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STRATEGIC HIGHWAY RESEARCH PROGRAM

SPECIFIC PAVEMENT STUDIES
MATERIALS SAMPLING AND TESTING REQUIREMENTS
FOR EXPERIMENT SPS-7
BONDED PORTLAND CEMENT CONCRETE OVERLAYS

STRATEGIC HIGHWAY RESEARCH PROGRAM
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PREFACE

This report contains guidelines for the development and implementation of a material sampling and testing program for each test site included in the Specific Pavement Studies' experiment SPS-7, Bonded Portland Cement Concrete Overlays. These guidelines will help the SHRP regional office develop recommendations for a material sampling and testing plan tailored for the individual test site. The SHRP regional office and the participating highway agency must coordinate the activities associated with the development and implementation of the recommended field sampling and testing plan to ensure compliance with the plan objectives and thus achieve the study's goals.

This report should be used in conjunction with the SHRP Guide for Field Materials Sampling, Testing and Handling to perform the field material drilling and sampling work. Copies of these guidelines should be available during the on-site sampling and testing operations. All persons involved in the field sampling and testing operations for the SPS-7 experiment must be familiar with its content, particularly the types and numbers of samples to be obtained from the different test sections and pavement layers.

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1. INTRODUCTION

1.1 OVERVIEW

This report provides guidelines for the development and implementation of a material sampling and testing program for each of the test sites included in the Specific Pavement Studies' experiment SPS-7, Bonded Portland Cement Concrete Overlays. These guidelines will be used by the SHRP regional office to develop recommendations for a material sampling and testing plan tailored to the individual test site.

The SPS-7 experiment requires the construction of multiple test sections with similar details and materials at each of twelve sites located in the four climatic regions. The experimental design and construction considerations for this experiment are described in the document, "Specific Pavement Studies: Experimental Design and Research Plan for Experiment SPS-7, Bonded Portland Cement Concrete Overlays," February 1990. Construction features and details for this experiment are described in the document, "Specific Pavement Studies: Construction Guidelines for Experiment SPS-7, Bonded Portland Cement Concrete Overlays," December 1990. In spite of attempts to control uniformity in construction, some variation between sites will exist. Therefore, it is important to develop and implement a sampling and testing plan that will provide the information necessary to evaluate such variations and their effect on performance.

To obtain materials characterization required for the SPS-7 experiment, the following steps are required:

1. Review of project site layout and soil profile logs.

2. Formulation of a field sampling plan. This plan should take into account site conditions and the laboratory material testing requirements. An adequate number of samples must be retrieved in the field to assure that all laboratory material characterization tests may be performed.

3. Development of a field sampling plan report. This report should specify sampling area locations, type and number of samples required from each location and material, and a tracking table that specifies the tests to be performed on each sample.

4. Field sampling and testing of materials. In reporting this activity, adjustments made in the field to the sampling and testing plan must be recorded.

5. Testing of material samples in the laboratory.

6. Compilation and storage of data. This will include compilation of field sampling, field testing and laboratory material test data and entry of this data into the National Pavement Performance Database.

The SPS-7 experiment was developed to investigate the performance of bonded portland cement concrete (PCC) overlays for jointed and continuously reinforced concrete pavements and the effect of selected factors on performance. These factors include overlay thickness, surface preparation, and bonding agent. Characterization of the material properties and the variations of these properties between and within the test sections is required to evaluate cause of performance differences between test sections and provide a basis for better rehabilitation of bonded concrete overlays.

1.2 MINIMUM REQUIREMENTS

The material sampling and test plan must be tailored to the specific features encountered on each project. Also, participating agencies may construct supplemental test sections at the site in addition to those required for the SPS-7 experiment. Therefore, the material sampling and testing plan will vary from one site to another. For illustration, an example of the material sampling and testing requirements together with a conceptual site plan are presented in this report for a hypothetical "ideal" test site.

The site used for this illustration consists of the nine test sections required for the experiment. These sections include one control section and

eight experimental sections, as shown in Figure 1. The rehabilitation treatments for these sections are as follows:

Section 1 - Concrete pavement repair, no overlay.

Section 2 - Concrete pavement repair, surface preparation by milling, cement grout as a bonding agent, 3-inch thick PCC overlay.

Section 3 - Concrete pavement repair, surface preparation by milling, no grout, 3-inch thick PCC overlay.

Section 4 - Concrete pavement repair, surface preparation by shot blasting, no grout, 3-inch thick PCC overlay.

Section 5 - Concrete pavement repair, surface preparation by shot blasting, cement grout as a bonding agent, 3-inch thick PCC overlay.

Section 6 - Concrete pavement repair, surface preparation by shot blasting, cement grout as a bonding agent, 5-inch thick PCC overlay.

Section 7 - Concrete pavement repair, surface preparation by shot blasting, no grout, 5-inch thick PCC overlay.

Section 8 - Concrete pavement repair, surface preparation by milling, no grout, 5-inch thick PCC overlay.

Section 9 - Concrete pavement repair, surface preparation by milling, cement grout as a bonding agent, 5-inch thick PCC overlay.

The hypothetical "ideal" SPS-7 test site shown in Figure 1 will be used to illustrate the minimum materials sampling and testing requirements. For this site, the test sections are 600-feet long each and are spaced 300 feet apart. Since the material sampling and testing methods are destructive, the sampling areas must be located outside the 500-foot monitoring length. The material sampling areas are located adjacent to the ends of the test sections and are consecutively numbered as illustrated in Figure 1. Sampling prior to overlay placement (locations 1 through 9) is intended to characterize the properties of the existing pavement base, subbase, and subgrade. This sampling allows the cores and test pit patches to be covered with the overlay to minimize distress progression at these locations. Sampling after overlay placement (locations 10 through 25) is intended to characterize the as-placed overlay material, the original underlying PCC pavement, and the effectiveness of the bond at the overlay/pavement interface. "Pre-construction" and "Post Construction" are used in this report to refer to prior and after overlay placement, respectively.

