of Transportation

Materials Sampling, Field testing and Laboratory Testing Plan

Strategic Highway Research Program

SPS-2 and SPS-8 Experimental Projects

Federal Aid Project No. I 076-1(138)

State Highway No. I-76

Adams County

Colorado

Prepared By

Nichols Consulting Engineers, Chtd.
SHRP Western Region Office
1885 S. Arlington Ave., Suite 111
Reno, Nevada 89509

May 11, 1992

NICHOLS
CONSULTING
ENGINEERS, Chtd

May 11, 1992
File: 800.12.4.9.0

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Mr. Ahmad Ardani, P.E.
Colorado Department of Transportation
4201 E. Arkansas Avenue
Denver, Colorado 80222

Dear Ahmad:

Enclosed are five copies of the revised materials sampling and testing document for the SPS-2 and 8 projects on I-76 in Colorado. Based on comments and new information received from SHRP-DC, the following revisions have been made in this version:

1. Resilient modulus testing is to be performed under an FHWA testing contract. The only cost to the agency is that for shipping the cores to the designated laboratory.

2. The new guidelines from SHRP on the time to obtain the cores were incorporated in the document. This required the addition of several more cores since the cores from the lean concrete base must be obtained at different times than those from the PCC surface.

3. The SPS-8 test plan was revised to be in compliance with the draft guidelines recently released from SHRP DC.

4. Several errors were also found and corrected during the revision of the plan.

Also enclosed is a computer disk which contains the WordPerfect and AutoCad computer files for the document and figures.

Sincerely,
NICHOLS CONSULTING ENGINEERS

Gary E. Elkins

Gary E. Elkins
Chief Engineer

GEE/llv

cc: Cal Berge (w/o encl.), Amir Hanna, Shiraz Tayabji

1885 S Arlington Ave Suite 111
Reno, Nevada 89509

Telephone (702) 329-4955
Fax (702) 329-3098

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Materials Sampling, Field Testing and Laboratory Testing Plan

SPS-2 and SPS-8 Experimental Projects
I-76 Project, Adams County, Colorado

This document presents a materials and sampling plan for the experimental Strategic Highway Research Program (SHRP) SPS-2 and SPS-8 projects planned for construction on the I-76 project, Federal Aid Project No. I 076-1(138), in Adams County near Denver, Colorado

Background

The SHRP SPS-2 experiment entitled, "Strategic Study of Structural Factor for Rigid Pavements", consists of the construction of 12 test sections with varying thickness, lane width, portland cement concrete (PCC) strength, and base type. On the SPS-2 project in Colorado, one additional section representing the Colorado standard design for this route will be monitored. A total of thirteen test sections for the SPS-2 experiment will be monitored. The SPS-2 test sections will be constructed in the east bound direction on the I-76 main lanes.

The SHRP SPS-8 experiment entitled, "Study of Environmental Effects in the Absence of Heavy Loads", consists of the construction of two PCC test sections with an 8" and 11" thickness on a dense graded aggregate base. These test sections correspond to two of the test sections in the SPS-2 experiment. These two sections will be constructed on the realignment of Chestnut lane, east of its intersection with 136th Ave. and portions of the abandoned existing I-76 alignment.

The same materials sampling, field tests, and laboratory tests procedures must be followed for the SPS-2 and SPS-8 test sections on this project.

In the next portion of this documents, tables of combined materials sampling, field tests and laboratory test quantities are presented. The details of the sampling of the SPS-2 and SPS-8 projects are subsequently presented in sperate portions of this document since they will be constructed during different phases of the projects. The records of the tests and results must also be kept sperate for entry and storage in the National Pavement Research Data Base developed by SHRP.

Sampling and Testing Quantities

The combined quantities for materials sampling, field testing, and laboratory testing for the SPS-2 and SPS-8 experimental projects are contained in Tables 1 - 4. 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 1. Estimated quantities of laboratory materials testing for the SPS-2 and SPS-8 experimental projects, on I-76 project, Colorado.

	SHRP TEST Designation	SHRP Protocol	No.
SUBGRADE			
Sieve Analysis	SS01	P51	11
Hydrometer to 0.01mm	SS02	P42	11
Atterberg Limits	SS03	P43	11
Classification and Type of Subgrade	SS04	P52	35
Moisture-Density Relations	SS05	P55	11
Resilient Modulus	SS07	Ship to FHWA Lab	9
Unit Weight	SS08	P56	24
Natural Moisture Content	SS09	P49	11
Unconfined Comp. Strength	SS10	P54	9
Permeability	SS11	P57	6
In-Place Density		LTPP Method	56
Plate Bearing Testing	SS06	P58	6
Expansion Index	TBA	TBA(2)	3
UNBOUND GRANULAR BASE			
Particle Size Analysis	UG01	P41	6
Sieve Analysis (Washed)	UG02	P41	6
Atterberg Limits	UG04	P43	6
Moisture-Density Relations	UG05	P44	6
Resilient Modulus	UG07	Ship to FHWA Lab	6
Classification	UG08	P47	6
Permeability	UG09	P48	6
Natural Moisture Content	UG10	P49	6
In-Place Density		LTPP Method	30
Plate Bearing Test	SS06	P58	5
PERMEABLE ASPHALT TREATED BASE			
Core Examination/Thickness	AC01	P01	16
Bulk Specific Gravity	AC02	P02	16
Maximum Specific Gravity	AC03	P03	6
Asphalt Content (Extraction)	AC04	P04	6
Moisture Susceptibility	AC05	P05	6
Resilient Modulus	AC07	Ship to FHWA Lab	12
Indirect Tensile Strength	AC07	Ship to FHWA Lab	16
Plate Bearing Test	SS06	P58	2

Note 1. Will be based on ASTM B4829-88.

Table 2. Estimated quantities of laboratory materials testing on SPS-2 and SPS-8 experimental projects, on I-76 project, Colorado.

	SHRP TEST Designation	SHRP Protocol	No.
LEAN CONCRETE BASE - AS DELIVERED			
Compressive Strength	PC01	P61	
7 day			12
28 day			12
1 year			12
PORTLAND CEMENT CONCRETE - AS DELIVERED			
Compressive Strength	PC01	P61	
14 day			24
28 day			24
1 year			24
Splitting Tensile Strength	PC02	P62	
14 day			24
28 day			24
1 year			24
Flexural Strength	PC09	P69	
14 day			24
28 day			24
1 year			24
Air Content		ASTM C231	24
Slump		ASTM C143	24
Temperature		ASTM C1064	24

Table 3. Estimated quantities for laboratory materials testing on SPS-2 and SPS-8 experimental projects, on I-76 project, Colorado.

	SHRP TEST Designation	SHRP Protocol	No.
LEAN CONCRETE BASE - AS PLACED			
Compressive Strength	PC01	P61	
14 day			6
28 day			6
1 year			6
PORTLAND CEMENT CONCRETE - AS PLACED			
Compressive Strength	PC01	P61	
14 day			24
28 day			24
1 year			24
Splitting Tensile Strength	PC02	P62	
14 day			24
28 day			24
1 year			24
PCC Unit Weight	PC05	P65	72
Static Modulus of Elasticity	PC04	P64	
28 day			24
1 year			24
Air Content @ 28 days	PC08	P68	8
PCC Coefficient of Thermal Expansion	PC03	Ship to FHWA	8

Table 4. Estimated quantities for material sampling and other field tests on SPS-2 and SPS-8 experimental projects, on I-76 project, Colorado.

	Quantity	Units
Portland Cement Concrete		
Coring - 4" diam. cores	1,943	Linear Inches
Bulk Sampling (molded into test specimens)	24	Number
Unbound Base/Subbase Layers		
Bulk Sampling	6	Samples
Lean Concrete Base		
Bulk Sampling	6	Samples
Coring	108	Linear Inches
Permeable Asphalt Treated Base		
Bulk Sampling	6	Samples
Coring	72	Linear Inches
Subgrade		
Thin-walled tube sampling	42	Samples
Bulk Sampling (400 lbs each sample)	11	Samples
Shoulder Auger Probes	220	Linear Feet
Elevation Surveys (5 person hours per section per layer, ~60 points/section/layer)	240	Person-Hours

Sampling and Testing of SPS-2 Test Sections

This portion of the document presents the details of material sampling, field testing and laboratory testing for the SPS-2 experimental test sections to be constructed in the east bound lanes of I-76. Sampling and testing of the SPS-2 project during construction includes the following measurements, tests and samples from the various construction stages:

Subgrade

- Bulk sampling and thin-walled tube sampling of the prepared subgrade surface.
- Moisture and density tests on the prepared subgrade surface.
- Plate bearing tests.
- Auger probes through the shoulder to a depth of 20' below the prepared subgrade or embankment surface.
- Base line elevation surveys on the surface of the prepared subgrade or embankment to use as a reference in determining layer thickness.

Dense Graded Aggregate Base

- Bulk sampling of the Dense Graded Aggregate Based (DGAB).
- Moisture and density tests on the compacted DGAB.
- Plate bearing tests on the prepared DGAB.
- Elevation measurements on the prepared DGAB surface.

Lean Concrete Base

- Bulk sampling and molding of cylindrical test specimens from the as-delivered Lean Concrete Base (LCB) material.
- Plate bearing tests on the LCB surface.
- Coring of the LCB for laboratory testing.
- Elevation measurements on the prepared LCB surface.

Permeable Asphalt Treated Base

- Bulk sampling of the Permeable Asphalt Treated Base (PATB) material.
- Plate bearing tests on the surface of the PATB.
- Coring of the PATB for laboratory testing.
- Elevation measurements on the prepared PATB surface.

Portland Cement Concrete Surface

- Bulk sampling and molding of PCC specimens for laboratory testing.
- Slump, air content and temperature measurements on the as-delivered PCC mix.
- Coring of the PCC surface for laboratory testing.
- Elevation measurements on the finished PCC surface.

The details for these samples, tests, and measurements are presented in subsequent portions of this document organized by layer type.

The development of the materials sampling plan was based upon the construction sequencing proposed by CDOT for this project. Changes to the construction sequencing which alter the timing and ordering of construction of the experimental test sections may require changes to this sampling plan.

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-2 project:

SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing (PCC, Bituminous Materials, Aggregates and Soils), Operational Guide No. SHRP-LTPP-OG-004, Strategic Highway Research Program, November, 1989, (Revised January, 1992).

Specific Pavement Studies, Materials and Testing Requirements for Experiment SPS-2, Strategic Study of Structural Factors for Rigid Pavements, Operational Memorandum No. SHRP-LTPP-OM-022, Strategic Highway Research Program, April, 1991.

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-2, Strategic Study of Structural Factors for Rigid Pavements, Operational Memorandum No. SHRP-LTPP-OM-018, Strategic Highway Research Program, December, 1990.

Test Section Layout

The stationing for the location of the experimental test sections are shown in Tables 5 and 6. In Table 5 the start and end of each section and the start and end of the monitoring portion within each test section is specified in terms of the project's construction stationing. The relevant design features of each test section are also shown in this table.

In Table 6, the location of each test section is specified in terms of the construction stationing, test section stationing, and SHRP reference project stations. Construction stations are the same as those shown on the construction plans. Test section stationing refers to the method SHRP uses to reference locations within and adjacent to the ends of individual test sections. The SHRP test section stations start with station 0+00 assigned to the beginning of the 500' monitoring portion of the test section. On the SPS-2 Colorado project, this station is either 50 or 65 feet from the beginning of the test section. Since the monitoring portion of the test section

is 500 feet long, station 5+00 occurs at the end of the monitoring portion which is either 50 to 65 feet from the end of the test section.

The SHRP reference project station is a continuous stationing system that starts from the beginning of the monitoring portion of the first test section encountered on the project. This system will be used for future monitoring of these test sections.

Summary of Sampling and Testing on each Test Section

Figures 1 to 4 present an overview of the materials sampling and testing to be performed on the SPS-2 test sections on I-76. Samples and tests on the prepared subgrade, on the surface of the Dense Graded Aggregate Base, on the Permeable Asphalt Treated Base, and on the surface of the portland cement concrete pavement layers are illustrated in these figures. Figures 5 through 17 illustrate the details of the location and type of samples and tests to be performed on each constructed material layer for each test section. In each figure, the surface material present during the various construction stages are shown starting with the surface of the prepared subgrade. Locations are specified by the Test Section Stations relative to the beginning and end of the monitoring portion of each test section. The only measurements not shown in these figures are the elevation surveys to be performed on the finished surface of each material layer. The 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.

Subgrade

A summary of the samples, laboratory and field tests on the subgrade materials is presented in Table 7. In this table, B-type samples are bulk samples and A-type samples are thin-wall (Shelby) tube samples of the subgrade materials. The T-type test locations are for nuclear moisture-density tests, PB-type locations are for plate bearing tests, and the S-type locations are for the 20' deep auger probes through the shoulder.

Thin-wall (Shelby) Tube Samples

Undisturbed samples of the natural subgrade or fill material shall be obtained to a depth of 4' below the top of the subgrade or fill using thin-wall (Shelby) tube sampling at the locations listed in Table 8. Two samples should be obtained at each location. These operations shall be performed in accordance with **AASHTO T203 "Soil Investigation and Sampling by Auger Boring"** and **AASHTO M146 "Terms Relating to subgrade, Soil-Aggregate and Fill Materials"**. Shelby tube sampling shall be performed in accordance with **AASHTO T207**. If Shelby tube samples can not be obtained, split spoon samples may be obtained following Section 3.4.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Bulk Samples

Bulk samples of the subgrade or embankment material should be obtained from the locations listed in Table 9. In general, bulk sampling should consist of a single excavation, 2'

by 2' in area and 12 inches deep. Approximately 400 lbs of material should be obtained from each sampling location. The sampling operation should be performed following similar procedures to those contained in Section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling. Samples for gravimetric moisture tests should be obtained at each bulk sample location. **In-place density and moisture tests should be obtained at each bulk sampling location prior to sampling operations.**

Density and Moisture Measurements

In-place density and moisture measurements should be performed on the prepared subgrade or embankment material surface at the locations specified in Table 10 and bulk sampling locations shown in Table 9. These test shall be performed using recently calibrated nuclear moisture-density gauges 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 reading made during each 90° rotation of the nuclear gauge through a full 360°.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared subgrade at the locations specified in Table 11. Plate bearing tests should be performed in accordance with the procedures contained in SHRP Protocol P-58.

Auger Probes

Auger probes to a depth of 20' from the surface of the prepared subgrade or embankment should be performed at the shoulder locations specified in Table 12. The purpose of these probes is to determine if bedrock or other significantly dense layers exist within 20 feet of the pavement surface elevation. Auguring shall be performed using a truck mounted drill rig using 4 or 6 inch, continuous flight, solid, helical augers.

Dense Graded Aggregate Base

A summary of the samples to be taken from the Dense Graded Aggregate Base (DGAB) material and tests to be conducted is presented in Table 13. Field sampling of the DGAB material includes only bulk samples. Tests include in-place density and moisture measurements and plate bearing tests.

Bulk Samples

Bulk samples of the DGAB material maybe performed at the approximate locations specified in Table 14 prior to compaction to avoid interruptions to construction activities. Uncontaminated 200 lbs 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.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared base at the locations specified in Table 15. Plate bearing tests should be performed in accordance with the procedures contained in SHRP Protocol P-58.

Density and Moisture Measurements

Nuclear density and moisture measurements shall be performed on top of the prepared DGAB at the location specified in Table 16. These measurements shall be performed following the same procedures used for subgrade soils.

Permeable Asphalt Treated Base

The field and laboratory test plan for the Permeable Asphalt Treated Base (PATB) materials is presented in Table 17. Sampling of this material includes bulk samples of the uncompacted mix and cores obtained after placement of the PCC surface material. Field tests include only plate bearing tests on the compacted surface.

Bulk Samples

Bulk sampling of the uncompacted mix can be performed at the mix plant to avoid interruptions to construction activities. Care should be taken to obtain the designated samples of the materials to be placed in the test sections shown in Figures 13 through 16. If sampling at the mix plant is not feasible, samples should be obtained from the haul vehicle at the test site. These samples shall be obtained in accordance with **AASHTO T168** and shipped to the laboratory in suitable containers. Each sample shall consist of 100 lbs of material.

Plate Bearing Tests

Plate bearing tests should be performed on the surface of the prepared PATB at the locations specified in Table 18 in accordance with SHRP guidelines.

Cores

Cores of the PATB shall be obtained at the same time the PCC surface material is cored. The locations of the cores listed in Table 17 are shown in Table 23. The Federal Highway Administration will perform the resilient modulus test and indirect tensile strength test which is a part of the resilient modulus test, under a sperate contract. The cores of the PATB material must be shipped to the designated FHWA laboratory after the core examination and bulk specific gravity tests have been performed.

Lean Concrete Base

A summary of the sampling and testing plan for the Lean Concrete Base (LCB) materials are shown in Table 19 for the as-delivered material and Table 22 for the as-placed material. In general, the applicable portion of the specifications for sampling, molding, curing and transportation of PCC materials shall apply to LCB materials.

As-Delivered

Sampling of the concrete used in the LCB shall be performed in the field, during or just before placement. The test sections from which the designated bulk samples should be obtained are shown in Table 20. These samples shall be obtained in accordance with **AASHTO T141 "Sampling Fresh Concrete"**, molded into the specimens specified in Table 20, cured, packaged and shipped to the laboratory. As shown in Table 20, six - 6" by 12" cylindrical specimens shall be molded from each bulk sample.

As-Placed

Sampling of the as-placed LCB materials shall consist of 4 inch diameter cores. The cores shall be obtained from 1 to 4 days **prior** to the specified age for conduct of the laboratory tests. In Table 22, tests on the cores are specified at 14 days, 28 days, and 1 year after placement. The objective of these tests are to characterize the properties of the material after being subjected to in-place curing conditions. These cores shall be obtained during the following time periods:

Specified Test Age	Date After Placement to Obtain Cores
14 days	10 - 13 days
28 days	21 - 24 days
1 year	350 - 360 days

After placement of the PCC surface layer over the LCB, coring of the LCB must be performed through the PCC surface layer. Prior to placement of the PCC layer, the cores of the LCB should be obtained directly from the surface of the LCB and the core holes repaired. The locations of the LCB cores specified in Table 22 are shown in Table 23. After cores for the strength tests are taken they must be soaked in a lime water bath for a period of 40 hours immediately prior to testing. Coring operations shall be performed in accordance with **AASHTO T24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"** using equipment specified in the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling. Plugs shall not be inserted in cores intended for laboratory testing.

Care shall be taken to insure that cores are obtained at a 90° angle to the 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.

Portland Cement Concrete

A summary of the sampling and testing plan for the portland cement concrete (PCC) materials are shown in Table 19 for the as-delivered material and Table 22 for the as-placed material.

As-Delivered

Sampling of the concrete used in the PCC mix shall be performed in the field, during or just before placement. The test sections from which the designated bulk samples should be obtained are shown in Table 21. These samples shall be obtained in accordance with **AASHTO T141 "Sampling Fresh Concrete"**, molded into the specimens specified in Table 20, cured, packaged and shipped to the laboratory. All specimens shall be made and cured in the field in accordance with **AASHTO T23 "Making and Curing Concrete Specimens in the Field"** and **AASHTO T126 "Making and Curing Concrete Specimens in the Laboratory"**. As shown in Table 21, six - 6" by 12" cylindrical specimens and three - 6"x6" by 20 inch long beam specimens shall be molded from each bulk sample. Molded concrete samples shall be transported in accordance with **Section 10, "Transportation of Specimens to Laboratory" of ASTM C31.**

Field tests shall be performed on the bulk samples of fresh concrete to determine mix temperature, slump, and air content (volumetric). Samples shall be obtained in accordance with **ASTM C172** and tests performed in accordance with **ASTM C1064 (temperature), ASTM C231 (air content)**, and **ASTM C143 (slump).**

As-Placed

Sampling of the as-placed PCC materials shall consist of 4 inch diameter cores. The cores shall be obtained from 1 to 4 days **prior** to the specified age for conduct of the laboratory tests. This is to allow for a 40 hour lime water bath soak period immediately prior to testing the strength specimen. In Table 22, tests on the cores are specified at 14 days, 28 days, and 1 year after placement. The objective of these tests are to characterize the properties of the concrete after being subjected to in-place curing conditions. These cores shall be obtained during the following time periods:

Specified Test Age	Date After Placement to Obtain Cores
14 days	10 - 13 days
28 days	24 - 27 days
1 year	360 - 364 days

The locations of the PCC cores specified in Table 22 are shown in Table 23. Coring operations shall be performed in accordance with **AASHTO T24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"** using equipment specified in the SHRP-LTPP

Guide for Field Materials Sampling, testing and Handling. Plugs shall not be inserted in cores intended for laboratory testing. All cores shall be dried prior to packaging.

Care shall be taken to insure 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.

Elevation Measurements

Elevation measurements shall be made on the surface of each pavement layer (prepared subgrade or embankment, Dense Graded Aggregate Base, Permeable Asphalt Treated Base, lean concrete base, and PCC surface) at the locations specified in Table 24. Measurements must be made to an accuracy of 0.01 feet. Care must be taken to re-establish the same points on the surface of each succeeding material layer to insure accurate determination of the thickness of each layer.

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-2, Strategic Study of Structural factors for Rigid Pavements"**. These data forms must be completed at the time of the work. Completed forms shall be submitted to the designated SHRP representative.

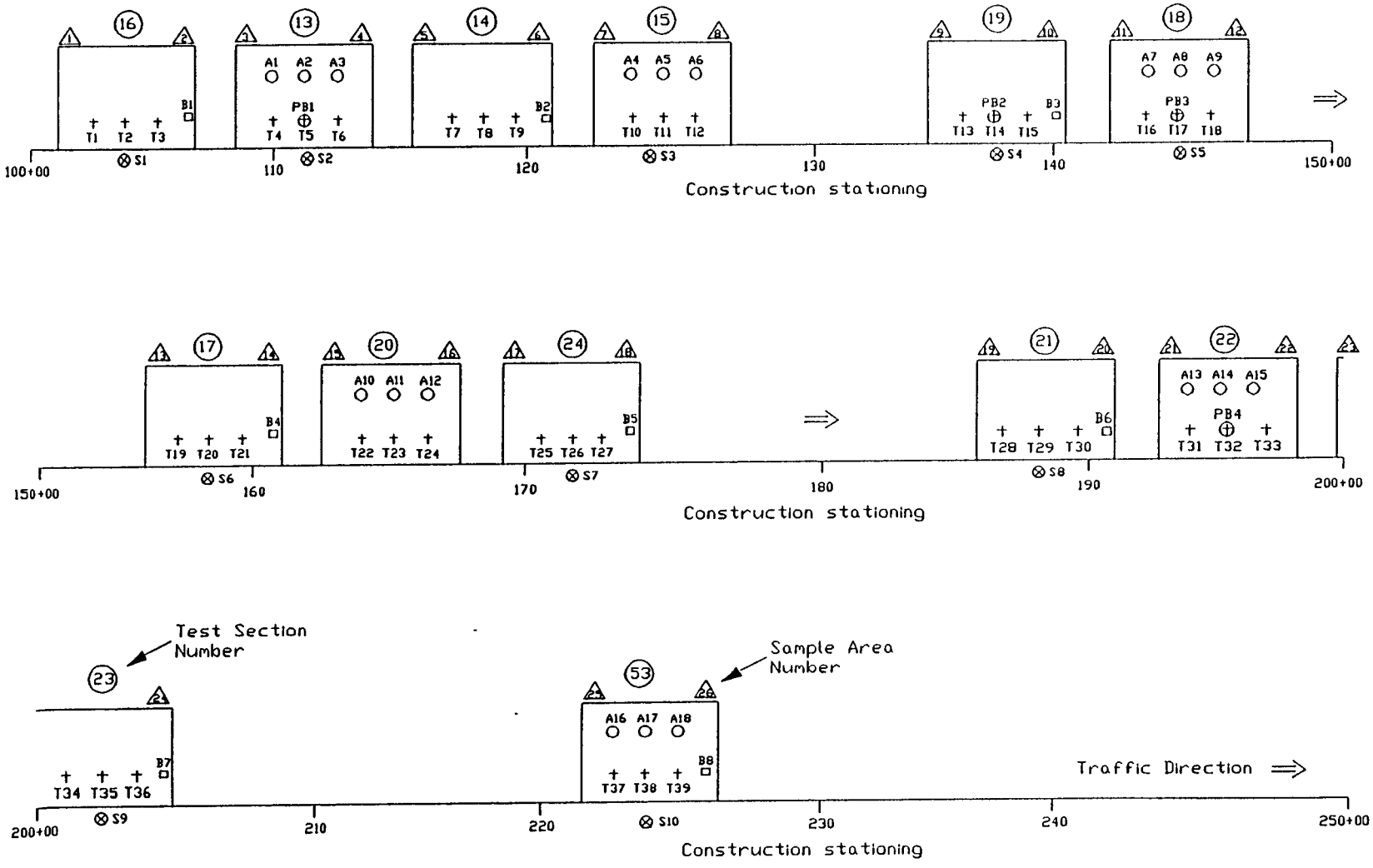


Figure 1. Overview of material sampling and testing on prepared subgrade on SPS-2 test sections, I-76 Colorado.

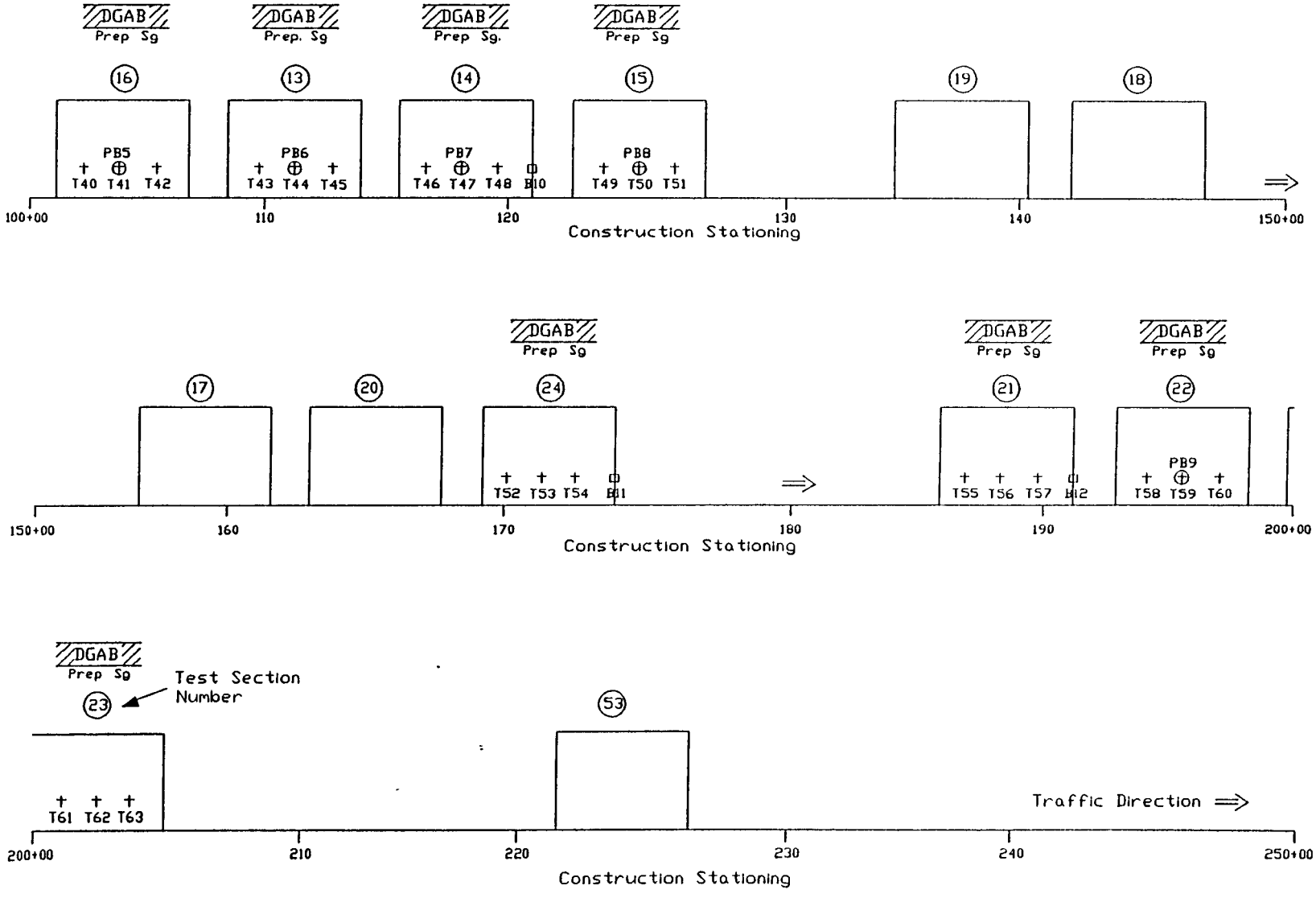


Figure 2. Overview of sampling and testing of Dense Graded Aggregate Base on SPS-2 test sections, I-76 Colorado.

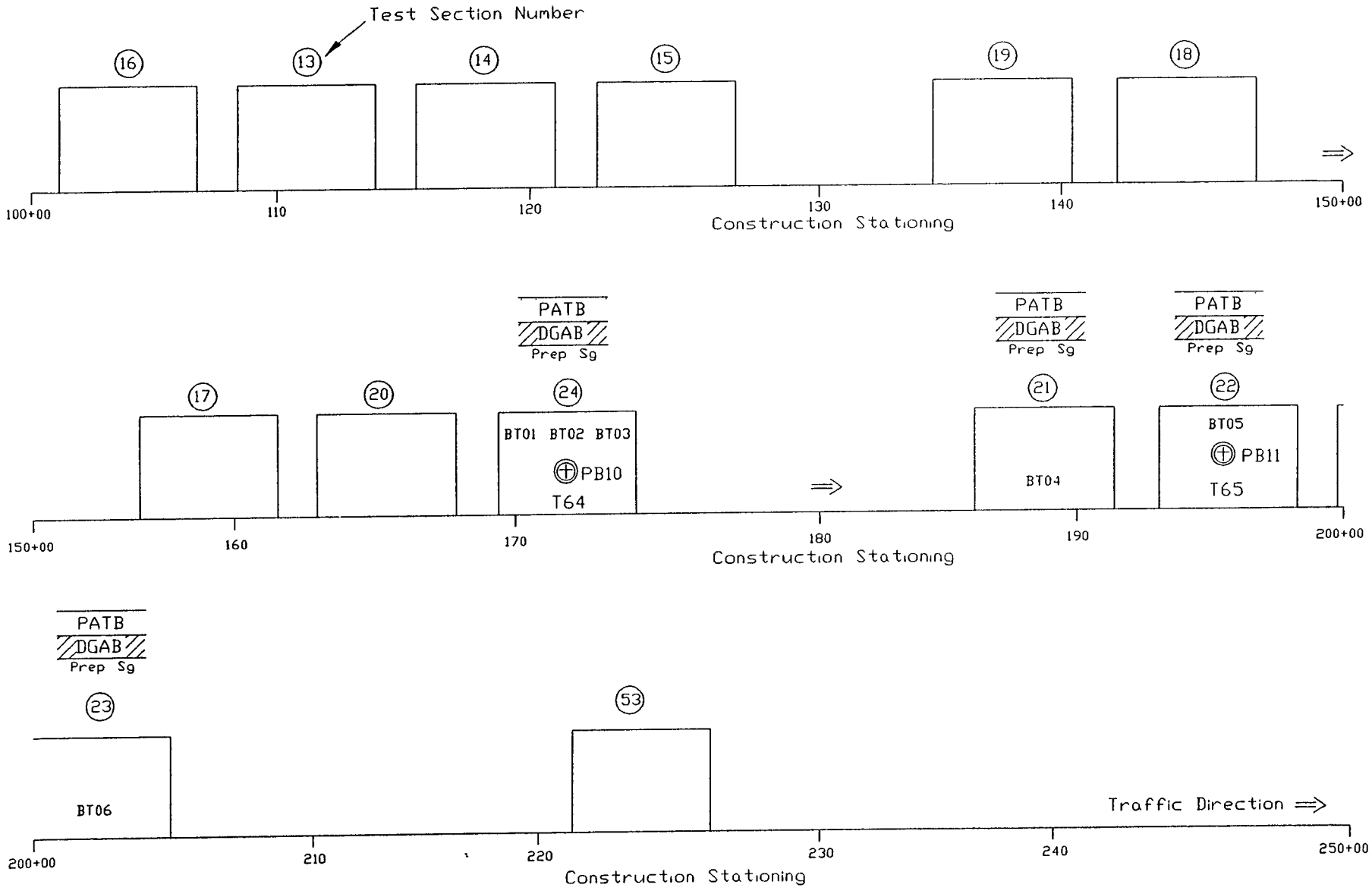


Figure 3. Overview of sampling and testing of Permeable Asphalt Treated Base on SPS-2 test sections, I-76 Colorado.

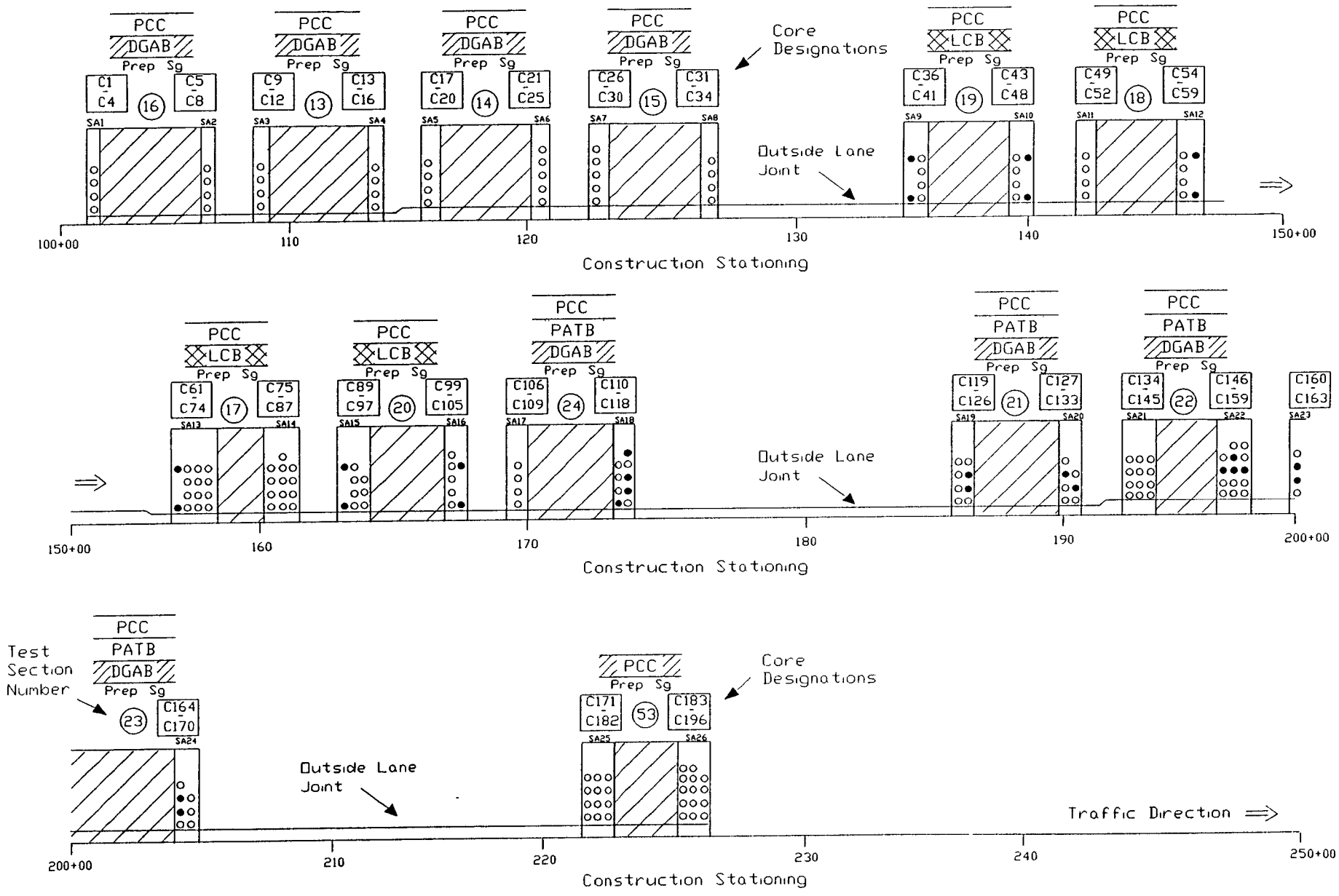
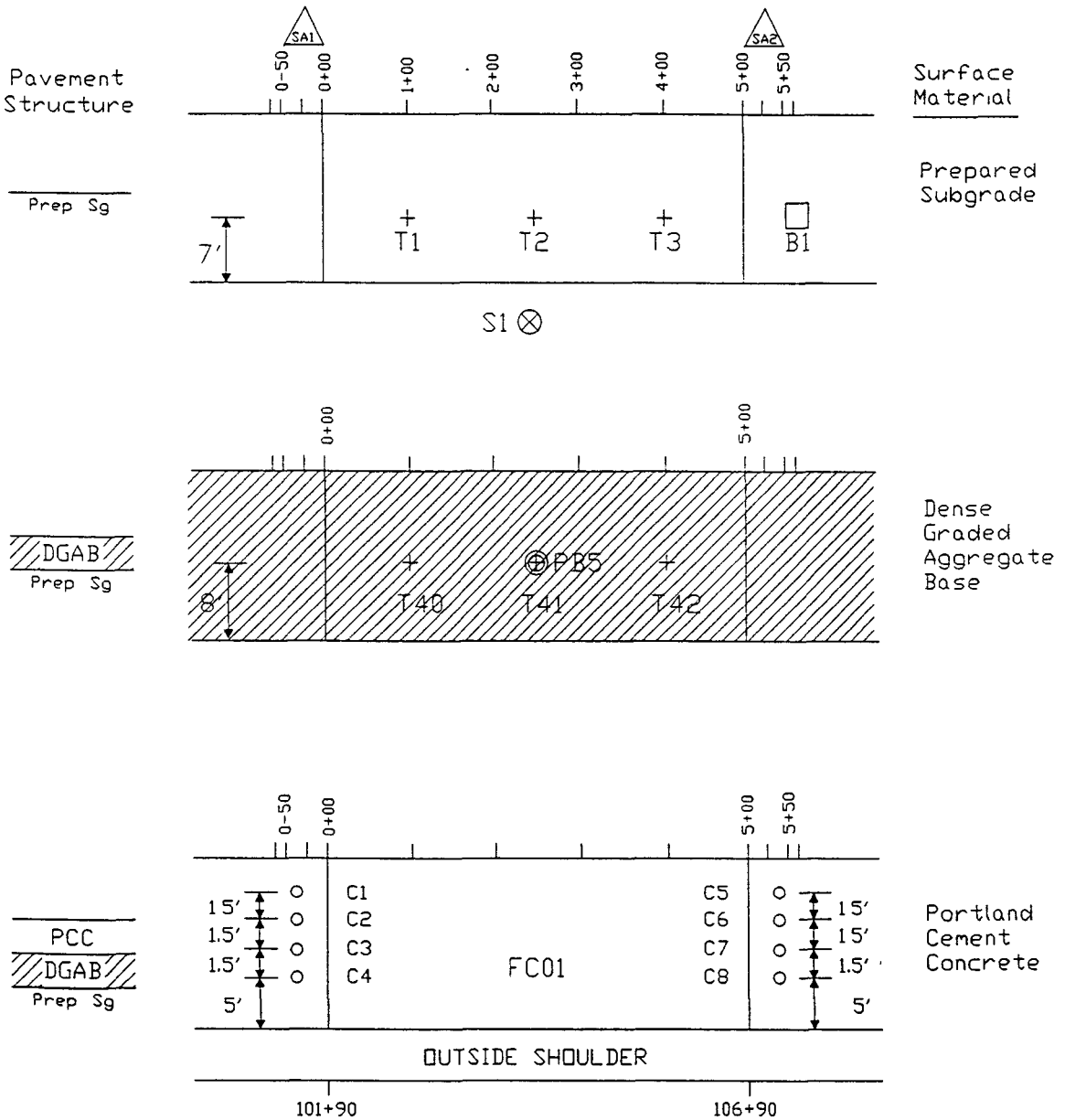
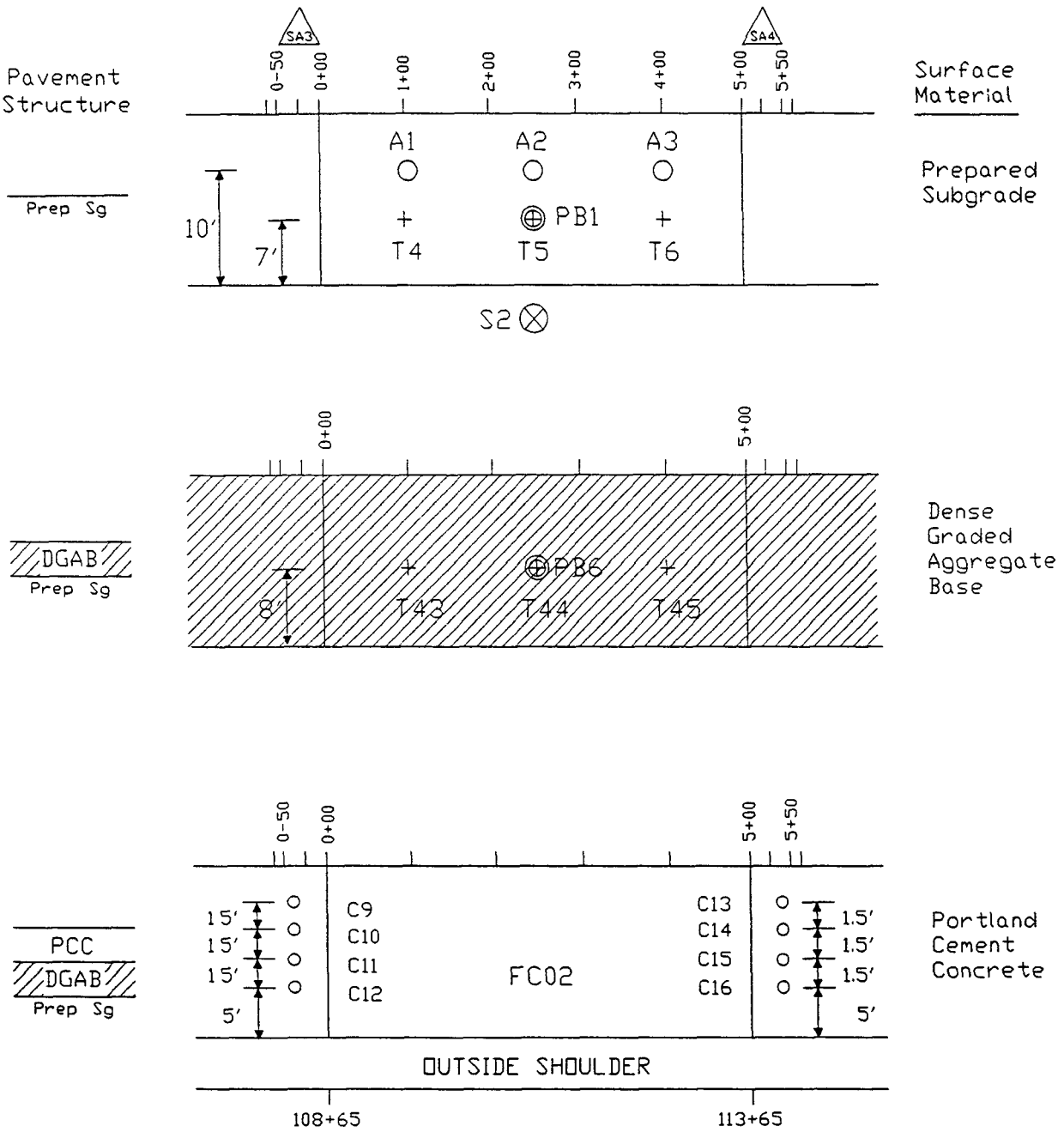