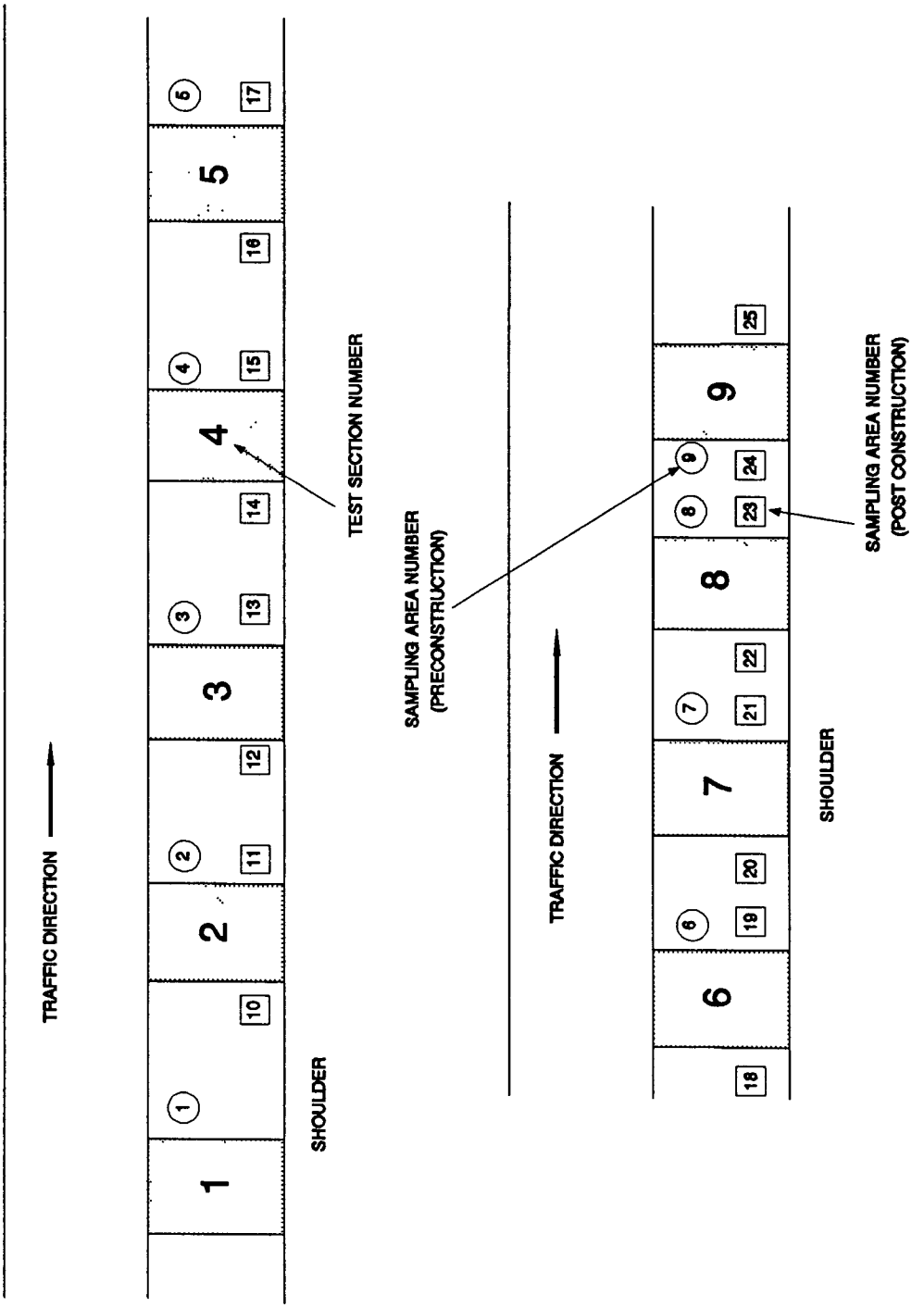


Figure 1. Example of Site Layout and Sampling Locations

The guidelines for formulating field materials sampling and laboratory testing plans for the SPS-7 experiment have been developed based on the experience gained from the materials testing program developed for the General Pavement Studies and the need for better characterization of the engineering properties of the materials within the test sites. The field material sampling plan should adequately address the laboratory testing needs. Therefore, a sufficient number of samples must be obtained from each test site to enable adequate characterization of the pavement materials by laboratory tests.

2. DEVELOPMENT OF SAMPLING AND TESTING PLANS

2.1 GENERAL

The details of the sampling plan for each SPS-7 site will differ depending on the variability and constraints of each specific project. The sampling plan must be tailored for the specific site conditions to account for distance between test sections, project length, subgrade variability and other conditions unique to the site. The following guidelines are presented to help simplify the process of developing an appropriate field sampling plan for the experiment.

The pre-construction and post-construction sampling plans should be prepared in a coordinated manner to ensure consistency. Participating highway agency input should be sought when appropriate during plan preparation. In addition, the following documents must be reviewed prior to plan preparation:

1. Project plan and profile sheets.
2. Soil profile sheets.
3. Laboratory material testing plans described in this document.
4. Other documents or information specific to this project. For example, review of field verification reports would help determine pavement structure cross-sections and subgrade variability along the site.

Criteria for selection of test section locations require that all test sections at each site should have the same structural cross section and constructed of the same materials under the same contract. To accommodate likely deviations from these and other established criteria, the test plan must be devised so that all known or suspected variations can be characterized. In general, variability of the subgrade will be determined during the site selection process and should be a prime consideration in development of the final sampling and testing plan for the site. Plan and profile sheets will help determine the location of cut/fill sections and the possible variability in subgrade materials. The constraints imposed on location of test sections to avoid cut/fill transitions, bridges, culverts, substructures and side hill fills and the inclusion of supplemental test sections desired by the participating agency will increase the potential for variability of the subgrade soils along the site.

Therefore, as an example, bulk sampling should be performed at a minimum of three locations per site. However, the actual number of sampling locations should be based on the total site length and known variations.

Table 1 lists the minimum number of material samples and sample types required for an SPS-7 site. A code system is assigned to each sample to designate sample type (core, test pit, or auger), core size, and sample location number. For each sample type, material samples are obtained from the different pavement layers. The number of material samples listed in Table 1 are those required for each material layer.

Different types of samples of the pavement structure are required at each site, as follows:

- Four-inch diameter cores of portland cement concrete overlay and the underlying portland cement concrete pavement. These samples are designated on sampling plans as C-Type cores and their locations are identified in Figures C.2 through C.9 of Appendix C.

- Four-inch diameter cores of the original portland cement concrete pavement, bound base layers and treated subbase layers. These samples are designated on sampling plans as C-Type cores and their locations are identified in Figures A.4, A.7, and A.10 of Appendix A.

- Six-inch diameter cores of the original portland cement concrete, bound base layers and treated subbase layers; augering of unstabilized base and subbase layers; thin-walled tube and/or splitspoon sampling of subgrade layers to 4 feet below the top of the untreated subgrade. These samples are designated on sampling plans as A-Type samples and their locations are identified in Figures A.2, A.3, A.5, A.6, A.8, and A.9 of Appendix A.

- Twelve-inch diameter cores of the original portland cement concrete, bound base layers and treated subbase layers; augering of unstabilized base, subbase and subgrade to 12 inches below the top of the untreated

Table 1. Scope of Material Sampling and Field Testing

MATERIAL AND SAMPLE DESCRIPTION	NUMBER OF MATERIAL SAMPLES	SAMPLE TYPE DESIGNATION
PRE-CONSTRUCTION SAMPLING		
1. Concrete (original pavement)		
Coring - 4" diam. cores	9	C1-C9
Coring - 6" diam. cores	6	A1-A6
Coring - 12" diam. cores	3	BA1-BA3
2. Unbound Base/Subbase Layers (per layer)		
Augering 6" diam. holes	6	A1-A6
Bulk sampling in 12" diam. holes	3	BA1-BA3
Bulk sampling in test pit	2	TP1-TP2
In situ density and moisture content (nuclear gauge)	2	TP1-TP2
Moisture content samples	7	TP1-TP2,BA1-BA3
3. Bound Base/Subbase Layers		
Coring - 4" diam. cores (per layer)	9	C1-C9
4. Subgrade		
Splitspoon sampling	12*	A1-A6
Thin-walled tube sampling (* 2 tubes or 2 spoons or combination per hole)	12*	A1-A6
Bulk sampling in 12" diam. holes	3	BA1-BA3
Bulk sampling in test pit	2	TP1-TP2
In situ density and moisture content (nuclear gauge)	2	TP1-TP2
Moisture content samples	7	TP1-TP2,BA1-BA3
5. Shoulder Auger Probes	3	S1-S3
AS-DELIVERED CONCRETE SAMPLING		
Bulk Sample - Concrete for 3" overlays	3	FC1-FC3
Bulk Sample - Concrete for 5" overlays	3	FC4-FC6

Table 1. Scope of Material Sampling and Field Testing (continued)

MATERIAL AND SAMPLE DESCRIPTION	NUMBER OF MATERIAL SAMPLES	SAMPLE TYPE DESIGNATION
POST CONSTRUCTION SAMPLING		
1. Concrete (overlay)		
Coring - 4" diam. cores		
14 day	11	C10-C20
28 day	44	C21-C64
365 day	44	C65-C108
2. Concrete (original pavement)		
Coring - 4" diam. cores		
14 day	11	C10-C20
28 day	44	C21-C64
365 day	44	C65-C108

subgrade for bulk sample retrieval. These samples are designated on sampling plans as BA-Type samples and their locations are identified in Figure A.6 of Appendix A.