Figure 4. Overview of coring plan for SPS-2 test sections, I-76 Colorado.



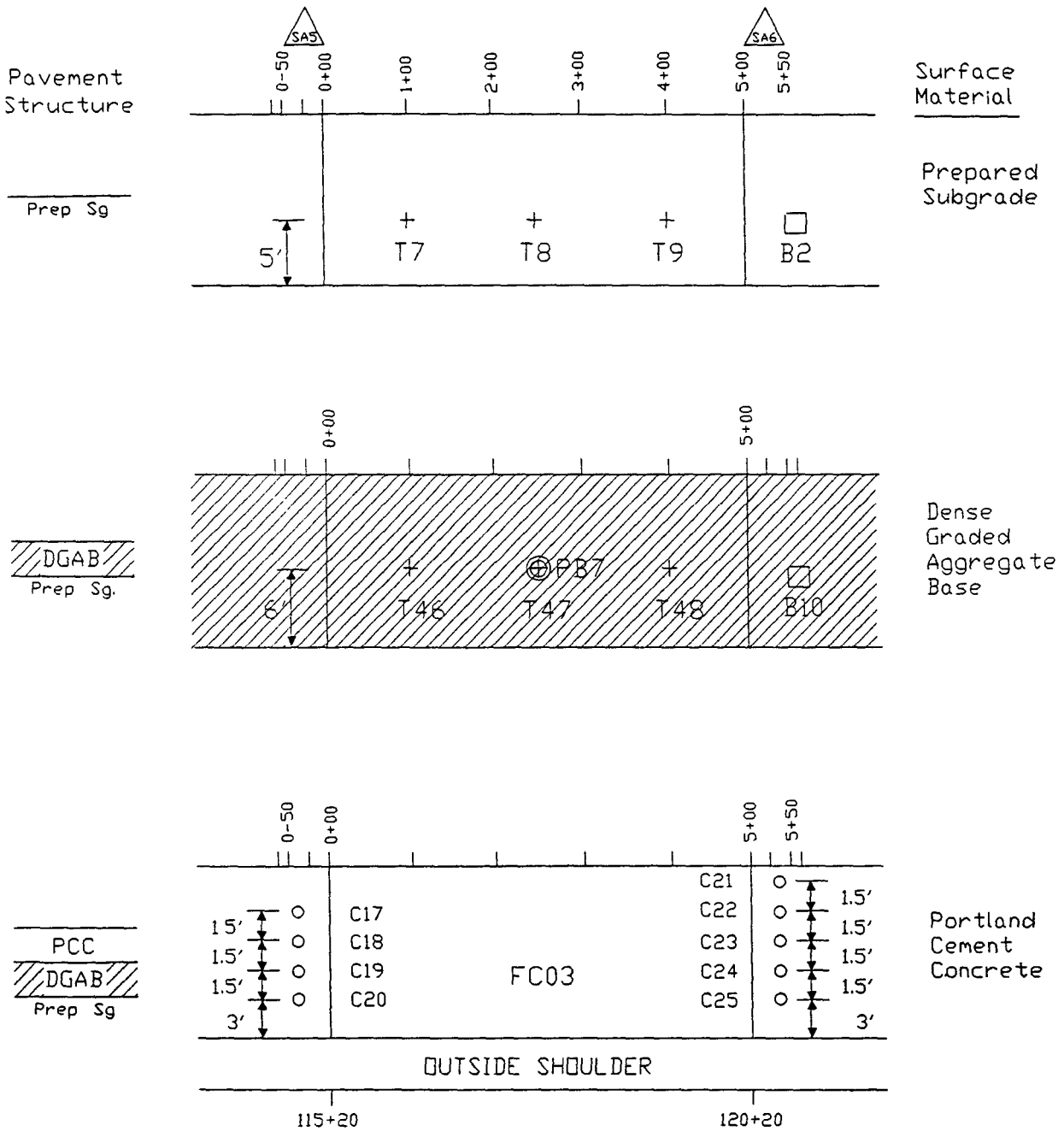
S1 - 20' shoulder probe
T1-T3 - Moisture-density tests on subgrade
PB5 - Plate bearing test on DGAB
B1 - Bulk sampling of subgrade
T40-T42 - Moisture-density tests on DGAB
C1-C8 - Cores of PCC surface
FC01 - Bulk sample of PCC for molded specimen

Figure 5. Sampling and test plans for section U16.



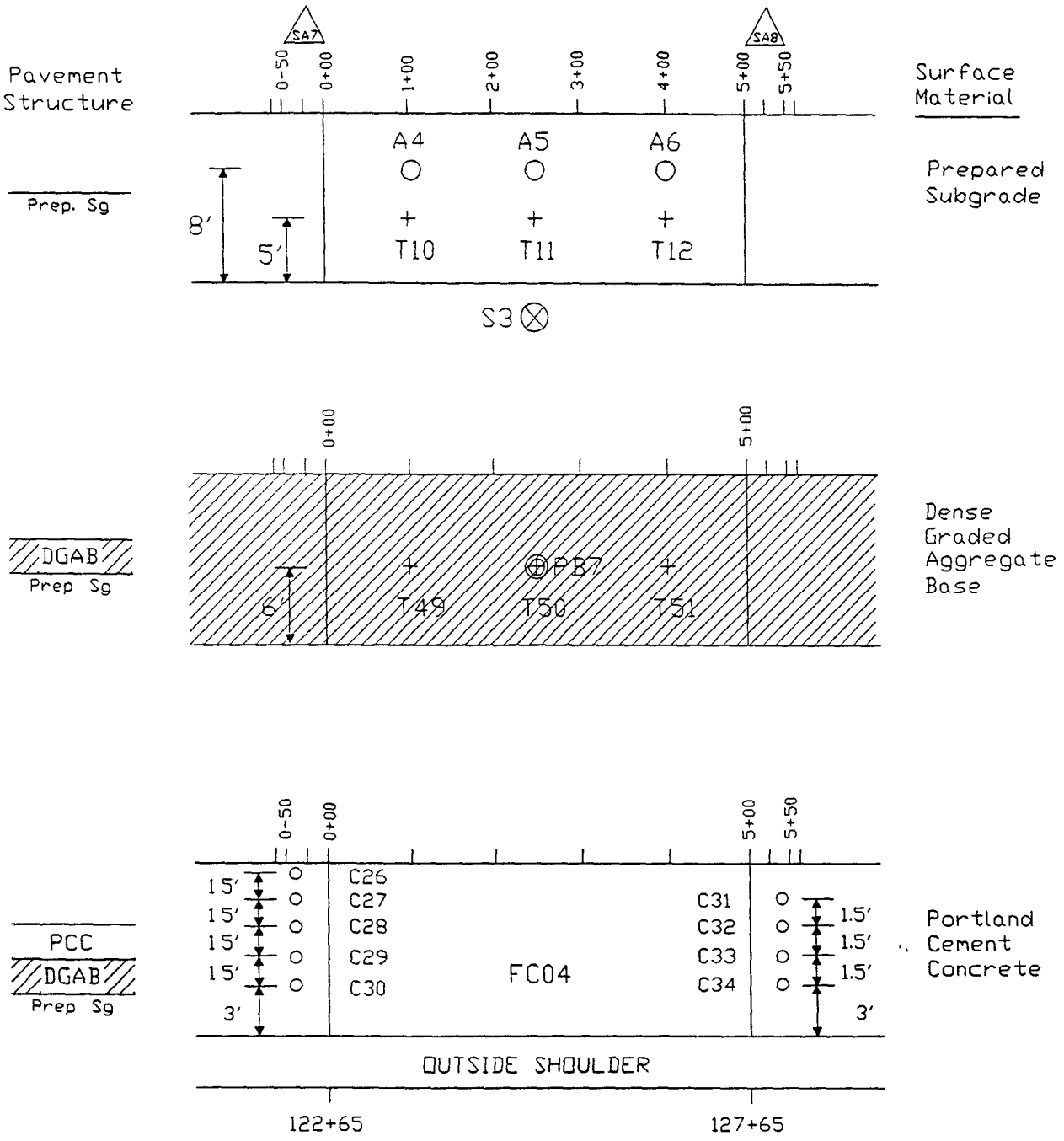
S2 - 20' shoulder probe
A1-A3 - Thinwall sampling of subgrade
T4-T6 - Moisture-density tests on subgrade
PB1 - Plate bearing test on subgrade
PB6 - Plate bearing test on DGAB
C9-C16 - Cores of PCC surface
FC02 - Bulk sampling of PCC for molded specimen

Figure 6. Sampling and test plan for test section U13.



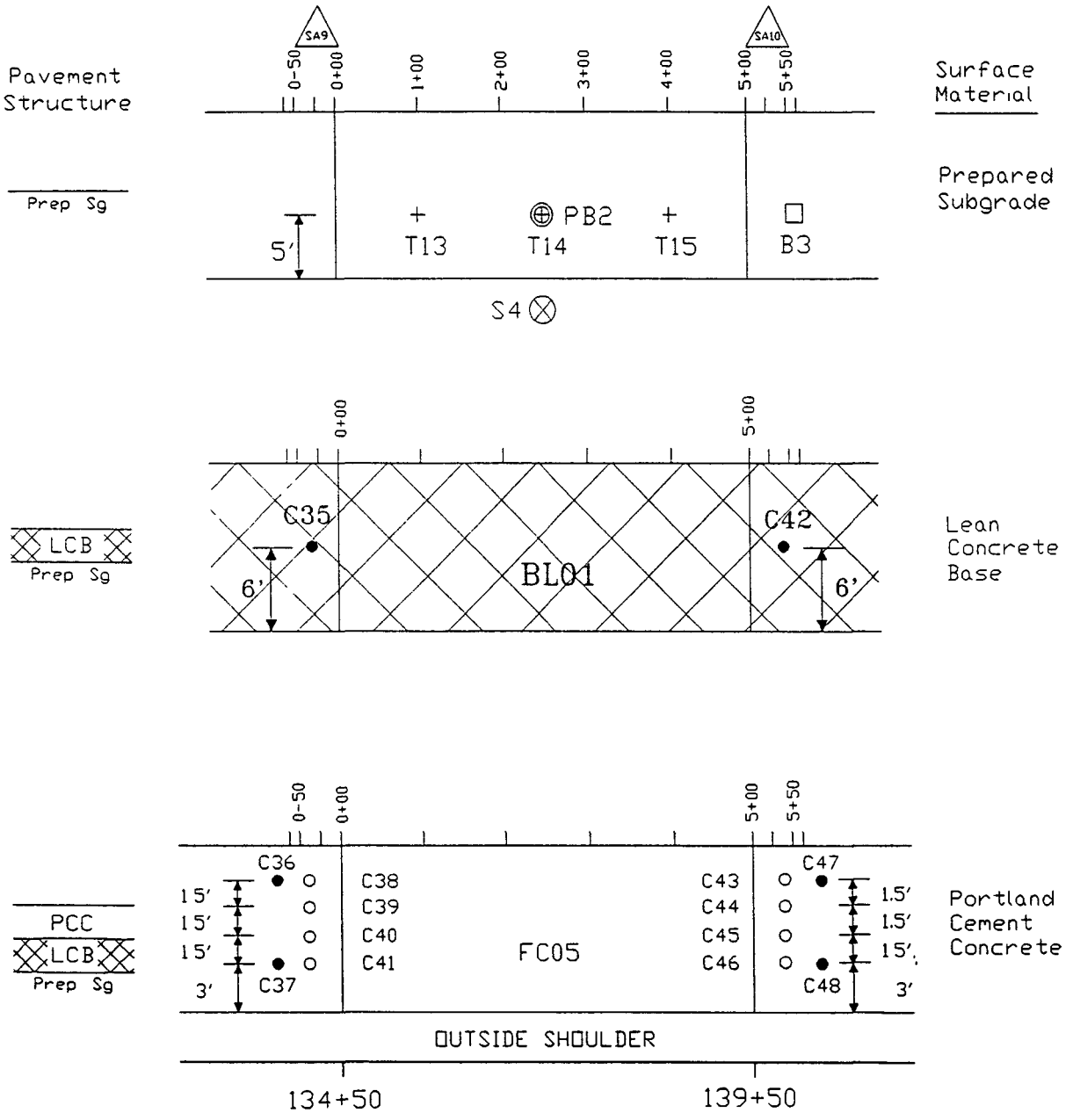
T7-T9 - Moisture-density tests on subgrade
B2 - Bulk sampling of subgrade
T46-T48 - Moisture-density tests on DGAB
B10 - Bulk sample of DGAB
PB7 - Plate bearing tests on DGAB
C17-C25 - Cores of PCC surface
FC03 - Bulk sampling of PCC for molded specimen

Figure 7. Sampling and test plan for test section U14.