- Six-foot by four-foot test pit to a depth of 12 inches below the top of the untreated subgrade for bulk sampling of unstabilized layers and the subgrade materials and for nuclear density and moisture measurements on unstabilized pavement layers and subgrade material. These samples are designated on sampling plans as TP-Type samples and their locations are identified in Figures A.3 and A.9 of Appendix A. When possible, these locations may take advantage of pre-overlay repair that may be required outside of the monitoring sections.

- Six-inch diameter shoulder auger probes augered to a depth of 20 feet through the shoulder to determine the depth to a rigid layer. These are designated on sampling plans as S-Type sampling locations and are identified in Figures A.3, A.6, and A.9 of Appendix A. The purpose of the shoulder auger probe is to determine if bedrock or other significantly dense layers exist within 20 feet of the pavement surface. This determination is extremely important for later analysis of deflection measurements. However, shallow auger probes would not be warranted at locations where rock is known to exist at very deep depths. Therefore, maps from the U.S. Geological Survey and the U.S. Department of Agriculture, county soil surveys, and other information from soil borings for nearby bridges or other structures should be used to assess the need for this auger probe.

- Bulk samples of the fresh portland cement concrete used in the overlay for molding into laboratory specimens.

Bulk sampling of the portland cement concrete used in the overlay is required during overlay construction. Six separate samples should be obtained during construction. Each sample should be large enough for making six test cylinders and three test beams. These test specimens should be prepared and shipped to the laboratory designated by the participating highway agency.

The laboratory material testing program corresponding to the sampling plan outlined in Table 1 is shown in Tables 2, 3 and 4. These tables show the SHRP test designation, SHRP material testing protocol, the number of tests for each layer of material and the material source/sample type designation which corresponds to the codes shown in Table 1. The site-specific field material sampling and laboratory testing plan for each SPS-7 site should include the following elements:

- Overall sampling location layout plan (based on Figure 1).
- Detailed pre-construction sampling layout.
- Detailed post-construction sampling layout.
- Pre-construction laboratory testing plan.
- Post-construction laboratory testing plan.

Other items which may be included with the sampling and testing plan are soil profile logs, plan and profile sheets and other information specific to the project which are pertinent to the field sampling and laboratory testing plans. The recommended plan should be compiled and submitted for review and approval by SHRP prior to implementation.

The following sections provide details for each element of the SPS-7 site-specific field material sampling and laboratory testing plan.

2.2 OVERALL SAMPLING LOCATION LAYOUT PLAN

The overall sampling layout plan is used to identify the location of sampling areas relative to the test sections for sampling activities before and after overlay construction. The approximate transition lengths between test sections should be indicated on the plan. Figure 1 illustrates an example of an overall sampling plan.

Since the material sampling and testing methods are destructive, the sampling areas should be located outside the monitoring length of the test section. However, the sampling areas should be located relatively close to the test section ends so that the samples obtained represent the materials and conditions encountered within the section but they should not be located too close to the section ends and thus contribute to the development of distress in

Table 2. PRECONSTRUCTION LABORATORY TESTING PLANS

Material Type and Properties	SHRP Designation	SHRP Protocol	Tests per Layer	Material Source/ [1] Test Locations
PRE-CONSTRUCTION				
I. BOUND (TREATED) BASE AND SUBBASE				
Type and Classification of Material and Treatment	TB01	P31	3	C1 C4 C7
Pozzolanic/Cementitious: Compressive Strength	TB02	P32	3	C1 C4 C7
Asphalt treated: Resilient Modulus	TB03	P33	9	C1 C2 C3 C4 C5 C6 C7 C8 C9
HMAC: Resilient Modulus	AC07	P07	9	C1 C2 C3 C4 C5 C6 C7 C8 C9
II. UNBOUND GRANULAR BASE AND SUBBASE				
Particle Size Analysis	UG01	P41	3	TP1 [BA1-3] TP2
Sieve Analysis (washed)	UG02	P41	3	TP1 [BA1-3] TP2
Atterberg Limits	UG04	P43	3	TP1 [BA1-3] TP2
Moisture-Density Relations	UG05	P44	3	TP1 [BA1-3] TP2
Resilient Modulus	UG07	P46	3	TP1 [BA1-3] TP2
Classification	UG08	P47	3	TP1 [BA1-3] TP2
Permeability	UG09	P48	3	TP1 [BA1-3] TP2
Natural Moisture Content	UG10	P49	3	TP1 [BA1-3] TP2
III. SUBGRADE				
Sieve Analysis	SS01	P51	3	TP1 [BA1-3] TP2
Hydrometer to 0.001mm	SS02	P42	3	TP1 [BA1-3] TP2
Atterberg Limits	SS03	P43	3	TP1 [BA1-3] TP2
Classification	SS04	P52	6	TP1 [BA1-3] TP2 A1 A3 A5
Moisture-Density Relations	SS05	P55	3	TP1 [BA1-3] TP2
Resilient Modulus	SS07	P46	3	A1 A3 A6
Unit Weight	SS08	P56	6	A1 A2 A3 A4 A5 A6
Natural Moisture Content	SS09	P49	3	TP1 [BA1-3] TP2
Depth to Rigid Layer			3	S1 S2 S3

NOTE: 1 Cores within brackets are from the same sampling location.

Table 3. DELIVERED CONCRETE LABORATORY TESTING PLANS

Material Type and Properties	SHRP Designation	SHRP Protocol	Tests * per Layer	Material Source/ [1] Test Locations: Concrete for 3-inch Overlays	Material Source/ [1] Test Locations: Concrete for 5-inch Overlays
PORTLAND CEMENT CONCRETE OVERLAY:					
Compressive Strength					
14 day	PC01	P61	6	FC1 FC2 FC3	FC4 FC5 FC6
28 day	PC01	P61	6	FC1 FC2 FC3	FC4 FC5 FC6
365 day	PC01	P61	6	FC1 FC2 FC3	FC4 FC5 FC6
Tensile Strength					
14 day	PC02	P62	6	FC1 FC2 FC3	FC4 FC5 FC6
28 day	PC02	P62	6	FC1 FC2 FC3	FC4 FC5 FC6
365 day	PC02	P62	6	FC1 FC2 FC3	FC4 FC5 FC6
Flexural Strength					
14 day	PC09	P69	6	FC1 FC2 FC3	FC4 FC5 FC6
28 day	PC09	P69	6	FC1 FC2 FC3	FC4 FC5 FC6
365 day	PC09	P69	6	FC1 FC2 FC3	FC4 FC5 FC6
Air Content	ASTM	TBA	2	FC1 or FC2 or FC3	FC4 or FC5 or FC6
Slump	ASTM	TBA	2	FC1 or FC2 or FC3	FC4 or FC5 or FC6

* Each set of 6 tests is made up of one specimen molded from each of the six fresh concrete samples (FC1-FC6).

Table 4. POST-CONSTRUCTION LABORATORY TESTING PLANS

Material Type and Properties	SHRP Designation	SHRP Protocol	Tests per Layer	Material Source/ Test Locations
POST-CONSTRUCTION				
I. PORTLAND CEMENT CONCRETE OVERLAY:				
Compressive Strength				
14 day	PC01	P61	4	C12 C15 C17 C19
28 day	PC01	P61	4	C43 C50 C57 C64
365 day	PC01	P61	4	C86 C93 C100 C107
Splitting Tensile Strength				
14 day	PC02	P62	4	C13 C16 C18 C20
28 day	PC02	P62	4	C39 C46 C53 C60
365 day	PC02	P62	4	C87 C94 C101 C108
PCC Coefficient of Thermal Expansion *				
14 day	PC03	P63	1	C11
Static Modulus of Elasticity				
28 day	PC04	P64	4	C42 C49 C56 C63
365 day	PC04	P64	4	C83 C90 C97 C104
Interface Bond Strength				
28 day	PC07	P67	32	C21-36 C37-38 C40-41 C44-45 C47-48 CB5-52 C54-55 C58-59 C61-62
365 day	PC07	P67	32	C65-80 C81-82 C85-86 C88-89 C92-93 C95-96 C99-100 C102-103 C106-107
Air Content of Hardened Concrete				
14 day	PC08	P68	2	C10 C14
PCC Unit Weight				
14 day	PC05	P65	4	C12 C15 C17 C19
28 day	PC05	P65	4	C43 C50 C57 C64
365 day	PC05	P65	4	C86 C93 C100 C107
Core Examination / Thickness	PC06	P66	99	C10-20 C21-64 C65-108
II. PORTLAND CEMENT CONCRETE ORIGINAL PAVEMENT:				
Compressive Strength	PC01	P61	9	C21 C25 C29 C33 C37 C44 C51 C58
Splitting Tensile Strength	PC02	P62	9	C23 C27 C31 C35 C40 C47 C54 C61
PCC Coefficient of Thermal Expansion *	PC03	P63	1	C11
Static Modulus of Elasticity	PC04	P64	9	C22 C25 C30 C34 C38 C45 C52 C59
PCC Unit Weight	PC05	P65	9	C21 C25 C29 C33 C37 C44 C51 C58
Core Examination / Thickness	PC06	P66	47	C10-20 C21-64 C65-108

* Test to be performed by FHWA

the test sections. Sampling areas should be located within the 50 feet immediately before and after the 500-foot long monitoring portion of each test section. As a guideline, sampling locations should be located at least 25 feet from the start or end of the monitoring length. However, when test sections are separated by short transition areas, sampling areas may be located less than 25 feet from the ends of the monitoring portion of the test section.

The sampling areas are designated with a code SA followed by a two digit number. The numbers are assigned consecutively starting in the pre-construction sampling areas and the first area encountered on the test site in the direction of traffic. Post-construction sampling areas should be numbered consecutively following the number assigned to the last pre-construction sampling area and also starting with the first area encountered on the test site in the direction of traffic.

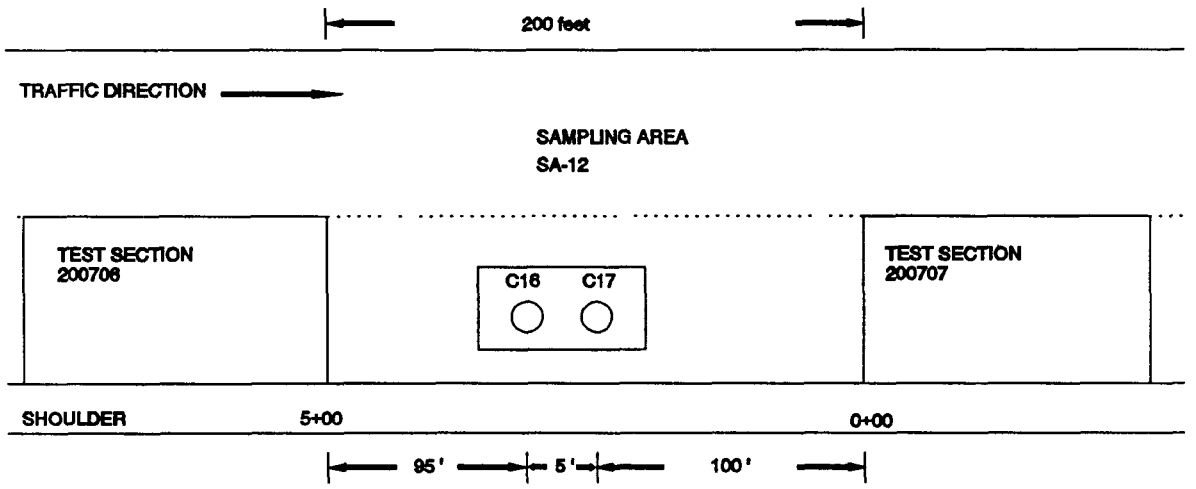
Location stationing of the sampling areas are specified relative to the end of the nearest adjacent test section. This test section relative station number should be used to reference the location as illustrated in Figure 2. Further explanation is provided in Appendix D.

2.3 PRE-CONSTRUCTION SAMPLING

When laying out the detailed pre-construction sampling plan, the following principles should be applied:

- In tailoring sampling plans to site-specific conditions, the tests to be performed on each sample must be considered since materials characterization is the primary objective of the sampling plan.

- Bound base and subbase layers should be sampled with three, 4-inch diameter C-Type cores at each of three locations distributed throughout the test site. Ideally, these sampling areas should be placed between the first and second test sections, in the middle of the site, and between the last two test sections. The cores should be located 2, 3 1/2 and 5 feet from the pavement edge.



	Alternative 1 Location referenced to test section 200706	Alternative 2 Location referenced to test section 200707
CORE C16 LOCATION		
STATE CODE	20	20
SPS PROJECT CODE	07	07
TEST SECTION NO	06	07
STATION	5+95	-1+05
OFFSET	03	03
CORE C17 LOCATION		
STATE CODE	20	20
SPS PROJECT CODE	07	07
TEST SECTION NO	06	07
STATION	6+00	-1+00
OFFSET	03	03

In this example of the location referencing system, designated sampling area SA-12 is situated between sections 200706 and 200707. In SA-12, two 4" C-type cores are specified, C16 and C17, to be 5 feet apart and three feet from the edge of the lane. The location of these two cores can be specified relative to either test section 200706 (alternative 1) or test section 200707 (alternative 2). In alternative 1, the station number of core C16 is 5+95 since it is 95 feet past the end of section 200707. Core C17 is at station 6+00. In alternative 2, the station number of core C16 is -1+05 and C17 is -1+00 since they occur in advance of test section 200707 Thus, when specifying the sampling locations on the field data form, the station number written on the form must correspond to the test section indicated on the form.

Figure 2. Illustration of Location Referencing System

- The generic field sampling plan described in this report includes one BA-Type core location (3 cores at that location) and two test pits for sampling of unbound materials. Test pits are preferred over BA-Type sampling areas since they allow measurements of the in-place moisture content and density of all unbound materials using nuclear methods. If test pits are not possible, three BA-Type boreholes should be used for bulk sampling.