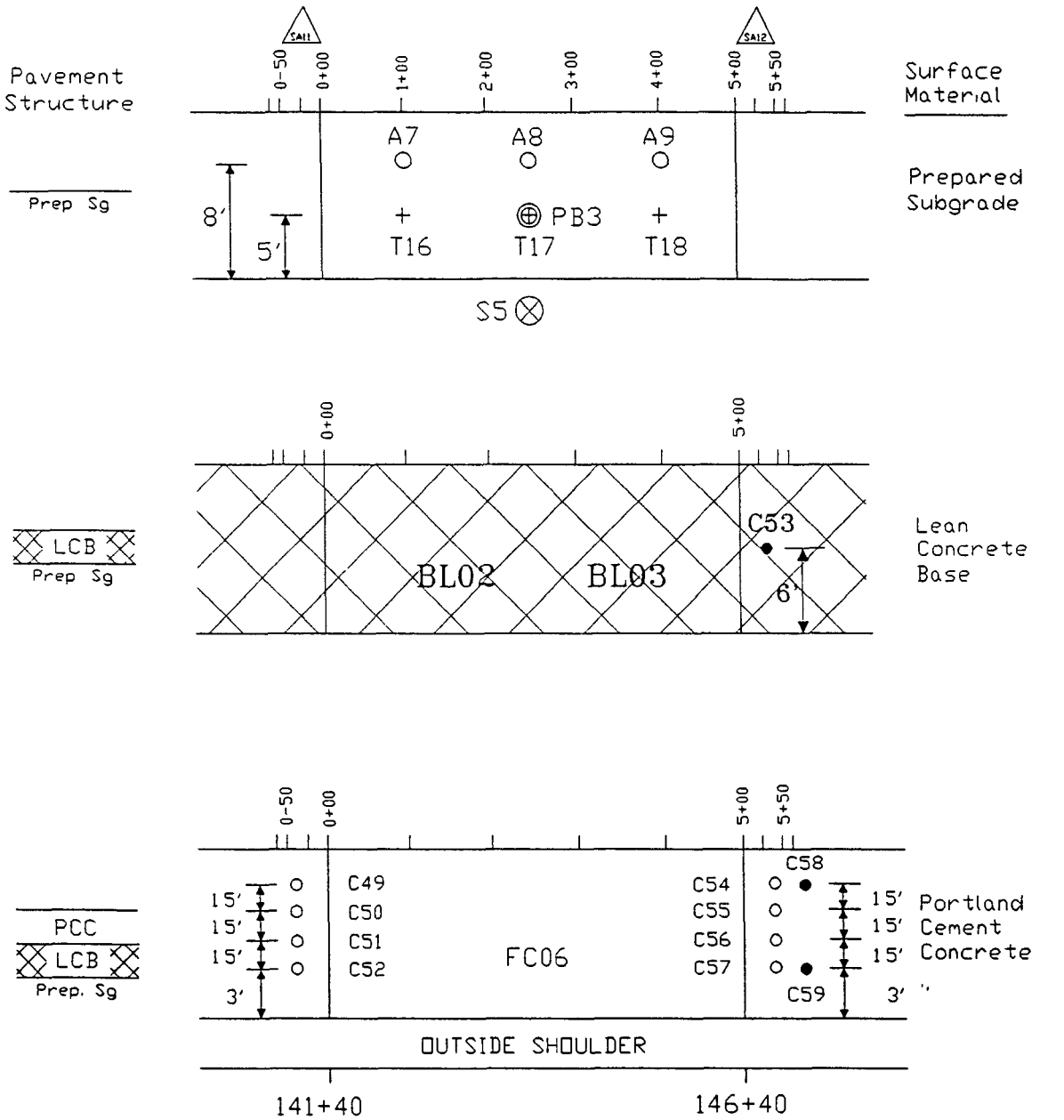
S3 - 20' shoulder probe
A4-A6 - Thinwall tube samples of subgrade
T10-T12 - Moisture-density tests on subgrade
T49-T51 - Moisture-density tests on DGAB
PB7 - Plate bearing test on DGAB
C26-C34 - Cores of PCC surface
FC04 - Bulk sample of PCC for molded specimen

Figure 8. Sampling and test plan for test section U15.



T1-T15 - Moisture-density tests on subgrade
PB2 - Plate bearing tests on subgrade
B2 - Bulk sampling of subgrade
S4 - 20' shoulder probe
BL01 - Bulk sampling of LCB for molded specimen
C35, C42 - Cores of LCB
C36, C37, C47, C48 - Cores of PCC surface and LCB
C38-C41, C43-C46 - Cores of PCC surface
FC05 - Bulk sample of PCC for molded specimen

Figure 9. Sampling and test plan for test section U19.



A7-A9 - Thinwalled tube samples of subgrade
T16-T18 - Moisture-density tests on subgrade
PB3 - Plate bearing test on subgrade
S5 - 20' shoulder probe
BL02-BL03 - Bulk samples of LCB for molded specimen
C53 - Core of LCB
C58, C59 - Cores of PCC surface and LCB
C49-C52, C54-C57 - Cores of PCC surface layer
FC06 - Bulk sample of PCC for molded specimen

Figure 10. Sampling and test plan for test section U18.

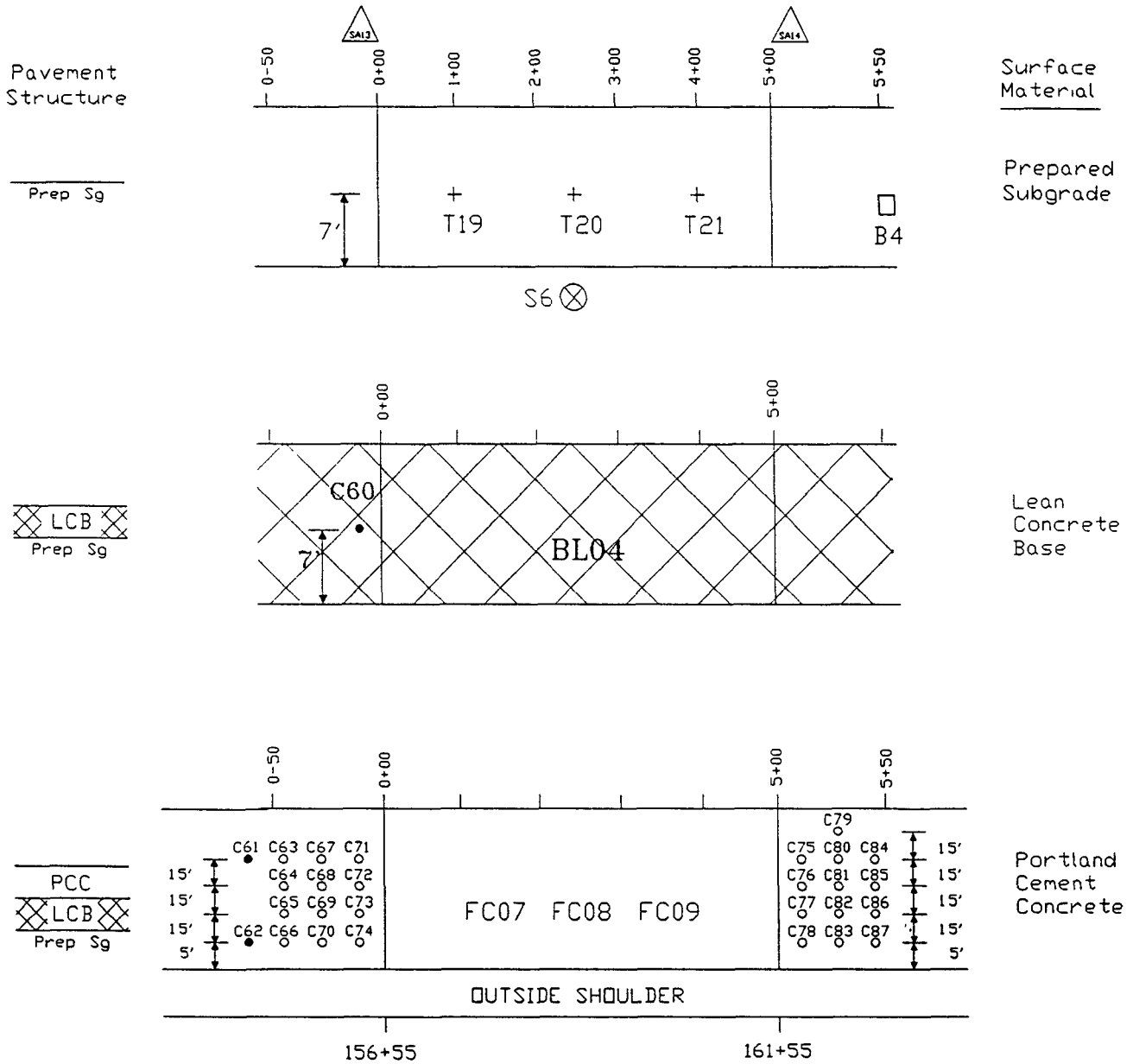
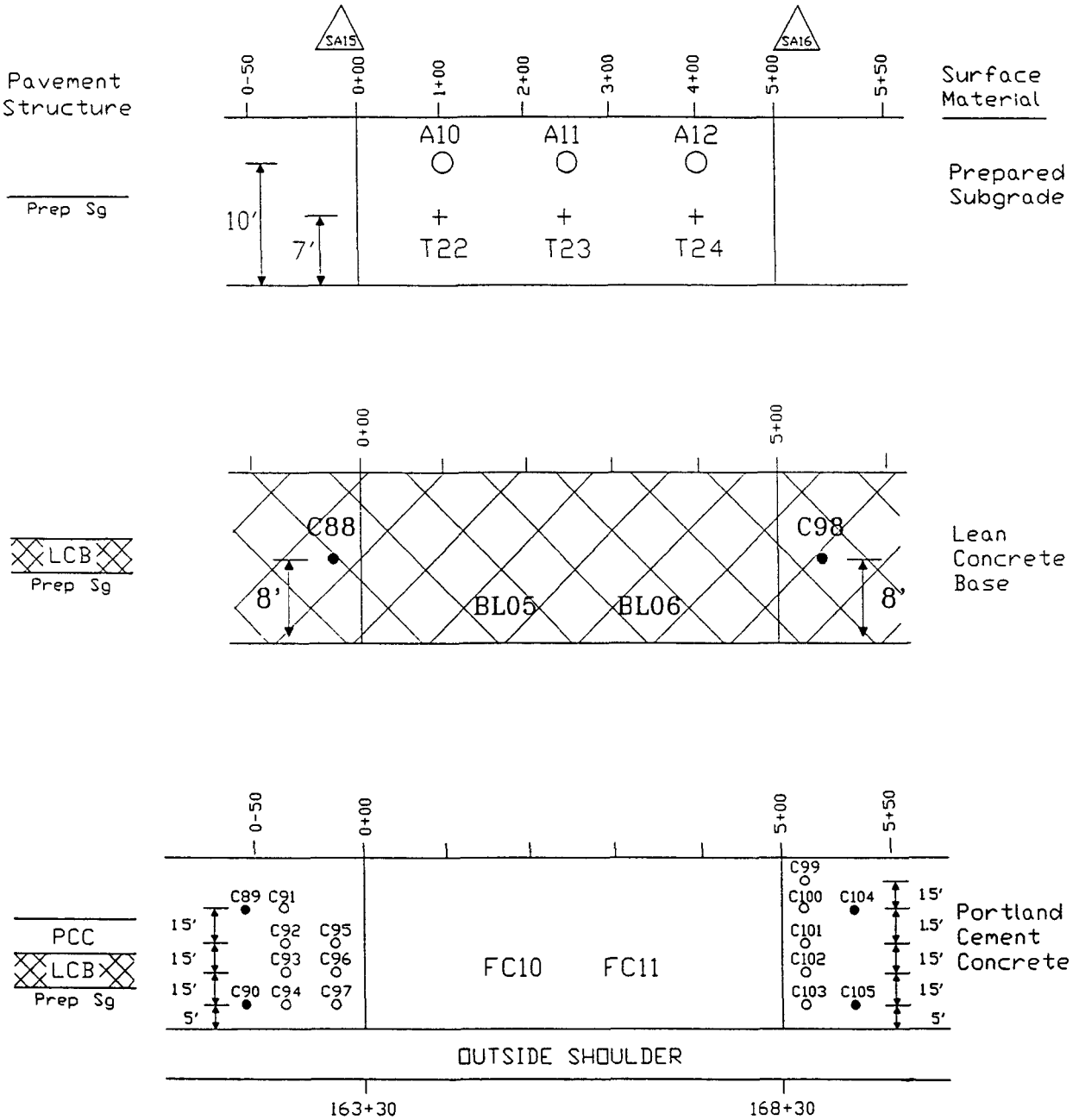
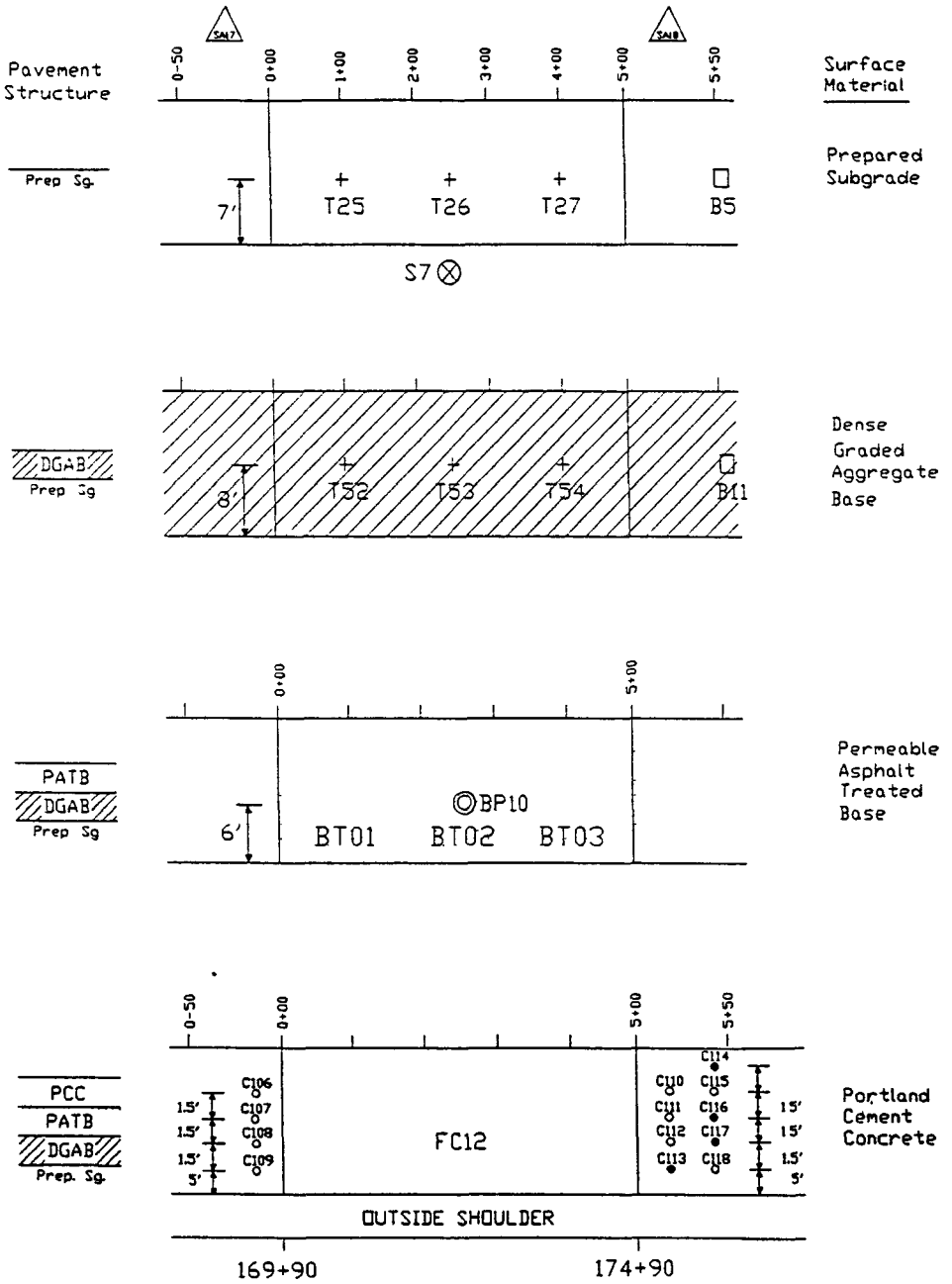


Figure 11. Sampling and test plan for test section U17.



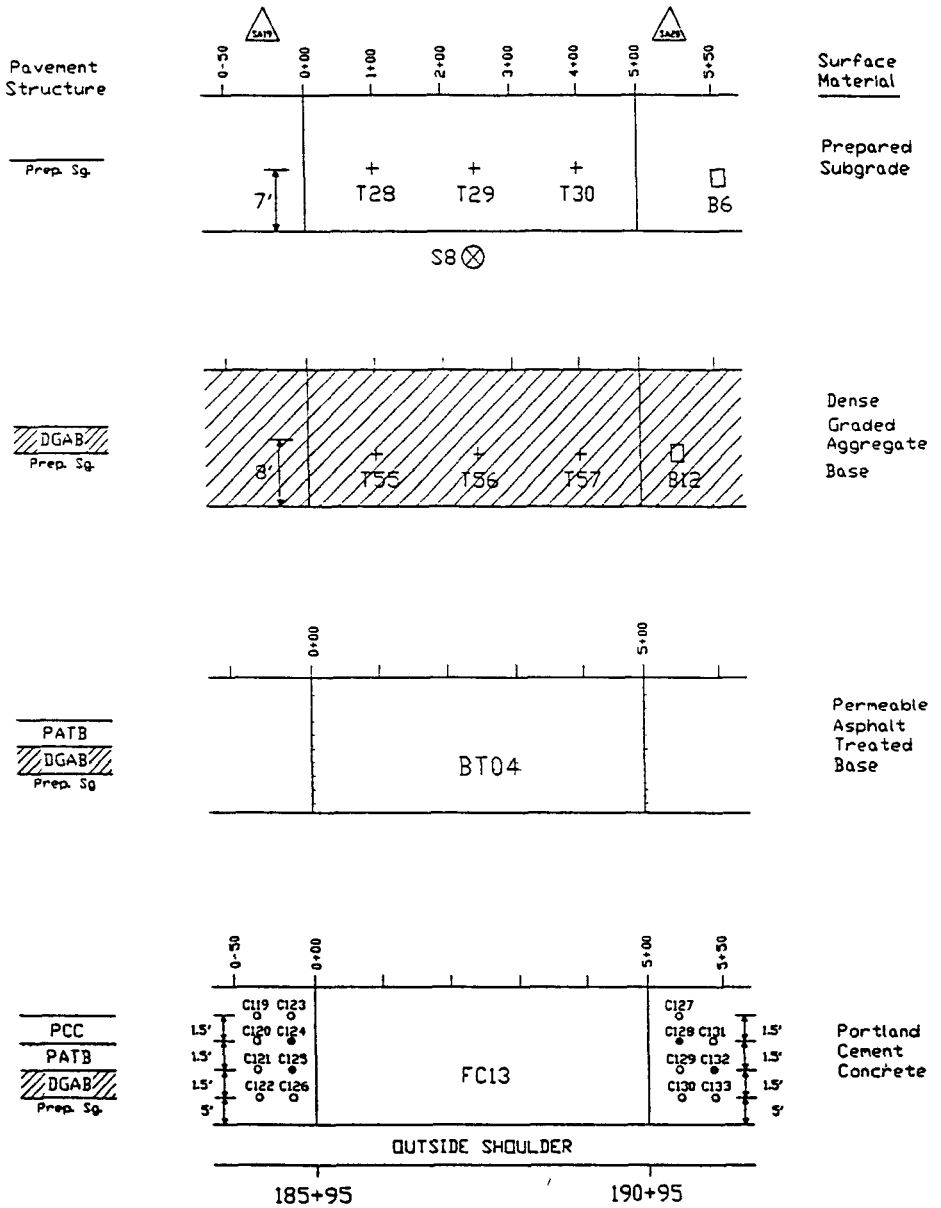
A10-A12 - Thinwall tube samples of subgrade
T22-T24 -Moisture-density tests on subgrade
BL05-BL06 - Bulk samples of LCB for molded specimen
C88, C98 - Cores of LCB
C89, C90, C104, C105 - Cores of PCC and LCB
C91-C97, C99-C103 - Cores of PCC surface layer
FC10-FC11 - Bulk samples of PCC for molded specimen

Figure 12. Sampling and test plan for test section U20.