- Test pit and BA-Type sampling should be performed at a minimum of three points on the project site. Ideally, these sampling areas should be placed between the first and second test sections in the middle of the site, and between the last two test sections.

- BA-Type boreholes or test pits should not be placed directly before or directly after an entire SPS test site. These bulk sampling areas should always be located between two test sections unless extenuating circumstances prevail.

- In general, bulk sampling areas should always consist of a combination of one test pit (or three BA-Type boreholes), one A-Type borehole and one C-Type corehole. Where a change in subgrade condition requires additional bulk sampling, the C-Type core may be omitted.

- Sampling locations, especially an A-Type, should not be located in cut and fill transition areas. A-Type sampling locations must always be located completely in either a cut or fill.

- In general, bulk or A-Type sampling locations should not be located over culverts or dried-up streams, lakes, etc. (as shown on as-built plans) or other unnatural or non-uniform areas. Sampling of such areas may be desirable in exceptional cases e.g., when a test section is located over a drained lake or bog.

- Sampling areas should not be located in areas which are considered non-representative of the test section, such as patched areas or other isolated distress occurrences.

- Bulk sampling areas (areas which include test pits or BA-Type sampling areas) should always be located adjacent to a test section in areas that will receive a PCC overlay. However, where possible test pits may be located outside the test section near pre-overlay repair sites.

- For a test section that is placed more than one mile away from another test section or group of test sections, sampling should include at least two C-Type cores (PCC only) located on one end and a bulk sampling area (test pit or BA-Type samples, A-Type and one C-Type cores) located on the other end.

- If a group of test sections is located more than a mile away from another localized group of test sections, each group may be treated separately and a complete set of tests performed for each group.

- Sampling for supplemental test sections, such as those representing the agency's rehabilitation practice, should be incorporated in the sampling and testing plan following the overall criteria established for the SPS experiment.

Generally, the sampling plan should reflect the variation of the materials at a specific site. If there is a high degree of variability at the site, the number of bulk sampling and A-Type sampling locations should be increased. Similarly, if the subgrade soil is relatively consistent, less bulk and A-Type samples would be required. The primary purpose of the plan is to characterize, as closely as possible, the integrity, physical properties and engineering behavior of the pavement and subgrade materials at the test site.

Detailed sampling plan layouts should be prepared for use in the field following the format shown in Appendix A. The location and type of each sample should be illustrated relative to the beginning and end of each test section.

2.4 AS-DELIVERED CONCRETE SAMPLING

The purpose of the as-delivered (fresh) concrete sampling is to characterize properties of the concrete mix used in the PCC overlay. This requires determination of the air content and slump of the concrete mix and

testing for compressive strength, flexural strength, and splitting tensile strength after 14, 28, and 365 days of laboratory curing. All the as-delivered test specimens are prepared from bulk samples of the fresh concrete retrieved at the test site.

- Compressive strength tests should be performed on 6 by 12-inch diameter molded cylinders after 14, 28, and 365 days of laboratory curing. Six cylinders are required for each curing time. Three test cylinders, one for each curing time, should be molded from each of six separate bulk samples that are retrieved at the beginning, middle, and end of overlay placement on the test sections.

- Splitting tensile strength tests should be performed on 6 by 12-inch molded cylinders after 14, 28, and 365 days of laboratory curing. Six cylinders are required for each curing time. Three test cylinders, one for each curing time, should be molded from each of six separate bulk samples that are retrieved at the beginning, middle and end of overlay placement on the test sections.

- Flexural strength tests should be performed on 6x6x20-inch molded beams after 14, 28, and 365 days of laboratory curing. Six beams are required for each curing time. Three test beams, one for each curing time, should be molded from each of six separate bulk samples that are retrieved at the beginning, middle and end of the construction of each PCC overlay thickness.

- Slump and air content tests should be performed on each of two bulk samples. One sample should be retrieved from the concrete prior to placement of the 3-inch thick overlays and the other prior to placement of the 5-inch thick overlays.

The specimens and tests required for sampling the fresh portland cement concrete prior to overlay placement are shown in Table 5.

2.5 POST-CONSTRUCTION SAMPLING

The purpose of the post-construction sampling is to characterize the as-

Table 5. Requirements for As-Delivered Concrete Test Specimens

Test	Specimens	Concrete for Test Sections	No. of Tests/Specimens
Compressive Strength	6 x 12 inch Cylinder	2, 3, 4, 5	9 *
		6, 7, 8, 9	9 *
Splitting Tensile	6 x 12 inch Cylinder	2, 3, 4, 5	9 *
		6, 7, 8, 9	9 *
Flexural Strength	6 x 6 x 20 inch Beam	2, 3, 4, 5	9 *
		6, 7, 8, 9	9 *

* Three specimens for testing at each of 14, 28, and 365 days of laboratory curing

placed properties of the PCC overlay material, the underlying PCC pavement, and the overlay/pavement interface bond strength. This requires determination of thickness, compressive strength, splitting tensile strength, coefficient of thermal expansion, modulus of elasticity, bond shear strength, air content, and unit weight of the hardened concrete. All post-construction cores must be four-inch in diameter.

Cores should be extracted from the PCC overlay and underlying pavement 14, 28, and 365 days after overlay placement as outlined in the following sections.

2.5.1 14-Day Sampling

Pavement cores are required from both the PCC overlay and the underlying concrete slab as close to 14 days after overlay placement as possible for determination of compressive strength, splitting tensile strength, and coefficient of thermal expansion, and air content as follows:

- Compressive strength of the overlay concrete should be determined from test cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). At least one core from each section should be tested.

- Splitting tensile strength of the overlay concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). At least one core from each section should be tested for splitting tensile strength.

- Coefficient of thermal expansion of the overlay concrete and original concrete should be determined for tests on at least one core extracted from one of the test sections with a 5-inch thich overlay (Sections 6 through 9).

- Air content of the hardened concrete should be determined from tests on at least two cores: one core extracted from a test section with a 3-inch thick overlay (Sections 2 through 5) and one core extracted from a test section with a 5-inch thick overlay (Sections 6 through 9).

2.5.2 28-Day Sampling

Pavement cores are required from both the PCC overlay and the underlying concrete as close to 28 days after overlay placement as possible for determination of compressive strength, splitting tensile strength, modulus of elasticity, and bond strength, as follows:

- Compressive strength of the overlay concrete and the underlying concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). Also, compressive strength of the existing concrete should be determined from tests on cores extracted from the control section (Section 1) and each of the test sections with a 3-inch thick PCC overlay (Sections 2 through 5). At least one core from each section should be tested.

- Splitting tensile strength of the overlay concrete and the underlying concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). Also splitting tensile strength of the existing concrete should be determined from tests on cores extracted from the control section (Section 1) and each of the test sections with a 3-inch thick PCC overlay (Sections 2 through 5). At least one core from each section should be tested.

- Static modulus of elasticity of the overlay concrete and the underlying concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). Also, static modulus of the existing concrete should be determined from tests on cores extracted from the control section (Section 1) and each of the test sections with a 3-inch thick PCC overlay (Sections 2 through 5). At least one core from each section should be tested.

- Interface bond shear strength should be determined from tests on cores extracted from each rehabilitated test section (Sections 2 through 9). At least four cores from each section should be tested. Portions of

these cores may be used for determination of modulus of elasticity splitting tensile strength, or compressive strength of the existing concrete as indicated above.

2.5.3 365-Day Sampling

Pavement cores are required from both the PCC overlay and the underlying pavement as close to 365 days after overlay placement as possible for determination of compressive strength, splitting tensile strength, modulus of elasticity, and bond strength, as follows:

- Compressive strength of the overlay concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). At least one core from each section should be tested.

- Splitting tensile strength of the overlay concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). At least one core from each section should be tested.

- Static modulus of elasticity of the overlay concrete should be determined from tests on cores extracted from each of the test sections with a 5-inch thick PCC overlay (Sections 6 through 9). At least one core from each section should be tested.

- Interface bond shear strength should be determined from tests on cores extracted from each rehabilitated test section (Sections 2 through 9). At least four cores from each section should be tested.

In addition to these tests, the unit weight of the concrete used in the overlay and the underlying pavement should be determined from all cores designated for compressive strength tests. Also, two cores from both ends of each test section should be used to verify the as-placed overlay thickness determined from rod and level survey data. These cores should be placed along the same transverse line, 3 feet and six feet from the shoulder.

Testing on any supplemental sections may be done at the direction of the participating agency. The rationale for testing of the SHRP test sections may form the basis for the testing plan for these supplemental sections.

Care must be taken to insure that the post-construction sampling areas are located in portions of the pavement that were constructed with the same materials, layer thicknesses, and preparation used on the adjacent test sections and thus are representative of the test section. Areas with varying layer thicknesses or material types must be avoided.

An example of post-construction sampling plan for a the hypothetical "ideal" SPS-7 test site is shown in Appendix C.

3. FIELD MATERIALS SAMPLING

3.1 GENERAL

This section describes procedures for field material sampling, field testing and handling of cores and other material samples in the field and during transfer to the laboratory for testing. These procedures should be followed as closely as possible to minimize the variability of material properties attributable to differences in sampling and handling techniques.

Throughout this document, the various types of base and subbase materials are referred to by such terms as "bound", "treated", "untreated", etc. The terms "bound", "treated", and "stabilized" are used interchangeably and refer to base and subbase layers containing a cementing agent such as asphalt or portland cement. The terms "unbound", "untreated", and "unstabilized" are used interchangeably and refer to granular base and subbase layers containing no additional materials. Subgrade soils are classified as fine-grained or coarse-grained soils and refer to the materials beneath a base or subbase layer that have not been disturbed or placed as fill material.

The field material sampling and field testing activities will provide pavement material samples for laboratory testing and will yield in situ density and moisture test data and visual pavement layer information for the test site. This information will be included in the National Pavement Performance Data Base. Field sampling and field testing will be performed in three phases, pre-construction, during construction and post-construction. The pre-construction phase is intended to fully characterize the existing pavement structure and thus provide a baseline to compare the different rehabilitation techniques. The during construction phase will provide samples to help determine the properties of the as-delivered (fresh) portland cement concrete used in the overlay. The post-construction sampling and testing phase will help determine material properties of the as-built sections. This information will be used in evaluating the effectiveness and long-term performance of the different rehabilitation techniques. Requirements and details of field material sampling activities for each of these three construction phases are presented in the following sections of the report.

The spacing and length of the test sections will help limit the variations in material properties along the site. However, accurate characterization of the materials in the existing pavement is required to evaluate their effect on the performance of the rehabilitated pavement. Sampling of the existing pavement structure will include the following types of samples:

- Four-inch outer diameter cores of PCC, bound base layers and treated subbase layers.

- Six-inch diameter cores of PCC, bound base layers and treated subbase layers; augering of unstabilized base and subbase layers; thin-walled tube and/or splitspoon sampling of subgrade layers to four feet below the top of the untreated subgrade.

- Twelve-inch diameter cores of PCC, bound base layers and treated subbase layers; augering of unstabilized base, subbase and subgrade to twelve inches below the top of the untreated subgrade for bulk sample retrieval.

- Six foot by four foot test pits to twelve inches below the top of the untreated subgrade soil, nuclear density and moisture measurements on stabilized pavement layers and subgrade material; bulk sampling of unstabilized layers and the subgrade.

- Six inch shoulder auger probes.

The Field Set Number "1" has been assigned to designate all sampling operations performed prior to overlay construction. Therefore, the number "1" shall be used when completing the material sampling and field testing forms for sampling prior to construction activities.

During overlay construction, portland cement concrete used in the overlay of the test sections will be sampled. All sampling of materials during construction will be performed at the site before placement. The following specimens will be molded from the fresh portland cement concrete:

- Thirty-six, 6 by 12-inch cylinders. Eighteen of these specimens will be used for compressive strength tests and the other eighteen will be used for splitting tensile strength tests.

- Eighteen, 6x6x20-inch long beams. These specimens will be used for flexural strength tests.

All specimens shall be made and cured in the field in accordance with AASHTO T23, "Making and Curing Concrete Test Specimens in the Field," and in the laboratory in accordance with AASHTO T126, "Making and Curing Concrete Test Specimens in the Laboratory." The specimens shall be sent to the laboratory designated by the participating highway agency (unless the highway agency authorizes other arrangements) for curing and testing.

Characterization of the PCC overlay (post-construction sampling) materials is essential for evaluating the performance of the rehabilitated structure. The in-place material sampling of the PCC overlay consists of retrieving four-inch diameter cores of the overlay as indicated in Table 1. These sample areas will be illustrated on the sampling plans with a small circle. No other type of sampling will be required after overlay placement.

The Field Set Number "2" has been assigned to designate sampling operations performed during and after overlay placement. Therefore, the number "2" shall be used when completing the material sampling and field testing forms for those sampling activities performed during and after construction.

3.2 FIELD OPERATIONS

This section outlines procedures for field sampling, field testing and handling of materials retrieved from the SPS-7 test site. Field operations for each site will include the following activities:

1. SHRP regional office should coordinate with the participating highway agency the field activities involved in the drilling and sampling operations. With concurrence of the participating highway agency, the SHRP Regional Engineer shall designate a representative to assist the participating highway agency and contractors in ensuring that the field

operations are performed in accordance with the approved field sampling and testing plan.

2. After arriving at the site and establishing traffic control, the responsible personnel shall lay out the initial sample locations and perform the sampling and testing operations in the following sequence:

   a) sawing and removal of PCC pavement at the test pit location(s).
   b) coring and boring of BA-Type boreholes.
   c) bulk sampling and moisture/density testing in the test pit(s) as layers are removed.
   d) boring and augering of C-Type core holes and A-Type auger holes.
   e) shelby tube undisturbed sampling of subgrade material. If unable to obtain Shelby tube samples, the SHRP Representative may direct the use of splitspoon sampling to obtain subgrade material samples.
   f) auger probes in the shoulder.
   g) patching, cleanup and removal of traffic control.

When appropriate, a different sequence of activities may be used to improve the efficiency of the operations. However, special considerations must be given to the test pit location(s) because of their complexity and the substantial time and effort they require. Core or auger locations that are considered unacceptable should be replaced with alternate locations and marked on the as-sampled layout plan.

3. SHRP Representative shall record and report problems encountered during field operations to the SHRP Regional Engineer and obtain recommendations for resolution.