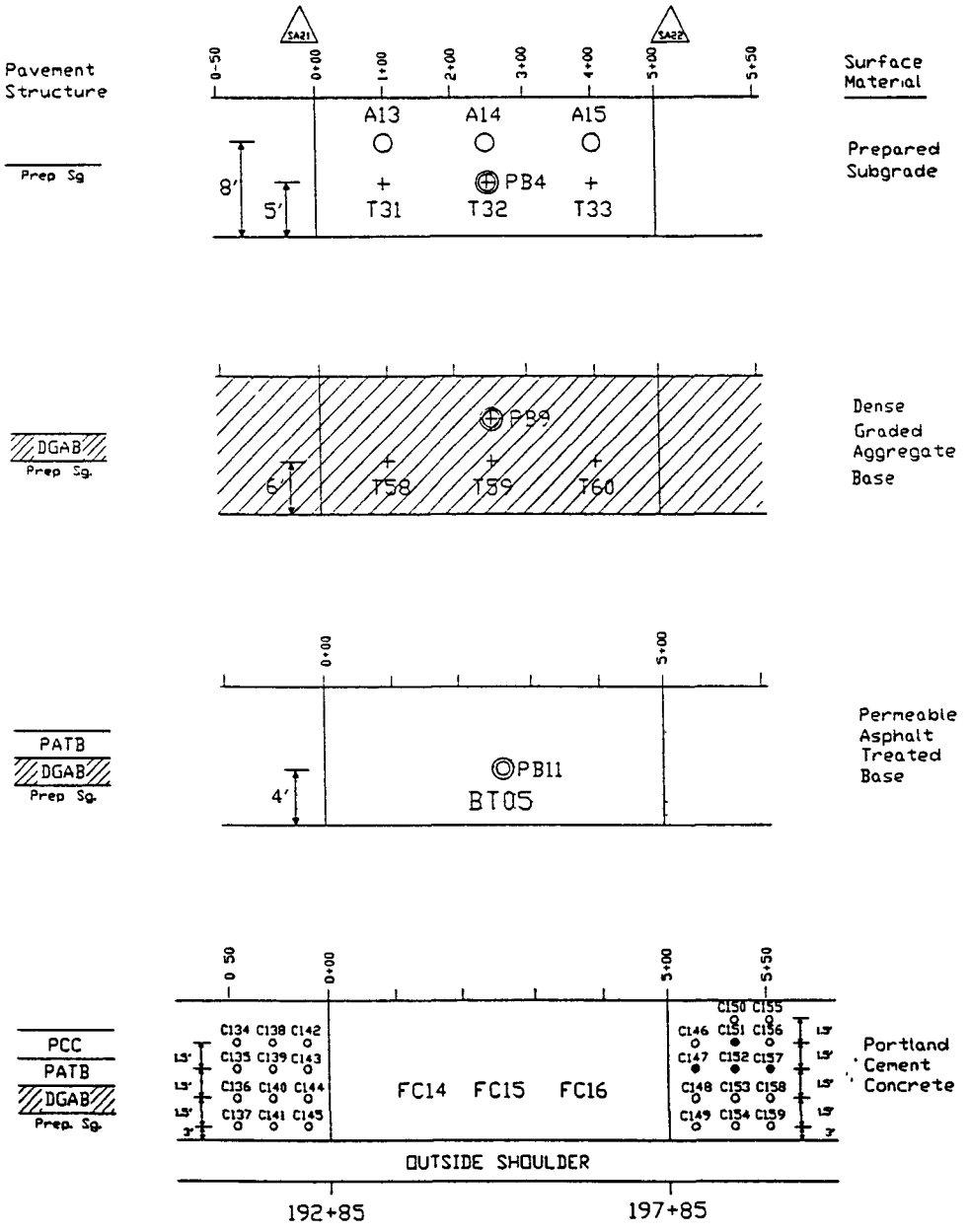
T25-T27 - Moisture-density tests on subgrade
B5 - Bulk sample of subgrade
S7 - 20′ shoulder probe
T52-T54 - Moisture-density tests on DGAB
B11 - Bulk sample of DGAB
BP10 - Plate bearing test on PATB
BT01-BT03 - Bulk sample of PATB
C106-C118 - Cores of PCC surface layer
C113, C114, C116, C117 - Cores of PCC and PATB
FC12 - Bulk sample of PCC for molded specimen

Figure 13. Sampling and test plan for test section U24.



T28-T30 - Moisture-density test on subgrade
B6 - Bulk sample of subgrade
S8 - 20' shoulder probe
T55-T57 - Moisture-density test on DGAB
B12 - Bulk sample of DGAB
BT04 - Bulk sample of PATB
C119-C133 - Cores of PCC surface layer
C124, C125, C128, C132 - Cores of PCC and PATB
FC13 - Bulk sample of PCC for molded specimen

Figure 14. Sampling and test plan for test section U21.



A13-A15 - Thinwall tube samples of subgrade
T31-T33 - Moisture-density tests on subgrade
PB4 - Plate bearing test on subgrade
T58-T60 - Moisture-density tests on DGAB
PB9 - Plate bearing test on DGAB
PB11 - Plate bearing test on PATB
BT05 - Bulk samples of PATB
C120-C145 - Cores of PCC surface
C132-C135 - Cores of PCC and PATB
FC14-FC16 - Bulk samples of PCC for molded specimen

Figure 15. Sampling and test plan for test section U22.

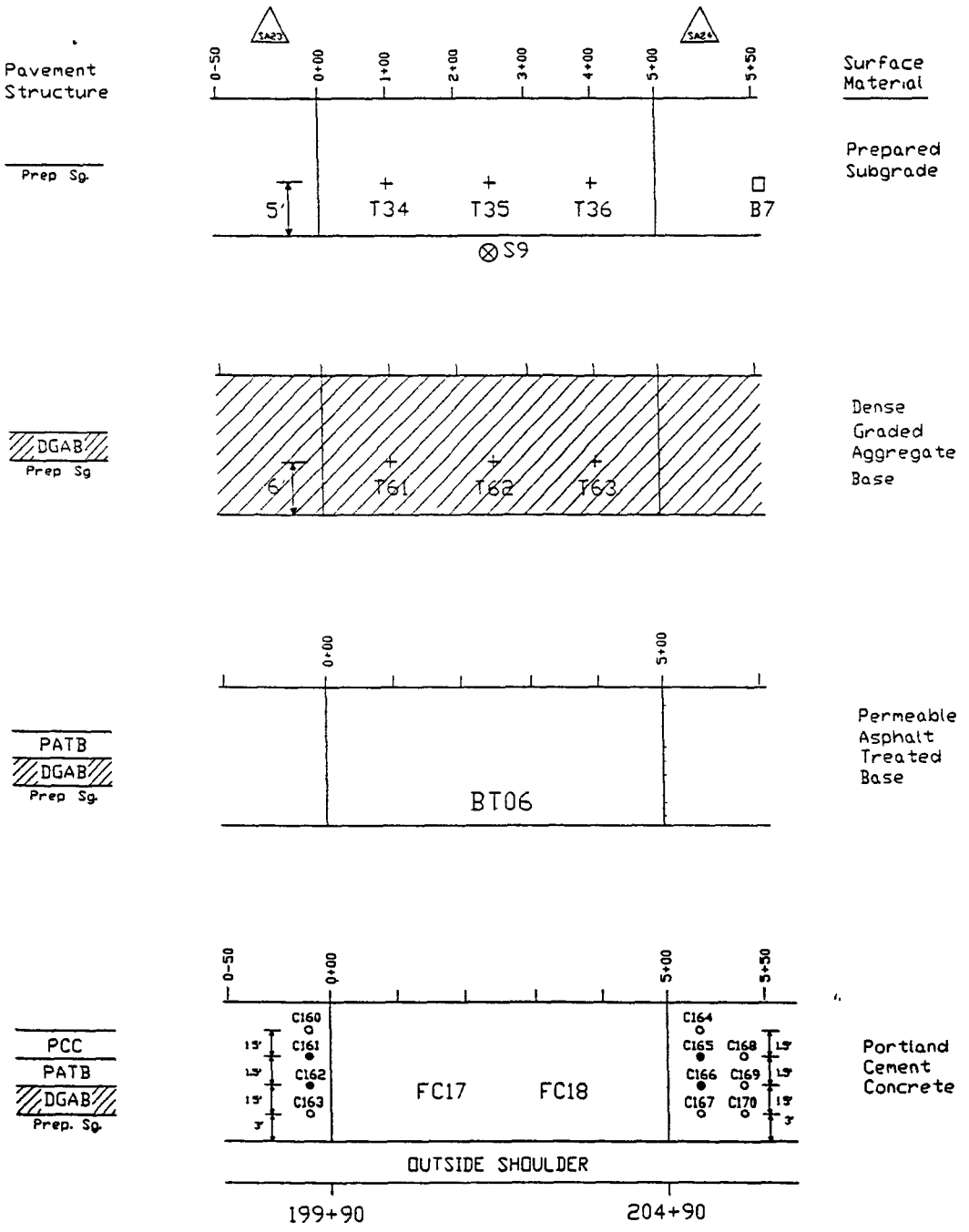
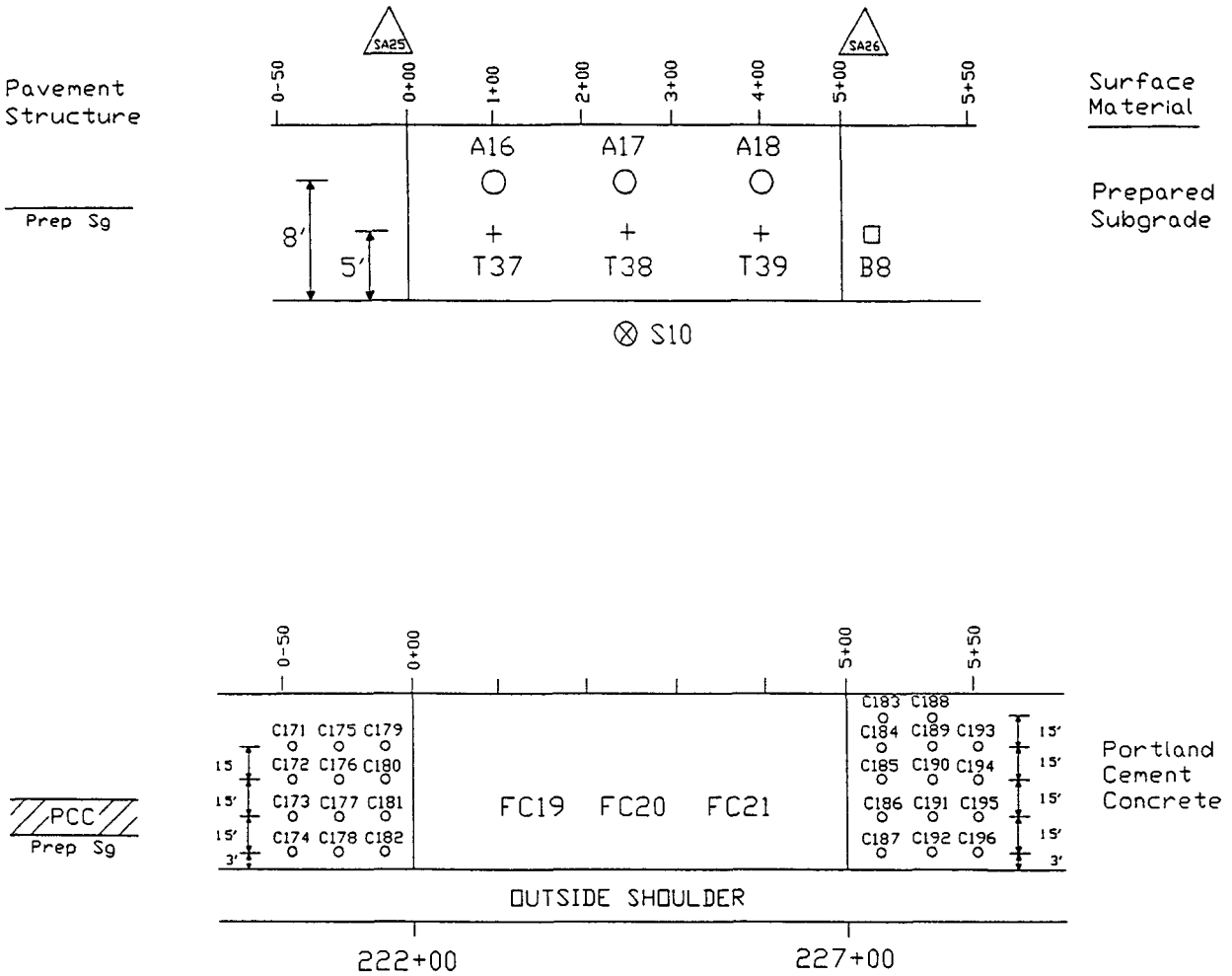


Figure 16. Sampling and test plan for test section U23.



A16-A18 - Thinwalled tube samples of subgrade
T37-T39 - Moisture-density tests on subgrade
B8 - Bulk sample of subgrade
S10 - 20' shoulder probe
C171-C196 - Cores of PCC surface
FC19-FC21 - Bulk samples of PCC for molded specimen

Figure 17. Sampling and test plan for test section 53.

Table 5. Location of SPS-2 test sections, I-76 Colorado.

Section No.	Start Section	Start Monitor	End Monitor	End Section	Notes
U16	101+40	101+90	106+90	107+55	DG\11"\900#\14'
Trans	107+55			108+15	
U13	108+15	108+65	113+65	114+30	DG\8"\550#\14'
Trans	114+30			115+20	
U14	115+20	115+20	120+20	121+35	DG\8"\900#\12'
Trans	121+35			121+95	
U15	121+95	122+65	127+65	128+10	DG\11"\550#\12'
Trans	128+10			134+00	Large box culverts @ 133
U19	134+00	134+50	139+50	140+15	LC\11"\550#\12'
Trans	140+15			140+75	
U18	140+75	141+40	146+40	146+90	LC\8"\900#\12'
Trans	146+90			155+90	136th Ave. taper & exit ramp
U17	155+90	156+55		159+86.3	LC\8"\550#\14'
U17	159+86.3		161+55	162+05	
Trans	162+05			162+65	
U20	162+65	163+30	168+30	168+80	LC\11"\900#\14'
Trans	168+80			169+40	
U24	169+40	169+90	174+90	175+55	PB\11"\900#\14'
Trans	175+55			185+30	136th Ave entrance ramp
U21	185+30	185+95	190+95	190+45.84	PB\8"\550#\14'
U21	190+45.84			191+45	
Trans	191+45			192+35	
U22	192+35	192+85	197+85	198+50	PB\8"\900#\12'
Trans	198+50			199+25	
U23	199+25	199+90	204+90	205+40	PB\11"\550#\12'

Key to Notes:

DG	- Dense Graded Aggregate Base Section
LC	- Lean Concrete Base Section
PB	- Permeable Asphalt Concrete Base Section
8" or 11"	- PCC surface thickness, inches.
550# or 900#	- design flexural strength for PCC mix, psi.
14' or 12'	- outside lane width, feet.

Table 6. Test section location table showing construction and project stations.

Test Section	Location	Construction Stationing	Test Section Stationing	SHRP Reference Project Station
U16	Begin	101+40	0-50	
	Begin Monitoring	101+90	0+00	0+00
	End Monitoring	106+90	5+00	5+00
	End	107+55	5+65	5+65
U13	Begin	108+15	0-50	6+25
	Begin Monitoring	108+65	0+00	6+75
	End Monitoring	113+65	5+00	11+75
	End	114+30	5+65	12+40
U14	Begin	115+20	0-50	13+30
	Begin Monitoring	115+70	0+00	13+80
	End Monitoring	120+70	5+00	18+80
	End	121+35	5+65	19+45
U15	Begin	121+95	0-65	20+05
	Begin Monitoring	122+65	0+00	20+70
	End Monitoring	127+65	5+00	25+70
	End	128+10	5+50	26+20
U19	Begin	134+00	0-50	32+10
	Begin Monitoring	134+50	0+00	32+60
	End Monitoring	139+50	5+00	37+60
	End	140+15	5+65	38+25
U18	Begin	140+75	0-65	38+85
	Begin Monitoring	141+40	0+00	39+50
	End Monitoring	146+40	5+00	44+50
	End	146+90	5+50	45+00
U17	Begin	155+90	0-65	54+00
	Begin Monitoring	156+55	0+00	54+65
	End Monitoring	161+55	5+00	59+65
	End	162+05	5+50	60+15
U20	Begin	162+65	0-65	60+75
	Begin Monitoring	163+30	0+00	61+40
	End Monitoring	168+30	5+00	66+40
	End	168+80	5+50	66+90

Table 6. Test section location table showing construction and project stations (Contd.).

Test Section	Location	Construction Stationing	Test Section Stationing	SHRP Reference Project Station
U24	Begin	169+40	0-50	67+50
	Begin Monitoring	169+90	0+00	68+00
	End Monitoring	174+90	5+00	73+00
	End	175+55	5+65	73+65
U21	Begin	185+30	0-65	83+40
	Begin Monitoring	185+95	0+00	84+05
	End Monitoring	190+95	5+00	89+05
	End	191+45	5+50	89+55
U22	Begin	192+35	0-50	90+45
	Begin Monitoring	192+95	0+00	90+95
	End Monitoring	197+85	5+00	95+95
	End	198+50	5+65	96+60
U23	Begin	199+25	0-65	97+35
	Begin Monitoring	199+90	0+00	98+00
	End Monitoring	204+90	5+00	103+00
	End	205+40	5+50	103+50
53	Begin	221+10	0-90	119+20
	Begin Monitoring	222+00	0+00	120+10
	End Monitoring	227+00	5+00	125+10
	End	227+90	5+90	126+00

Table 7. Field and laboratory test plan for subgrade materials, SPS-2 Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Sieve Analysis	SS01	P51	8	B1 - B8
Hydrometer to 0.01 mm	SS02	P42	8	B1 - B8
Atterberg Limits	SS03	P43	8	B1 - B8
Subgrade Classification and Type	SS04	P52	26	A1 - A18, B1 - B8 **see Note 1**
Moisture-Density Relations	SS05	P55	8	B1 - B8
Resilient Modulus	SS07	P46	6	A2, A5, A8, A11, A14, A17
Unit Weight	SS08	P56	18	A1 - A18
Natural Moisture Content	SS09	P49	8	B1 - B8
Unconfined Compression Strength	SS10	P54	6	A1, A4, A10, A13, A16
Permeability	SS11	P57	5	A3, A6, A9, A12, A15
In-Place Density		SHRP-LTPP Method	47	B1-B8, T1-T39
Depth to Rigid Layer		SHRP-LTPP Method	10	S1-S10
Plate Bearing Test	SS06	P58	4	PB1 - PB4

Note 1. Visual-manual classification method only.