4. Test samples shall be prepared for shipping together with completed logs and other records.

3.2.1 Coring of Pavement Surface and Bound (Treated) Layers

This activity will involve coring of the concrete PCC pavement surface and other treated base and subbase layers of pavements at the locations shown on the field material sampling plan. Exploration logs must be prepared using Sampling

Data Sheets 1 and 2 in Appendix D. This coring will occur at two times: prior to overlay placement (4-inch, 6-inch, and 12-inch diameter cores) and after overlay placement (4-inch diameter cores). The coring operations shall be carried out in accordance with AASHTO T24, "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete", using the equipment and methods specified in the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. Sampling prior to overlay placement and after overlay placement will be referred to as prior to construction and after construction, respectively.

3.2.1.1 Coring - Prior to Construction - Core locations shall be as shown on the sampling plan figures developed for the specific test site. It is especially important that the 4-inch and 6-inch diameter cores be taken perpendicular to the pavement surface, i.e. at an angle of 90 degrees to the surface, to ensure the recovery of straight, intact, smooth-surfaced specimens suitable for laboratory testing. Details on tolerances and quality control of the coring operations are included in Section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. All cores shall be dried before packaging.

Special care must be taken during the coring operations of treated materials. The bit type, rate of penetration and cooling medium shall be varied as necessary to minimize tearing and breakage. If 4-inch diameter cores suitable for testing cannot be recovered from the designated C-Type sampling locations due to the nature or condition of the material, chunks or pieces of the treated materials from these layers shall be obtained from the test pit area or the respective BA-Type sampling locations. These chunk and piece samples shall then be coded, packaged, and shipped as bulk material.

Portland cement concrete cores that are extracted with an adhering treated layer shall not be split at the layer interface in the field. These samples should be wrapped and shipped to the testing laboratory.

3.2.1.2 Coring - After Construction - Core locations shall be as shown on the post-construction field sampling plan figures developed for the test site. Only 4-inch diameter C-Type cores are required of the full depth of the rehabilitated pavement, i.e. the PCC overlay plus the original PCC pavement. All coring specifications outlined previously shall be followed. If the overlay/pavement interface bond is damaged during coring, the core should be discarded and noted

in the log, and a replacement core be extracted in proximity of the damaged core. However, if no bond exists at the overlay/pavement interface, the condition should be noted in the log and core portions of both the overlay and original pavement should be sealed and shipped to the laboratory. Also, if the original pavement portion of the core is damaged, the core may still be usable for the bond strength test or the strength test of the overlay concrete, although another an undamaged core will be required for strength tests of the original concrete. The cores shall then be packaged and shipped to the testing laboratory.

3.2.2 Augering of Subsurface Layers for Bulk Sampling

This activity is required only before overlay placement and involves pavement coring, augering and sampling of untreated base/subbase and subgrade layers at BA-Type locations to obtain bulk samples. These operations shall be carried out in accordance with AASHTO T203, "Soil Investigation and Sampling by Auger Borings" and AASHTO M146, "Terms Relating to Subgrade, Soil-Aggregate and Fill Materials".

The pavement surface layer and any treated materials shall be cored with a 12-inch diameter bit at the BA-Type bulk sampling augering locations. All 12-inch diameter cores of PCC shall be removed and discarded unless undamaged cores of these materials were not recovered at the C-Type locations. All untreated base and subbase layers shall be augered separately to obtain uncontaminated samples of each layer. The material raised by the auger from the layer immediately below the cored of pavement surfaces or bound layers should be discarded due to possible contamination by water or fines from the coring operations. As augering of the unbound layer proceeds, the operator must observe the presence of material from the next lower layer. If materials from the two layers are mixed together, the sample should be discarded. The uncontaminated material from each layer shall be separately retained as large bulk samples.

Bulk sample quantities required for packaging and shipment are shown in Table 6. A small bag or jar sample shall be obtained from each layer of each BA-Type borehole for laboratory moisture testing.

At the undisturbed sample locations (A1, A2), the pavement surface layer and any treated materials shall be cored with a 6-inch diameter bit and all cores

Table 6. Weight Requirements for Bulk Samples of Unbound Base, Subbase and Subgrade Layers.

Layer	Bulk Samples from 3-12" Auger Holes (BA1, BA2, and BA3)	Bulk Samples from Test Pit
Unbound Base	Maximum 200 lbs. (100 lbs. Minimum)	200 lbs.
Unbound Subbase	Maximum 200 lbs. (100 lbs. Minimum)	200 lbs.
Subgrade	• Coarse Grain 200 lbs. • Fine Grain 150 lbs.	200 lbs. 150 lbs.

removed. Undisturbed samples of the natural subgrade or fill material directly beneath base and/or subbase layers at A-Type locations shall be obtained to a depth of 4 feet below the top of the subgrade or fill using Shelby (thinwall) tube sampling. If Shelby tube samples cannot be obtained, splitspoon samples may be obtained if approved by the SHRP representative. Shelby (thinwall) tube sampling shall be performed in accordance with AASHTO T207. Splitspoon sampling shall be performed following the procedures outlined in section 3.4.5 of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. If rock, boulders or other forms of dense material are encountered within four feet of the top of natural subgrade or fill, another attempt for sampling the subgrade shall be made with a longitudinal offset of 5 to 10 feet. If refusal occurs at the second location at a shallow depth, splitspoon sampling shall be terminated.

3.2.3 Test Pit Excavation and Sampling

Test pits shall be excavated and sampled in accordance with Section 3.5 of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. The requirements for bulk sample quantities are listed in Table 6.

3.2.4 Uncompacted Mix Sampling Procedures

The sampling of the portland cement concrete mix used for the construction of the overlay shall be performed in the field during or just before placing of the concrete to avoid interruption to construction activities. These samples shall be obtained in accordance with AASHTO T141, "Sampling Fresh Concrete", molded into test specimens, cured, packaged and shipped to the testing laboratory.

3.2.5 Collection of Samples, Marking, Packaging, and Shipping

All samples retrieved during the sampling and testing process shall be carefully marked, packaged and shipped to the laboratory designated by the participating highway agency (unless the highway agency authorizes other arrangements). The samples shall be packaged and preserved in accordance with ASTM D4220 (Group B), "Preparing and Transporting Soil Samples". Extreme care

must be taken in packaging and shipping of test samples to avoid damage of the samples.

3.2.6 Logs and Reports

Accurate and detailed record keeping is essential for the materials sampling and testing program. During the field sampling operations, two types of forms must be completed. These are the Field Operations Information Forms and the Sampling Data Sheets. Field Operations Information Forms are used to record general information about the pavement test sections and the materials samples. Sampling Data Sheets are used to record the actual information for each sampling area or sampling location. A person should be designated to record data at each site on the appropriate data sheets, insure the accuracy and integrity of the collected data and forward the data sheets to the appropriate personnel. This person shall have a thorough understanding of the content of the data sheets and the procedures for completing the sheets. If these forms are completed by a person other than the SHRP representative, then the data sheets must be approved by the SHRP representative prior to sending the field data sheets to the appropriate personnel.

3.2.6.1 Core Holes - A separate log shall be completed for each core hole. The depth of penetration of each coring operation and the average length of the recovered core shall be recorded to the nearest 0.1 inch. Data sheets for these logs are included in Appendix D. Sampling Data Sheet 1 shall be used to record cores obtained from A- and BA-Type sampling areas. Sampling Data Sheet 2 shall be used to record pavement cores from C-Type sampling areas. These logs shall show the general type of material in accordance with terminology described in Appendix D of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. Remarks shall include the type of cooling medium, difficulties encountered in coring, defects observed in the core such as cracks, voids and disintegration, and other pertinent observations.