Table 8. Locations for thin-wall (Shelby) tube sampling of subgrade.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
A1	109+65	34.0	10	13
A2	111+15	34.0	10	13
A3	112+65	34.0	10	13
A4	123+65	34.0	8	15
A5	125+15	34.0	8	15
A6	126+65	34.0	8	15
A7	142+40	34.0	8	18
A8	143+90	34.0	8	18
A9	145+40	34.0	8	18
A10	164+30	34.0	10	20
A11	165+80	34.0	10	20
A12	167+30	34.0	10	20
A13	193+85	34.0	8	22
A14	195+35	34.0	8	22
A15	196+85	34.0	8	22
A16	223+00	34.0	8	53
A17	224+50	34.0	8	53
A18	226+00	34.0	8	53

Table 9. Locations of prepared subgrade bulk sampling.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line	Outside Lane Edge		
B1	107+40	37.0	7	16	2
B2	121+20	37.0	5	14	6
B3	140+00	37.0	5	19	10
B4	161+95	37.0	7	17	14
B5	175+40	37.0	7	24	18
B6	191+35	37.0	7	21	20
B7	205+30	37.0	5	23	23
B8	227+50	37.0	5	53	26

Table 10. Locations for in-place density and moisture tests on prepared subgrade.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
T1	102+90	37.0	7	16
T2	104+40	37.0	7	16
T3	105+90	37.0	7	16
T4	109+65	37.0	7	13
T5	111+15	37.0	7	13
T6	112+65	37.0	7	13
T7	116+70	37.0	5	14
T8	118+20	37.0	5	14
T9	119+70	37.0	5	14
T10	123+65	37.0	5	15
T11	125+15	37.0	5	15
T12	126+65	37.0	5	15
T13	135+50	37.0	5	19
T14	137+00	37.0	5	19
T15	138+50	37.0	5	19
T16	142+40	37.0	5	18
T17	143+90	37.0	5	18
T18	145+40	37.0	5	18
T19	157+55	37.0	7	17
T20	159+05	37.0	7	17
T21	160+55	37.0	7	17
T22	164+30	37.0	7	20
T23	165+80	37.0	7	20
T24	167+30	37.0	7	20
T25	170+90	37.0	7	24
T26	172+40	37.0	7	24
T27	173+90	37.0	7	24
T28	186+95	37.0	7	21
T29	188+45	37.0	7	21
T30	189+95	37.0	7	21

Table 10. Locations for in-place density and moisture tests on prepared subgrade (Contd.).

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
T31	193+85	37.0	5	22
T32	195+35	37.0	5	22
T33	196+85	37.0	5	22
T34	200+90	37.0	5	23
T35	202+40	37.0	5	23
T36	203+90	37.0	5	23
T37	223+00	37.0	5	53
T38	224+50	37.0	5	53
T39	226+00	37.0	5	53

Table 11. Locations of plate bearing tests on subgrade.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
PB1	111+15	37.0	7	13
PB2	137+00	37.0	5	19
PB3	143+90	37.0	5	18
PB4	195+35	37.0	5	22

Table 12. Locations of 20' deep shoulder probes.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
S1	104+40	55.0	13	16
S2	112+65	55.0	13	13
S3	125+65	55.0	13	15
S4	137+00	55.0	13	19
S5	143+90	55.0	13	18
S6	159+05	55.0	13	20
S7	172+40	55.0	13	24
S7	188+45	55.0	13	21
S9	202+40	55.0	13	23
S10	224+50	55.0	13	53

Table 13. Field and laboratory test plan for Dense Graded Aggregate Base materials, SPS-2 Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Particle Size Analysis	UG01	P41	3	B10, B11, B12
Sieve Analysis (washed)	UG02	P41	3	B10, B11, B12
Atterberg Limits	UG04	P43	3	B10, B11, B12
Moisture-Density Relations	UG05	P44	3	B10, B11, B12
Resilient Modulus	UG07	Ship to FHWA lab	3	B10, B11, B12
Classification	UG08	P47	3	B10, B11, B12
Permeability	UG09	P48	3	B10, B11, B12
Natural Moisture Content	UG10	P49	3	B10, B11, B12
In-Place Density		LTPP Method	24	T40 - T63
Plate Bearing Test	SS06	P58	5	PB5 - PB9

Table 14. Bulk sampling of uncompacted Dense Graded Aggregate Base (DGAB).

Sample Location Designation	Station	Offset, feet		Test Section	Sampl e Area
		Center Line	Outside Lane Edge		
B10	121+25	36.0	6	14	6
B11	175+45	36.0	8	24	18
B12	191+40	36.0	8	21	20

Table 15. Locations for plate bearing tests on DGAB.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
PB05	104+40	36.0	6	16
PB06	111+15	36.0	6	13
PB07	118+20	36.0	6	14
PB08	125+15	36.0	6	15
PB09	195+35	36.0	6	22

Table 16. Locations for in-place moisture and density measurements on compacted DGAB.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
T40	102+90	36.0	8	16
T41	104+40	36.0	8	16
T42	105+90	36.0	8	16
T43	109+65	36.0	8	13
T44	111+15	36.0	8	13
T45	112+65	36.0	8	13
T46	116+70	36.0	6	14
T47	118+20	36.0	6	14
T48	119+70	36.0	6	14
T49	123+65	36.0	6	15
T50	125+15	36.0	6	15
T51	126+65	36.0	6	15
T52	170+90	36.0	8	24
T53	172+40	36.0	8	24
T54	173+90	36.0	8	24
T55	186+95	36.0	8	21
T56	188+45	36.0	8	21
T57	189+95	36.0	8	21
T58	193+85	36.0	6	22
T59	195+35	36.0	6	22
T60	196+85	36.0	6	22
T61	200+90	36.0	6	23
T62	202+40	36.0	6	23
T63	203+90	36.0	6	23

Table 17. Field and laboratory test plan for Permeable Asphalt Treated Base materials, SPS-2 Colorado

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Core Examination/Thickness	AC01	P01	16	C113,C114,C116,C117; C124,C125,C128,C132; C147,C151,C152,C157; C161,C162,C165,C166 **(Note 1)**
Bulk Specific Gravity	AC02	P02	16	C113,C114,C116,C117; C124,C125,C128,C132; C147,C151,C152,C157; C161,C162,C165,C166 **(Note 1)**
Maximum Specific Gravity	AC03	P03	6	BT1 - BT3, BT4 - BT6 **(Note 2)**
Asphalt Content (Extraction)	AC04	P04	6	BT1 - BT3, BT4 - BT6
Moisture Susceptibility	AC05	P05	6	BT1 - BT3, BT4 - BT6
Resilient Modulus	AC07	Ship to FHWA	4	C113,C114,C116; C124,C125,C128; C147,C151,C152; C161,C162,C165
Indirect Tensile Strength	AC07	Ship to FHWA	16	C113,C114,C116,C117; C124,C125,C128,C132; C147,C151,C152,C157; C161,C162,C165,C166
Plate Bearing Test			2	PB10, PB11

Notes

1. Core locations are shown in Table 23.
2. Bulk sampling locations are shown in Figures 13, 14, 15, and 16.

Table 18. Locations for plate bearing tests on Permeable Asphalt Treated Base.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
PB10	172+40	38.0	6	24
PB11	195+35	38.0	4	22

Table 19. Field and laboratory test plan for as-delivered lean concrete base and PCC materials, SPS-2 Colorado

Test Name	SHRP Test Designation	SHRP Protocol	No. of Tests	Material Source / Test Location	
Lean Concrete Base - As Delivered					
Compressive Strength	PC01	P61			
7 Day			12	BL1,BL2,BL3; BL4,BL5,BL6 (Note 1)	
28 Day			12	BL1,BL2,BL3; BL4,BL5,BL6 (Note 1)	
1 Year			12	BL1,BL2,BL3; BL4,BL5,BL6 (Note 1)	
Portland Cement Concrete - As Delivered (Note 2)					
Compressive Strength	PC01	P61		550 psi PCC mix	900 psi PCC mix
14 Day			21	FC02,FC04,FC05; FC07,FC08,FC09; FC13,FC17,FC18; FC19,FC20,FC21[3]	FC01,FC03,FC06; FC10,FC11,FC12; FC14,FC15,FC16
28 Day			21		
1 Year			21		
Splitting Tensile Strength	PC02	P62		550 psi PCC mix	900 psi PCC mix
14 Day			21	FC02,FC04,FC05; FC07,FC08,FC09; FC13,FC17,FC18; FC19,FC20,FC21[3]	FC01,FC03,FC06; FC10,FC11,FC12; FC14,FC15,FC16
28 Day			21		
1 Year			21		
Flexural Strength	PC09	P69		550 psi PCC mix	900 psi PCC mix
14 Day			21	FC02,FC04,FC05; FC07,FC08,FC09; FC13,FC17,FC18; FC19,FC20,FC21[3]	FC01,FC03,FC06; FC10,FC11,FC12; FC14,FC15,FC16
28 Day			21		
1 Year			21		
Air Content	ASTM C231	LTPP Method	21	FC01 - FC21	
Slump	ASTM C143	LTPP Method	21	FC01 - FC21	
Temperature	ASTM C1064	LTPP Method	21	FC01 - FC21	

Notes:
1. A total of 6 cylinder specimens are molded from each bulk sample, two specimens for each cure age.
2. A total of 6 cylinder specimens and 3 beam specimens are molded from each PCC bulk sample.
3. FC19-FC21 are bulk samples from Colorado's standard PCC mix for the project, taken from test section 53.

Table 20. Bulk samples and molded specimens from lean concrete base.

Sample Number	Test Age After Placement	Specimen Number 6x12" Cylinder Compression Test	Test Section
BL01	7 days	LX01, LX02	19
	28 days	LY03, LY04	
	1 year	LZ05, LZ06	
BL02	7 days	LX07, LX08	18
	28 days	LY09, LY10	
	1 year	LZ11, LZ12	
BL03	7 days	LX13, LX14	18
	28 days	LY15, LY16	
	1 year	LZ17, LZ18	
BL04	7 days	LX19, LX20	17
	28 days	LY21, LY22	
	1 year	LZ23, LZ24	
BL05	7 days	LX25, LX26	20
	28 days	LY27, LY28	
	1 year	LZ29, LZ30	
BL06	7 days	LX31, LX32	20
	28 days	LY33, LY34	
	1 year	LZ35, LZ36	

Table 21. Bulk samples and molded specimens from PCC mix.

Sample Number	Test Age After Placement	Specimen Number			Test Section
		6x12" Cylinder Compression Test	6x12" Cylinder Indirect Tensile	6x6x12" Beam Flexural Strength	
FC01	14 days	GX01	GX04	FX01	16
	28 days	GY02	GY05	FY02	
	1 year	GZ03	GZ06	FZ03	
FC02	14 days	GX07	GX10	FX04	13
	28 days	GY08	GY11	FY05	
	1 year	GZ09	GZ12	FZ06	
FC03	14 days	GX13	GX16	FX07	14
	28 days	GY14	GY17	FY08	
	1 year	GZ15	GZ18	FZ09	
FC04	14 days	GX19	GX22	FX10	15
	28 days	GY20	GY23	FY11	
	1 year	GZ21	GZ24	FZ12	
FC05	14 days	GX25	GX28	FX13	19
	28 days	GY26	GY29	FY14	
	1 year	GZ27	GZ30	FZ15	
FC06	14 days	GX31	GX34	FX16	18
	28 days	GY32	GY35	FY17	
	1 year	GZ33	GZ36	FZ18	
FC07	14 days	GX37	GX40	FX19	17
	28 days	GY38	GY41	FY20	
	1 year	GZ39	GZ42	FZ21	
FC08	14 days	GX43	GX46	FX22	17
	28 days	GY44	GY47	FY23	
	1 year	GZ45	GZ48	FZ24	
FC09	14 days	GX49	GX52	FX25	17
	28 days	GY50	GY53	FY26	
	1 year	GZ51	GZ54	FZ27	
FC10	14 days	GX55	GX58	FX28	20
	28 days	GY56	GY59	FY29	
	1 year	GZ57	GZ60	FZ30	

Table 21. Bulk samples and molded specimens from PCC mix (Contd.).

Sample Number	Test Age After Placement	Specimen Number			Test Section
		6x12" Cylinder Compression Test	6x12" Cylinder Indirect Tensile	6x6x12" Beam Flexural Strength	
FC11	14 days	GX61	GX64	FX31	20
	28 days	GY62	GY65	FY32	
	1 year	GZ63	GZ66	FZ33	
FC12	14 days	GX67	GX70	FX34	24
	28 days	GY68	GY71	FY35	
	1 year	GZ69	GZ72	FZ36	
FC13	14 days	GX73	GX76	FX37	21
	28 days	GY74	GY77	FY38	
	1 year	GZ75	GZ78	FZ39	
FC14	14 days	GX79	GX82	FX40	22
	28 days	GY80	GY83	FY41	
	1 year	GZ81	GZ84	FZ42	
FC15	14 days	GX85	GX88	FX43	22
	28 days	GY86	GY89	FY44	
	1 year	GZ87	GZ90	FZ45	
FC16	14 days	GX91	GX94	FX46	22
	28 days	GY92	GY95	FY47	
	1 year	GZ93	GZ96	FZ48	
FC17	14 days	GX97	GX100	FX49	23
	28 days	GY98	GY101	FY50	
	1 year	GZ99	GZ102	FZ51	
FC18	14 days	GX103	GX106	FX52	23
	28 days	GY104	GY107	FY53	
	1 year	GZ105	GZ108	FZ54	
FC19	14 days	GX109	GX112	FX55	53
	28 days	GY110	GY113	FY56	
	1 year	GZ111	GZ114	FZ57	
FC20	14 days	GX115	GX118	FX58	53
	28 days	GY116	GY119	FY59	
	1 year	GZ117	GZ120	FZ60	
FC21	14 days	GX121	GX124	FX61	53
	28 days	GY122	GY125	FY62	
	1 year	GZ123	GZ126	FZ63	

Table 22. Field and laboratory test plan for as-placed LCB and PCC materials, SPS-2 Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Lean Concrete Base - As Placed				
Compressive Strength	PC01	P61		
14 Day			6	*C35,C42,C53;C60,C88,C98*
28 Day			6	*C37,C48,C59;C62,C90,C105*
1 Year			6	*C36,C47,C58;C61,C89,C104*
Portland Cement Concrete - As Placed				
Compressive Strength	PC01	P61		
14 Day			21	C5,C23,C52; C9,C29,C41; C66,C71,C79; C91,C109,C115; C123,C131,C160; C137,C142,C150; C174,C179,C188
28 Day			21	C6,C25,C49; C10,C30,C38; C65,C72,C80; C92,C108,C116; C124,C132,C161; C136,C143,C151; C173,C180,C189
1 Year			21	C8,C21,C51; C12,C27,C40; C63,C74,C82; C94,C107,C118; C126,C133,C163; C134,C145,C153; C171,C182,C191
Splitting Tensile Strength	PC02	P62		
14 Day			21	C3,C17,C56; C13,C33,C45; C70,C75,C87; C95,C112,C103; C127,C119,C164; C141,C146,C158; C178,C183,C196
28 Day			21	C4,C19,C54; C14,C34,C43; C69,C76,C86; C96,C113,C99; C128,C120,C165; C140,C147,C157; C177,C184,C193
1 Year			21	C1,C20,C57; C16,C31,C46; C67,C77,C84; C97,C111,C100; C129,C122,C167; C138,C148,C155; C175,C186,C194
PCC Unit Weight	PC05	P65	63	All compressive strength cores
Static Modulus of Elasticity	PC04	P64		
28 Day			21	C7,C22,C55; C15,C28,C39; C68,C73,C81; C93,C102,C117; C125,C169,C162; C152,C144,C139; C176,C181,C190
1 Year			21	C2,C24,C50; C11,C26,C44; C64,C78,C85; C101,C110,C106; C130,C121,C168; C135,C149,C156; C172,C185,C195
Air Content @ 28 Days	PC08	P68	7	C18;C32;C83;C114;C166;C154;C187
PCC Thermal Coef.		Ship to FHWA	7	C37;C59;C62;C105;C170;C159;C192

Table 23. PCC and bound base core locations, SPS-2 Colorado.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C1	101+63	34.5	9.5	16	1	350-360
C2	101+63	36.0	8.0	16	1	350-360
C3	101+63	37.5	6.5	16	1	10-13
C4	101+63	39.0	5.0	16	1	21-24
C5	107+17	34.5	9.5	16	2	10-13
C6	107+17	36.0	8.0	16	2	21-24
C7	107+17	37.5	6.5	16	2	21-24
C8	107+17	39.0	5.0	16	2	350-360
C9	108+38	34.5	9.5	13	3	10-13
C10	108+38	36.0	8.0	13	3	21-24
C11	108+38	37.5	6.5	13	3	350-360
C12	108+38	39.0	5.0	13	3	350-360
C13	113+92	34.5	9.5	13	4	10-13
C14	113+92	36.0	8.0	13	4	21-24
C15	113+92	37.5	6.5	13	4	21-24
C16	113+92	39.0	5.0	13	4	350-360
C17	115+43	34.5	7.5	14	5	10-13
C18	115+43	36.0	6.0	14	5	21-24
C19	115+43	37.5	4.5	14	5	21-24
C20	115+43	39.0	3.0	14	5	350-360
C21	120+97	33.0	9.0	14	6	350-360
C22	120+97	34.5	7.5	14	6	21-24
C23	120+97	36.0	6.0	14	6	10-13
C24	120+97	37.5	4.5	14	6	350-360
C25	120+97	39.0	3.0	14	6	21-24

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C26	122+38	33.0	9.0	15	7	350-360
C27	122+38	34.5	7.5	15	7	350-360
C28	122+38	36.0	6.0	15	7	21-24
C29	122+38	37.5	4.5	15	7	10-13
C30	122+38	39.0	3.0	15	7	21-24
C31	127+92	34.5	7.5	15	8	350-360
C32	127+92	36.0	6.0	15	8	21-24
C33	127+92	37.5	4.5	15	8	10-13
C34	127+92	39.0	3.0	15	8	21-24
C35	134+20	36.0	6.0	19	9	*10-13* (1)
C36	134+20	34.5	7.5	19	9	*350-360* (1)
C37	134+20	39.0	3.0	19	9	*21-24* (1)
C38	134+23	34.5	7.5	19	9	21-24
C39	134+23	36.0	6.0	19	9	21-24
C40	134+23	37.5	4.5	19	9	350-360
C41	134+23	39.0	3.0	19	9	10-13
C42	139+80	36.0	6.0	19	10	*10-13* (1)
C43	139+77	34.5	7.5	19	10	21-24
C44	139+77	36.0	6.0	19	10	350-360
C45	139+77	37.5	4.5	19	10	10-13
C46	139+77	39.0	3.0	19	10	350-360
C47	139+80	34.5	7.5	19	10	*350-360* (1)
C48	139+80	39.0	3.0	19	10	*21-24* (1)
C49	141+13	34.5	7.5	18	11	21-24
C50	141+13	36.0	6.0	18	11	350-360
C51	141+13	37.5	4.5	18	11	350-360
C52	141+13	39.0	3.0	18	11	10-13
C53	146+70	36.0	6.0	18	12	*10-13* (1)
C54	146+67	34.5	7.5	18	12	21-24
C55	146+67	36.0	6.0	18	12	21-24
C56	146+67	37.5	4.5	18	12	10-13
C57	146+67	39.0	3.0	18	12	350-360
C58	146+70	34.5	7.5	18	12	*350-360* (1)
C59	146+70	39.0	3.0	18	12	*21-24* (1)

(1) - Time to obtain these cores of the PCC surface layer and Lean Concrete Base is from placement of the LCB.

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C60	156+22	36.0	8.0	17	13	*10-13* (1)
C61	156+22	34.5	9.5	17	13	*350-360* (1)
C62	156+22	39.0	5.0	17	13	*21-24* (1)
C63	156+25	34.5	9.5	17	13	350-360
C64	156+25	36.0	8.0	17	13	350-360
C65	156+25	37.5	6.5	17	13	21-24
C66	156+25	39.0	5.0	17	13	10-13
C67	156+28	34.5	9.5	17	13	350-360
C68	156+28	36.0	8.0	17	13	21-24
C69	156+28	37.5	6.5	17	13	21-24
C70	156+28	39.0	5.0	17	13	10-13
C71	156+31	34.5	9.5	17	13	10-13
C72	156+31	36.0	8.0	17	13	21-24
C73	156+31	37.5	6.5	17	13	21-24
C74	156+31	39.0	5.0	17	13	350-360
C75	161+79	34.5	9.5	17	14	10-13
C76	161+79	36.0	8.0	17	14	21-24
C77	161+79	37.5	6.5	17	14	350-360
C78	161+79	39.0	5.0	17	14	350-360
C79	161+82	33.0	11.0	17	14	10-13
C80	161+82	34.5	9.5	17	14	21-24
C81	161+82	36.0	8.0	17	14	21-24
C82	161+82	37.5	6.5	17	14	350-360
C83	161+82	39.0	5.0	17	14	21-24
C84	161+85	34.5	9.5	17	14	350-360
C85	161+85	36.0	8.0	17	14	350-360
C86	161+85	37.5	6.5	17	14	21-24
C87	161+85	39.0	5.0	17	14	10-13

(1) - Time to obtain these cores of the PCC surface layer and Lean Concrete Base is from placement of the LCB.

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C88	162+97	36.0	8.0	20	15	*10-13* (1)
C89	162+97	34.5	9.5	20	15	*350-360* (1)
C90	162+97	39.0	5.0	20	15	*21-24* (1)
C91	163+00	34.5	9.5	20	15	10-13
C92	163+00	36.0	8.0	20	15	21-24
C93	163+00	37.5	6.5	20	15	21-24
C94	163+00	39.0	5.0	20	15	350-360
C95	163+03	36.0	8.0	20	15	10-13
C96	163+03	37.5	6.5	20	15	21-24
C97	163+03	39.0	5.0	20	15	350-360
C98	168+60	36.0	8.0	20	16	*10-13* (1)
C99	168+57	33.0	11.0	20	16	21-24
C100	168+57	34.5	9.5	20	16	350-360
C101	168+57	36.0	8.0	20	16	350-360
C102	168+57	37.5	6.5	20	16	21-24
C103	168+57	39.0	5.0	20	16	10-13
C104	168+60	34.5	9.5	20	16	*350-360* (1)
C105	168+60	39.0	5.0	20	16	*21-24* (1)
C106	169+63	34.5	9.5	24	17	350-360
C107	169+63	36.0	8.0	24	17	350-360
C108	169+63	37.5	6.5	24	17	21-24
C109	169+63	39.0	5.0	24	17	10-13
C110	175+17	34.5	9.5	24	18	350-360
C111	175+17	36.0	8.0	24	18	350-360
C112	175+17	37.5	6.5	24	18	10-13
C113 (2)	175+17	39.0	5.0	24	18	21-24
C114 (2)	175+20	33.0	11.0	24	18	21-24
C115	175+20	34.5	9.5	24	18	10-13
C116 (2)	175+20	36.0	8.0	24	18	21-24
C117 (2)	175+20	37.5	6.5	24	18	21-24
C118	175+20	39.0	5.0	24	18	350-360

(1) - Time to obtain these cores of the PCC surface layer and Lean Concrete Base is from placement of the LCB.
(2) - These cores are of the PCC surface layer and the permeable treated asphalt concrete base layer.

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C119	185+65	34.5	9.5	21	19	10-13
C120	185+65	36.0	8.0	21	19	21-24
C121	185+65	37.5	6.5	21	19	350-360
C122	185+65	39.0	5.0	21	19	350-360
C123	185+68	34.5	9.5	21	19	10-13
C124 (2)	185+68	36.0	8.0	21	19	21-24
C125 (2)	185+68	37.5	6.5	21	19	21-24
C126	185+68	39.0	5.0	21	19	350-360
C127	191+22	34.5	9.5	21	20	10-13
C128 (2)	191+22	36.0	8.0	21	20	21-24
C129	191+22	37.5	6.5	21	20	350-360
C130	191+22	39.0	5.0	21	20	350-360
C131	191+25	36.0	8.0	21	20	10-13
C132 (2)	191+25	37.5	6.5	21	20	21-24
C133	191+25	39.0	5.0	21	20	350-360
C134	192+55	34.5	7.5	22	21	350-360
C135	192+55	36.0	6.0	22	21	350-360
C136	192+55	37.5	4.5	22	21	21-24
C137	192+55	39.0	3.0	22	21	10-13
C138	192+58	34.5	7.5	22	21	350-360
C139	192+58	36.0	6.0	22	21	21-24
C140	192+58	37.5	4.5	22	21	21-24
C141	192+58	39.0	3.0	22	21	10-13
C142	192+61	34.5	7.5	22	21	10-13
C143	192+61	36.0	6.0	22	21	21-24
C144	192+61	37.5	4.5	22	21	21-24
C145	192+61	39.0	3.0	22	21	350-360

(2) - These cores are of the PCC surface layer and the permeable treated asphalt concrete base layer.

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C146	198+09	34.5	7.5	22	22	10-13
C147 (2)	198+09	36.0	6.0	22	22	21-24
C148	198+09	37.5	4.5	22	22	350-360
C149	198+09	39.0	3.0	22	22	350-360
C150	198+12	33.0	9.0	22	22	10-13
C151 (2)	198+12	34.5	7.5	22	22	21-24
C152 (2)	198+12	36.0	6.0	22	22	21-24
C153	198+12	37.5	4.5	22	22	350-360
C154	198+12	39.0	3.0	22	22	21-24
C155	198+15	33.0	9.0	22	22	350-360
C156	198+15	34.5	7.5	22	22	350-360
C157 (2)	198+15	36.0	6.0	22	22	21-24
C158	198+15	37.5	4.5	22	22	10-13
C159	198+15	39.0	3.0	22	22	21-24
C160	199+63	34.5	7.5	23	23	10-13
C161 (2)	199+63	36.0	6.0	23	23	21-24
C162 (2)	199+63	37.5	4.5	23	23	21-24
C163	199+63	39.0	3.0	23	23	350-360
C164	205+17	34.5	7.5	23	24	10-13
C165 (2)	205+17	36.0	6.0	23	24	21-24
C166 (2)	205+17	37.5	4.5	23	24	21-24
C167	205+17	39.0	3.0	23	24	350-360
C168	205+20	36.0	6.0	23	24	350-360
C169	205+20	37.5	4.5	23	24	21-24
C170	205+20	39.0	3.0	23	24	21-24

(2) - These cores are of the PCC surface layer and the permeable treated asphalt concrete base layer.

Table 23. PCC and bound base core locations, SPS-2 Colorado (Contd.).

Sample Location Designation	Station	Offset		Test Section	Sample Area	Days After Placement
		Center Line	Outside Lane Edge			
C171	221+70	34.5	7.5	53	26	350-360
C172	221+70	36.0	6.0	53	26	350-360
C173	221+70	37.5	4.5	53	26	21-24
C174	221+70	39.0	3.0	53	26	10-13
C175	221+73	34.5	7.5	53	26	350-360
C176	221+73	36.0	6.0	53	26	21-24
C177	221+73	37.5	4.5	53	26	21-24
C178	221+73	39.0	3.0	53	26	10-13
C179	221+76	34.5	7.5	53	26	10-13
C180	221+76	36.0	6.0	53	26	21-24
C181	221+76	37.5	4.5	53	26	21-24
C182	221+76	39.0	3.0	53	26	350-360
C183	227+24	33.0	9.0	53	27	10-13
C184	227+24	34.5	7.5	53	27	21-24
C185	227+24	36.0	6.0	53	27	350-360
C186	227+24	37.5	4.5	53	27	350-360
C187	227+24	39.0	3.0	53	27	21-24
C188	227+27	33.0	9.0	53	27	10-13
C189	227+27	34.5	7.5	53	27	21-24
C190	227+27	36.0	6.0	53	27	21-24
C191	227+27	37.5	4.5	53	27	350-360
C192	227+27	39.0	3.0	53	27	21-24
C193	227+30	34.5	7.5	53	27	21-24
C194	227+30	36.0	6.0	53	27	350-360
C195	227+30	37.5	4.5	53	27	350-360
C196	227+30	39.0	3.0	53	27	10-13

Table 24. Elevation survey locations.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E1	101+90	44	39	36	33	30	0	5	8	11	14	16
E2	102+40	44	39	36	33	30	0	5	8	11	14	16
E3	102+90	44	39	36	33	30	0	5	8	11	14	16
E4	103+40	44	39	36	33	30	0	5	8	11	14	16
E5	103+90	44	39	36	33	30	0	5	8	11	14	16
E6	104+40	44	39	36	33	30	0	5	8	11	14	16
E7	104+90	44	39	36	33	30	0	5	8	11	14	16
E8	105+40	44	39	36	33	30	0	5	8	11	14	16
E9	105+90	44	39	36	33	30	0	5	8	11	14	16
E10	106+40	44	39	36	33	30	0	5	8	11	14	16
E11	106+90	44	39	36	33	30	0	5	8	11	14	16
E12	108+65	44	39	36	33	30	0	5	8	11	14	13
E13	109+15	44	39	36	33	30	0	5	8	11	14	13
E14	109+65	44	39	36	33	30	0	5	8	11	14	13
E15	110+15	44	39	36	33	30	0	5	8	11	14	13
E16	110+65	44	39	36	33	30	0	5	8	11	14	13
E17	111+15	44	39	36	33	30	0	5	8	11	14	13
E18	111+65	44	39	36	33	30	0	5	8	11	14	13
E19	112+15	44	39	36	33	30	0	5	8	11	14	13
E20	112+65	44	39	36	33	30	0	5	8	11	14	13
E21	113+15	44	39	36	33	30	0	5	8	11	14	13
E22	113+65	44	39	36	33	30	0	5	8	11	14	13
E23	115+70	42	39	36	33	30	0	3	6	9	12	14
E24	116+20	42	39	36	33	30	0	3	6	9	12	14
E25	116+70	42	39	36	33	30	0	3	6	9	12	14
E26	117+20	42	39	36	33	30	0	3	6	9	12	14
E27	117+70	42	39	36	33	30	0	3	6	9	12	14
E28	118+20	42	39	36	33	30	0	3	6	9	12	14
E29	118+70	42	39	36	33	30	0	3	6	9	12	14
E30	119+20	42	39	36	33	30	0	3	6	9	12	14
E31	119+70	42	39	36	33	30	0	3	6	9	12	14
E32	120+20	42	39	36	33	30	0	3	6	9	12	14
E33	120+70	42	39	36	33	30	0	3	6	9	12	14

Table 24. Elevation survey locations.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E34	122+65	42	39	36	33	30	0	3	6	9	12	15
E35	123+15	42	39	36	33	30	0	3	6	9	12	15
E36	123+65	42	39	36	33	30	0	3	6	9	12	15
E37	124+15	42	39	36	33	30	0	3	6	9	12	15
E38	124+65	42	39	36	33	30	0	3	6	9	12	15
E39	125+15	42	39	36	33	30	0	3	6	9	12	15
E40	125+65	42	39	36	33	30	0	3	6	9	12	15
E41	126+15	42	39	36	33	30	0	3	6	9	12	15
E42	126+65	42	39	36	33	30	0	3	6	9	12	15
E43	127+15	42	39	36	33	30	0	3	6	9	12	15
E44	127+65	42	39	36	33	30	0	3	6	9	12	15
E45	134+50	42	39	36	33	30	0	3	6	9	12	19
E46	135+00	42	39	36	33	30	0	3	6	9	12	19
E47	135+50	42	39	36	33	30	0	3	6	9	12	19
E48	136+00	42	39	36	33	30	0	3	6	9	12	19
E49	136+50	42	39	36	33	30	0	3	6	9	12	19
E50	137+00	42	39	36	33	30	0	3	6	9	12	19
E51	137+50	42	39	36	33	30	0	3	6	9	12	19
E52	138+00	42	39	36	33	30	0	3	6	9	12	19
E53	138+50	42	39	36	33	30	0	3	6	9	12	19
E54	139+00	42	39	36	33	30	0	3	6	9	12	19
E55	139+50	42	39	36	33	30	0	3	6	9	12	19
E56	141+40	42	39	36	33	30	0	3	6	9	12	18
E57	141+90	42	39	36	33	30	0	3	6	9	12	18
E58	142+40	42	39	36	33	30	0	3	6	9	12	18
E59	142+90	42	39	36	33	30	0	3	6	9	12	18
E60	143+40	42	39	36	33	30	0	3	6	9	12	18
E61	143+90	42	39	36	33	30	0	3	6	9	12	18
E62	144+40	42	39	36	33	30	0	3	6	9	12	18
E63	144+90	42	39	36	33	30	0	3	6	9	12	18
E64	145+40	42	39	36	33	30	0	3	6	9	12	18
E65	145+90	42	39	36	33	30	0	3	6	9	12	18
E66	146+40	42	39	36	33	30	0	3	6	9	12	18

Table 24. Elevation survey locations.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E67	156+55	44	39	36	33	30	0	5	8	11	14	17
E68	157+05	44	39	36	33	30	0	5	8	11	14	17
E69	157+55	44	39	36	33	30	0	5	8	11	14	17
E70	158+05	44	39	36	33	30	0	5	8	11	14	17
E71	158+55	44	39	36	33	30	0	5	8	11	14	17
E72	159+05	44	39	36	33	30	0	5	8	11	14	17
E73	159+55	44	39	36	33	30	0	5	8	11	14	17
E74	160+05	44	39	36	33	30	0	5	8	11	14	17
E75	160+55	44	39	36	33	30	0	5	8	11	14	17
E76	161+05	44	39	36	33	30	0	5	8	11	14	17
E77	161+55	44	39	36	33	30	0	5	8	11	14	17
E78	163+30	44	39	36	33	30	0	5	8	11	14	20
E79	163+80	44	39	36	33	30	0	5	8	11	14	20
E80	164+30	44	39	36	33	30	0	5	8	11	14	20
E81	164+80	44	39	36	33	30	0	5	8	11	14	20
E82	165+30	44	39	36	33	30	0	5	8	11	14	20
E83	165+80	44	39	36	33	30	0	5	8	11	14	20
E84	166+30	44	39	36	33	30	0	5	8	11	14	20
E85	166+80	44	39	36	33	30	0	5	8	11	14	20
E86	167+30	44	39	36	33	30	0	5	8	11	14	20
E87	167+80	44	39	36	33	30	0	5	8	11	14	20
E88	168+30	44	39	36	33	30	0	5	8	11	14	20
E89	169+90	44	39	36	33	30	0	5	8	11	14	24
E90	170+40	44	39	36	33	30	0	5	8	11	14	24
E91	170+90	44	39	36	33	30	0	5	8	11	14	24
E92	171+40	44	39	36	33	30	0	5	8	11	14	24
E93	171+90	44	39	36	33	30	0	5	8	11	14	24
E94	172+40	44	39	36	33	30	0	5	8	11	14	24
E95	172+90	44	39	36	33	30	0	5	8	11	14	24
E96	173+40	44	39	36	33	30	0	5	8	11	14	24
E97	173+90	44	39	36	33	30	0	5	8	11	14	24
E98	174+40	44	39	36	33	30	0	5	8	11	14	24
E99	174+90	44	39	36	33	30	0	5	8	11	14	24

Table 24. Elevation survey locations.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E100	185+95	44	39	36	33	30	0	5	8	11	14	21
E101	186+45	44	39	36	33	30	0	5	8	11	14	21
E102	186+95	44	39	36	33	30	0	5	8	11	14	21
E103	187+45	44	39	36	33	30	0	5	8	11	14	21
E104	187+95	44	39	36	33	30	0	5	8	11	14	21
E105	188+45	44	39	36	33	30	0	5	8	11	14	21
E106	188+95	44	39	36	33	30	0	5	8	11	14	21
E107	189+45	44	39	36	33	30	0	5	8	11	14	21
E108	187+95	44	39	36	33	30	0	5	8	11	14	21
E109	190+45	44	39	36	33	30	0	5	8	11	14	21
E110	190+95	44	39	36	33	30	0	5	8	11	14	21
E111	192+85	42	39	36	33	30	0	3	6	9	12	22
E112	193+35	42	39	36	33	30	0	3	6	9	12	22
E113	193+85	42	39	36	33	30	0	3	6	9	12	22
E114	194+35	42	39	36	33	30	0	3	6	9	12	22
E115	194+85	42	39	36	33	30	0	3	6	9	12	22
E116	195+35	42	39	36	33	30	0	3	6	9	12	22
E117	195+85	42	39	36	33	30	0	3	6	9	12	22
E118	196+35	42	39	36	33	30	0	3	6	9	12	22
E119	196+85	42	39	36	33	30	0	3	6	9	12	22
E120	197+35	42	39	36	33	30	0	3	6	9	12	22
E121	197+85	42	39	36	33	30	0	3	6	9	12	22
E122	199+90	42	39	36	33	30	0	3	6	9	12	23
E123	200+40	42	39	36	33	30	0	3	6	9	12	23
E124	200+90	42	39	36	33	30	0	3	6	9	12	23
E125	201+40	42	39	36	33	30	0	3	6	9	12	23
E126	201+90	42	39	36	33	30	0	3	6	9	12	23
E127	202+40	42	39	36	33	30	0	3	6	9	12	23
E128	202+90	42	39	36	33	30	0	3	6	9	12	23
E129	203+40	42	39	36	33	30	0	3	6	9	12	23
E130	203+90	42	39	36	33	30	0	3	6	9	12	23
E131	204+40	42	39	36	33	30	0	3	6	9	12	23
E132	204+90	42	39	36	33	30	0	3	6	9	12	23

Table 24. Elevation survey locations.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E133	222+00	42	39	36	33	30	0	3	6	9	12	53
E134	222+50	42	39	36	33	30	0	3	6	9	12	53
E135	223+00	42	39	36	33	30	0	3	6	9	12	53
E136	223+50	42	39	36	33	30	0	3	6	9	12	53
E137	224+00	42	39	36	33	30	0	3	6	9	12	53
E138	224+50	42	39	36	33	30	0	3	6	9	12	53
E139	225+00	42	39	36	33	30	0	3	6	9	12	53
E140	225+50	42	39	36	33	30	0	3	6	9	12	53
E141	226+00	42	39	36	33	30	0	3	6	9	12	53
E142	226+50	42	39	36	33	30	0	3	6	9	12	53
E143	227+00	42	39	36	33	30	0	3	6	9	12	53

Sampling and Testing of SPS-8 Test Sections

This portion of the document presents the materials testing, field testing and sampling plan for the SPS-8 project planned for the realignment and construction of Chestnut Street on the I-76 project.

Sampling and testing of the SPS-8 project during construction includes the following measurements, tests and samples from the various construction stages:

Subgrade

- Bulk sampling and thin-walled tube sampling of the prepared subgrade surface.
- Moisture and density tests on the prepared subgrade surface.
- Plate bearing tests on the prepared subgrade surface.
- Auger probes through the shoulder to a depth of 20' below the prepared subgrade or embankment surface.
- Base line elevation surveys on the surface of the prepared subgrade or embankment to use as a reference in determining layer thickness.

Dense Graded Aggregate Base

- Bulk sampling of the Dense Graded Aggregate Based (DGAB).
- Moisture and density tests on the compacted DGAB.
- Elevation measurements on the prepared DGAB surface.

Portland Cement Concrete Surface

- Bulk sampling and molding of PCC specimens for laboratory testing.
- Slump, air content and temperature measurements on the as-delivered PCC mix.
- Coring of the PCC surface during the specified time intervals for laboratory testing.
- Elevation measurements on the finished PCC surface.

Summary of Sampling and Testing on each Test Section

In Figure 18, an overview of the sampling and test locations on the SPS-8 test sections are shown. The location and type of sampling and tests to be performed on each constructed material layer in each test section are shown in Figure 18. Also shown in Figure 18 are construction stations for the beginning and end of each test section.

Subgrade

A summary of the samples, laboratory and field tests on the subgrade materials is presented in Table 25. In this table, B-type samples are bulk samples and A-type samples are thin-wall (Shelby) tube samples of the subgrade materials. The T-type test locations are for

nuclear moisture-density tests, and the S-type locations are for the 20' deep auger probes through the shoulder.

Thin-wall (Shelby) Tube Samples

Undisturbed samples of the natural subgrade or fill material shall be obtained to a depth of 4' below the top of the subgrade or fill using thin-wall (Shelby) tube sampling. Two samples should be obtained at each location shown in Table 26. These operations shall be performed in accordance with **AASHTO T203 "Soil Investigation and Sampling by Auger Boring"** and **AASHTO M146 "Terms Relating to subgrade, Soil-Aggregate and Fill Materials"**. Shelby tube sampling shall be performed in accordance with **AASHTO T207**. If Shelby tube samples can not be obtained, split spoon samples may be obtained following Section 3.4.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

Bulk Samples

Bulk samples of the subgrade or embankment material should be obtained from the locations shown in Table 27. In general, bulk samples should be obtained from a single excavation, 2' by 2' in area and 12 inches deep. Approximately 400 lbs of material should be obtained from each sampling location. The sampling operation should be performed following similar procedures to those contained in Section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling. Samples for gravimetric moisture tests should be obtained at each bulk sample location. **In-place density and moisture tests should be obtained at each bulk sampling location prior to sampling operations.**

Density and Moisture Measurements

In-place density and moisture measurements should be performed on the prepared subgrade or embankment material surface at the T designated locations shown in Table 28 and the B locations shown in Table 27. These test shall be performed using recently calibrated nuclear moisture-density gauges 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 reading made during each 90° rotation of the nuclear gauge through a full 360°.

Auger Probe

Auger probe to a depth of 20' from the surface of the prepared subgrade or embankment should be performed at the shoulder location shown in Figure 18. The purpose of this probe is to determine if bedrock or other significantly dense layer exist within 20 feet of the pavement surface elevation. Auguring shall be performed using a truck mounted drill rig using 4 or 6 inch, continuous flight, solid, helical augers.

Dense Graded Aggregate Base

A summary of the samples to be taken from the Dense Graded Aggregate Base (DGAB) material and tests to be conducted is presented in Table 29. Field sampling and testing of the DGAB material includes bulk samples and in-place density and moisture measurements.

Bulk Samples

The bulk sample of DGAB material maybe obtained prior to compaction to avoid interruptions to construction activities at the approximate location shown in Table 30. An uncontaminated 200 lbs sample shall be obtained from this 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.

Density and Moisture Measurements

Nuclear density and moisture measurements shall be performed on top of the prepared DGAB at the locations shown in Table 31. These measurements shall be performed following the same procedures used for subgrade soils.

Portland Cement Concrete

A summary of the sampling and testing plan for the portland cement concrete (PCC) materials are shown in Table 32 for the as-delivered material and Table 34 for the as-placed material.

As-Delivered

Sampling of the concrete used in the PCC mix shall be performed in the field, during or just before placement. The test sections from which the designated bulk samples should be obtained are shown in Table 33. These samples shall be obtained in accordance with **AASHTO T141 "Sampling Fresh Concrete"**, molded into the specimens specified in Table 33, cured, packaged and shipped to the laboratory. All specimens shall be made and cured in the field in accordance with **AASHTO T23 "Making and Curing Concrete Specimens in the Field"** and **AASHTO T126 "Making and Curing Concrete Specimens in the Laboratory"**. From each bulk PCC sample six - 6" by 12" cylindrical specimens and three - 6"x6" by 20 inch long beam specimens shall be molded. Molded concrete samples shall be transported in accordance with **Section 10, "Transportation of Specimens to Laboratory" of ASTM C31.**

Field tests shall be performed on the bulk samples of fresh concrete to determine mix temperature, slump, and air content (volumetric). Samples shall be obtained in accordance with **ASTM C172** and tests performed in accordance with **ASTM C1064 (temperature), ASTM C231 (air content)**, and **ASTM C143 (slump).**

As-Placed

Sampling of the as-placed LCB materials shall consist of 4 inch diameter cores. The cores shall be obtained from 1 to 4 days **prior** to the specified age for conduct of the laboratory tests. This is to allow time in the laboratory for soaking strength test specimen in lime water for at least 40 hrs immediately prior to the test. In Table 34, tests on the cores are specified at 14 days, 28 days, and 1 year after placement. The objective of these tests are to characterize the properties of the material after being subjected to in-place curing conditions. These cores shall be obtained during the following time periods:

Specified Test Age	Date After Placement to Obtain Cores
14 days	10 - 13 days
28 days	21 - 24 days
1 year	350 - 360 days

The locations of the PCC cores specified in Table 34 are shown in Table 35. Coring operations shall be performed in accordance with **AASHTO T24 "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete"** using equipment specified in the SHRP-LTPP Guide for Field Materials Sampling, testing and Handling. Plugs shall not be inserted in cores intended for laboratory testing. All cores shall be dried prior to packaging.

Care shall be taken to insure 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.

Elevation Measurements

Elevation measurements shall be made on the surface of each pavement layer (prepared subgrade or embankment, Dense Graded Aggregate Base, and PCC surface) at the locations shown in Table 36. Measurements must be made to an accuracy of 0.01 feet. Care must be taken to re-establish the same points on the surface of each succeeding material layer to insure accurate determination of the thickness of each layer.

Data Forms

The data forms and instructions contained in **"Specific Pavement Studies, Materials Sampling and Testing Requirements for Experiment SPS-2, Strategic Study of Structural factors for Rigid Pavements"** should be used for the SPS-8 test sections on this project. These data forms must be completed at the time of the work. Completed forms shall be submitted to the designated SHRP representative.

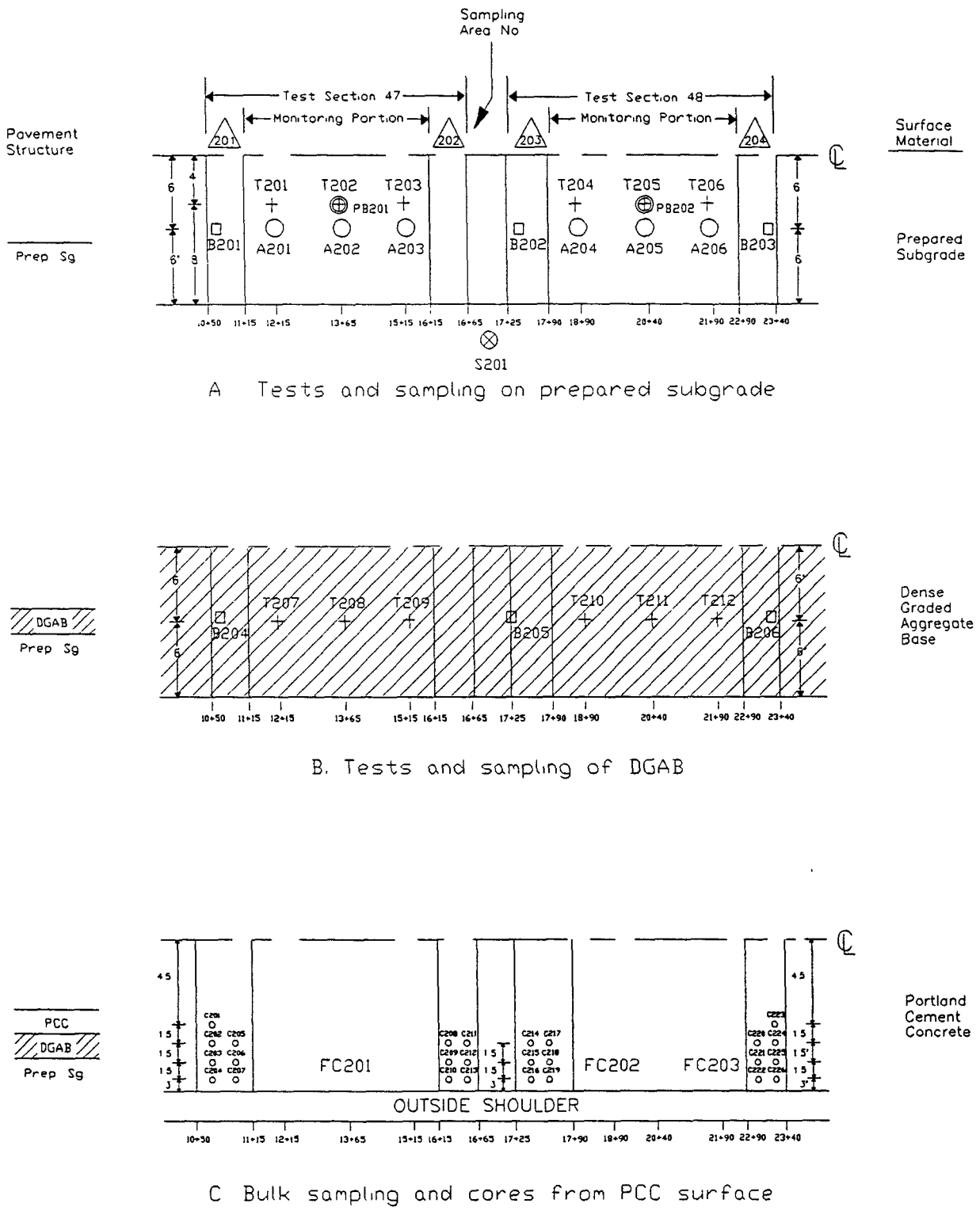


Figure 18. Sampling and test plans for SPS-8 test sections, Chestnut Street, I-76 project, Colorado.

Table 25. Field and laboratory test plan for subgrade materials, SPS-8 test sections on Chestnut Street, I project, Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Sieve Analysis	SS01	P51	3	B201, B202, B203
Hydrometer to 0.01 mm	SS02	P42	3	B201, B202, B203
Atterberg Limits	SS03	P43	3	B201, B202, B203
Subgrade Classification and Type	SS04	P52	9	B201, B202, B203, A201 - A206 see Note 1
Moisture-Density Relations	SS05	P55	3	B201, B202, B203
Resilient Modulus	SS07	Ship to FHWA	3	A201, A203, A205
Unit Weight	SS08	P56	6	A201 - A206
Natural Moisture Content	SS09	P49	3	B201, B202, B203
Unconfined Compression Strength	SS10	P54	3	A202, A204, A206
Permeability	SS11	P57	1	A202
In-Place Density		SHRP-LTPP Method	9	B201, B202, B203, T201-T206
Plate Bearing Test	SS06	P58	2	PB201, PB202
Depth to Rigid Layer		SHRP-LTPP Method	1	S201
Expansion Index	TBA	TBA (2)	3	B201, B202, B203

Note 1. Visual-manual classification method only.
Note 2. Will be based on ASTM B4829 - 88.

Table 26. Locations for thin-wall (Shelby) tube sampling of subgrade on SPS-8 test sections on Chestnut Street, I-76 project Colorado.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
A201	21+15	6.0	6.0	47
A202	13+65	6.0	6.0	47
A203	15+15	6.0	6.0	47
A204	18+90	6.0	6.0	48
A205	20+40	6.0	6.0	48
A206	21+90	6.0	6.0	48

Table 27. Locations of prepared subgrade bulk sampling on SPS-8 test sections on Chestnut Street, I-76 project Colorado.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line	Outside Lane Edge		
B201	10+50	6.0	6.0	47	201
B202	17+25	6.0	6.0	48	203
B203	23+40	6.0	6.0	48	204

Table 28. Locations for in-place density and moisture tests on prepared subgrade on SPS-8 test section on Chestnut street, I-76 project, Colorado.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
T201	12+15	4.0	8	47
T202	13+65	4.0	8	47
T203	15+15	4.0	8	47
T204	18+90	4.0	8	48
T205	20+40	4.0	8	48
T206	21+90	4.0	8	48

Table 29. Field and laboratory test plan for Dense Graded Aggregate Base materials, SPS-8 test sections on Chestnut Street, I-76 project, Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Location
Particle Size Analysis	UG01	P41	3	B204, B205, B206
Sieve Analysis (washed)	UG02	P41	3	B204, B205, B206
Atterberg Limits	UG04	P43	3	B204, B205, B206
Moisture-Density Relations	UG05	P44	3	B204, B205, B206
Resilient Modulus	UG07	Ship to FHWA	3	B204, B205, B206
Classification	UG08	P47	3	B204, B205, B206
Permeability	UG09	P48	3	B204, B205, B206
Natural Moisture Content	UG10	P49	3	B204, B205, B206
In-Place Density		LTPP Method	6	T207 - T212

Table 30. Bulk sampling of uncompacted Dense Graded Aggregate Base on SPS-8 test sections on Chestnut Street, I-76 project, Colorado.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line	Outside Lane Edge		
B204	10+55	6.0	6.0	47	201
B205	17+30	6.0	6.0	48	203
B206	23+35	6.0	6.0	48	204

Table 31. Locations for in-place moisture and density measurements on compacted DGAB on SPS-8 test sections on Chestnut Street, I-76 project, Colorado.

Sample Location Designation	Station	Offset, feet		Test Section
		Center Line	Outside Lane Edge	
T207	12+15	6.0	6	47
T208	13+65	6.0	6	47
T209	15+15	6.0	6	47
T210	18+90	6.0	6	48
T211	20+40	6.0	6	48
T212	21+90	6.0	6	48

Table 32. Field and laboratory test plan for as-delivered PCC materials, SPS-8 test sections on Chestnut Stre I-76 project, Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	No. of Tests	Material Source / Test Location
Portland Cement Concrete - As Delivered				
Compressive Strength	PC01	P61		
14 Day			3	FC201,FC202,FC203 **(Note 1)**
28 Day			3	
1 Year			3	
Splitting Tensile Strength	PC02	P62		
14 Day			3	FC201, FC202, FC203
28 Day			3	
1 Year			3	
Flexural Strength	PC09	P69		
14 Day			3	FC201, FC202, FC203
28 Day			3	
1 Year			3	
Air Content	ASTM C231	LTPP Method	3	FC201, FC202, FC203
Slump	ASTM C143	LTPP Method	3	FC201, FC202, FC203
Temperature	ASTM C1064	LTPP Method	3	FC201, FC202, FC203

Notes:
1. A total of 6 cylinder specimens and 3 beam specimens are molded from each PCC bulk sample.

Table 33. Bulk samples and molded specimens from PCC mix on SPS-8 test sections on Chestnut Street, I project, Colorado.

Sample Number	Test Age After Placement	Specimen Number			Test Section
		6x12" Cylinder Compression Test	6x12" Cylinder Indirect Tensile	6x6x12" Beam Flexural Strength	
FC201	14 days	GX201	GX204	FX201	47
	28 days	GY202	GY205	FY202	
	1 year	GZ203	GZ206	FZ203	
FC202	14 days	GX207	GX210	FX204	48
	28 days	GY208	GY211	FY205	
	1 year	GZ209	GZ212	FZ206	
FC203	14 days	GX213	GX216	FX207	48
	28 days	GY214	GY217	FY208	
	1 year	GZ215	GZ218	FZ209	

Table 34. Field and laboratory test plan for as-placed PCC materials, SPS-8 test sections on Chestnut Street, I project, Colorado.

Test Name	SHRP Test Designation	SHRP Protocol	Number of Tests	Material Source / Test Locatio
Portland Cement Concrete - As Placed				
Compressive Strength	PC01	P61		
14 Day			3	C201, C210, C220
28 Day			3	C202, C211, C221
1 Year			3	C204, C213, C222
Splitting Tensile Strength	PC02	P62		
14 Day			3	C205, C214, C223
28 Day			3	C206, C215, C224
1 Year			3	C208, C216, C225
PCC Unit Weight	PC05	P65	9	All compressive strength core
Static Modulus of Elasticity	PC04	P64		
28 Day			3	C203, C212, C226
1 Year			3	C207, C217, C219
Air Content @ 28 Days	PC08	P68	1	C209
PCC Thermal Coefficient		Ship to FHWA	1	C218

Table 35. PCC core locations on SPS-8 test sections on Chestnut Street, I-76 project, Colorado.

Sample Location Designation	Station	Offset, feet		Test Section	Sample Area
		Center Line	Outside Lane Edge		
C201	10+88	4.5	7.5	47	201
C202	10+88	6.0	6.0	47	201
C203	10+88	7.5	4.5	47	201
C204	10+88	9.0	3.0	47	201
C205	10+91	6.0	6.0	47	201
C206	10+91	7.5	4.5	47	201
C207	10+91	9.0	3.0	47	201
C208	16+41	6.0	6.0	47	202
C209	16+41	7.5	4.5	47	202
C210	16+41	9.0	3.0	47	202
C211	16+44	6.0	6.0	47	202
C222	16+44	7.5	4.5	47	202
C213	16+44	9.0	3.0	47	202
C214	17+63	6.0	6.0	48	203
C215	17+63	7.5	4.5	48	203
C216	17+63	9.0	3.0	48	203
C217	17+66	6.0	6.0	48	203
C218	17+66	7.5	4.5	48	203
C219	17+66	9.0	3.0	48	203
C220	23+16	6.0	6.0	48	204
C221	23+16	7.5	4.5	48	204
C222	23+16	9.0	3.0	48	204
C223	23+19	4.5	7.5	48	204
C224	23+19	6.0	6.0	48	204
C225	23+19	7.5	4.5	48	204
C226	23+19	9.0	3.0	48	204

Table 36. Elevation survey locations, SPS-8 test sections, Chestnut Street, I-76 project, Colorado.

Sample Location Designation	Station	Offset, Center Line, feet					Offset, Lane Edge, Feet					Test Sectio
		1	2	3	4	5	1	2	3	4	5	
E201	11+15	12	9	6	3	0	0	3	6	9	12	47
E202	11+65	12	9	6	3	0	0	3	6	9	12	47
E203	12+15	12	9	6	3	0	0	3	6	9	12	47
E204	12+65	12	9	6	3	0	0	3	6	9	12	47
E205	13+15	12	9	6	3	0	0	3	6	9	12	47
E206	13+65	12	9	6	3	0	0	3	6	9	12	47
E207	14+15	12	9	6	3	0	0	3	6	9	12	47
E208	14+65	12	9	6	3	0	0	3	6	9	12	47
E209	15+15	12	9	6	3	0	0	3	6	9	12	47
E210	15+65	12	9	6	3	0	0	3	6	9	12	47
E211	16+15	12	9	6	3	0	0	3	6	9	12	47
E212	17+90	12	9	6	3	0	0	3	6	9	12	48
E213	18+40	12	9	6	3	0	0	3	6	9	12	48
E214	18+90	12	9	6	3	0	0	3	6	9	12	48
E215	19+40	12	9	6	3	0	0	3	6	9	12	48
E216	19+90	12	9	6	3	0	0	3	6	9	12	48
E217	20+40	12	9	6	3	0	0	3	6	9	12	48
E218	20+90	12	9	6	3	0	0	3	6	9	12	48
E219	21+40	12	9	6	3	0	0	3	6	9	12	48
E220	21+90	12	9	6	3	0	0	3	6	9	12	48
E221	22+40	12	9	6	3	0	0	3	6	9	12	48
E222	22+90	12	9	6	3	0	0	3	6	9	12	48