3.2.6.2 Auger Holes - The data for each A-Type augering hole shall be recorded on Sampling Data Sheet 4. The data should include the thicknesses and descriptions of the unbound layers, the depth of shelby tube or splitspoon samples, and other related data. Data to be recorded on this form should include the following:

1. Material type and descriptions of each layer of untreated materials and soils in accordance with Table C.2. of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.
2. Thickness of each layer as measured in the hole to the nearest 0.1 inch.
3. Presence and levels of any water encountered.
4. Sample numbers.

The data for each BA- type bore hole shall be recorded on Sampling Data Sheet 5. The information to be recorded on Data Sheet 5 is similar to that described for A-Type cores.

3.2.6.3 Test Pits - Test pits data shall be logged as the excavations progress and reported on Sampling Data Sheets 6 and 7. The record shall include the description of each layer in accordance with the layer designations provided on the preliminary data sheets, the thickness of each layer to the nearest 0.1 inch, sample numbers and number of bags per sample, test numbers, any water seepage, sloughing, voids and other pertinent items. The layer thicknesses shall be measured at least at two points on each exposed face for a total of eight measurements. Additional measurements shall be made if thickness measurements vary by more than 0.3 inch for surface and treated layers or 1.0 inch for untreated layers. Measurements shall also be made of the shoulder surface and base/subbase layers. All measurements shall be recorded on the logs and a transverse profile (cross section) of the pavement shall be included.

Good quality color print photographs of the test pit profile shall be taken at and keyed to the locations described on the Sampling Data Sheet 6 test pit log. The photographs shall be taken with the sun behind the photographer (if possible to avoid shadows) to provide a total view of the test pit and close-up views of the pavement profiles. If voids or discontinuities exist in the pavement structure, multiple close-up pictures should be taken. The photographs should be sent to the SHRP regional office for processing and filing for archival purposes.

3.2.6.4 Shoulder Auger Probes - Data for shoulder auger probes shall be reported on Sampling Data Sheet 9.

Table 7 lists the forms that should be included in the field data packet for each sampling phase (i.e., pre-construction, during construction and post-construction).

3.2.7 Sample Code Number

Each sample (core, block, bulk, moisture, Shelby tube, splitspoon, chunks) shall be assigned a four digit number that must be recorded on the appropriate data forms. The sample code number will have two letters on the left side and two 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
K - block sample
M - moisture sample
T - Shelby tube sample
J - splitspoon sample
P - broken pieces or chunks
F - molded beam
G - molded cylinder

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

A - asphalt concrete
P - portland cement concrete (original pavement)
X - portland cement concrete (14-day test specimens)
Y - portland cement concrete (28-day test specimens)
Z - portland cement concrete (365-day test specimens)
T - treated, bound, or stabilized base/subbase
G - untreated, unbound granular base/subbase
S - subgrade soil or fill material

Table 7. Forms to be Completed During Each Phase of Field Material Sampling, Handling and Testing.

Pre-construction - (Field Set Number 1)

Field Operations Information Form 1

Field Operations Information Form 2

Sampling Data Sheet 1

Sampling Data Sheet 2

Sampling Data Sheet 4

Sampling Data Sheet 5

Sampling Data Sheet 6

Sampling Data Sheet 7

Sampling Data Sheet 8

Sampling Data Sheet 9

During Construction - (Field Set Number 2)

Field Operations Information Form 3

Sampling Data Sheet 11

Post-construction - (Field Set Number 2) **

Field Operations Information Form 1

Field Operations Information Form 2

Sampling Data Sheet 2

** **REPEAT THIS SET AT 28 DAY AND 365 DAY SAMPLING**

The numbers to the right will designate the sample number. The numbers shall be assigned consecutively for each sample type. For example, samples taken from C-Type core locations shall be designated C1, C2, C3, etc. Samples taken from A-Type locations shall be designated A1, A2, A3, etc. and samples taken from BA-Type shall be designated BA1, BA2, etc. 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:

FX02 Molded portland cement concrete beams for 14-day testing.

GZ03 Molded portland cement concrete cylinders for 365-day testing.

CA24 Asphaltic concrete cores.

CT24 Treated base or subbase cores.

KT02 A treated base/subbase block sample from the test pit (if retrieved).

PT02 Pieces of treated base or subbase (up to two bags from the test pit area or from 12-inch BA-Type bore holes). These types of samples must be taken if good cores could not be obtained from the treated layer.

BG01 Bulk samples from granular base or subbase material (from BA-Type bore holes and from the test pit). For example, assign BG01 (for base) and BG02 (for subbase) for samples of granular layers from auger hole BA1; BG03 and BG04 for BA2 samples; and BG05 and BG06 for samples from auger hole BA3.

BS01 Bulk samples of subgrade material from different BA-Type bore holes and for samples from the test pit.

MG01 Granular base/subbase samples for moisture content (from BA1, BA2, BA3, A1 and A2 Type auger holes and from the test pit).

MS01 Subgrade samples for moisture content (from BA-Type and A-Type auger holes and from the test pit).

TS04 Shelby tube samples from subgrade (two Shelby tubes from each A-Type location).

JS01 Jar samples of subgrade from splitspoon sampler (two splitspoons from each A-Type location).

3.2.8 Labels and Tags

Requirements regarding labels and tags shall be as specified in Section 3.6.5.(d) of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. However, as a minimum the following information shall be included on tags and labels:

STATE CODE
SPS PROTECT CODE
TEST SECTION NO.
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 [pre-construction] and 2 during the second round of sampling [during and after construction], etc.)

3.2.9 Packaging

Packaging shall be as specified in Section 3.6.5(e) of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. In addition, Field Operations Information Sheets 1 and 2 shall be sent with each shipment of materials samples.

Test specimens molded from sampled PCC shall be packaged in accordance with ASTM C31 Section 9.3 "Curing for Determining Form Removal Time or When a Structure May be Put into Service." Field Operations Information Sheet 3 shall be sent with each shipment of molded test specimens.

3.2.10 Shipping

All samples should be shipped within 5 days to the laboratory designated by the participating highway agency. Molded concrete specimens shall be transported in accordance with Section 10, "Transportation of Specimens to Laboratory" of ASTM C 31, "Making and Curing Concrete Test Specimens in the Field," following curing in accordance with Section 9, "Curing", as follows:

"Specimens shall not be transported from the field to the laboratory before completion of the initial curing. Specimens to be transported prior to an age of 48 h shall not be demolded prior to completion of transportation. Prior to transporting, specimens shall be cured and protected as required in Section 9. During transportation , the specimens must be protected with suitable cushioning material to prevent damage from jarring and from freezing temperatures, or moisture loss. Moisture loss may be prevented by wrapping the specimens in plastic or surrounding them with wet sand or wet saw dust. When specimens are received by the laboratory, they shall be removed from molds if not done before shipment and placed in the required standard curing at 73.4±3°F (23±1.7°C)."

Each box shall be labeled, as described in Section 3.2.8, to include the State Code, SPS Project Code, type(s) of samples, box number (for each series of boxes for the specific project to each delivery point). The boxes should be labeled "Handle with Care" or similar wording. Samples shall be protected against freezing and overheating.

3.2.11 Field Testing

Field testing includes in-situ density and moisture measurements and auger probes for determination of bed rock location if it exists within 20 feet of pavement surface.

3.2.11.1 In-situ Density and Moisture Measurements - The in-situ nuclear density testing shall be carried out in accordance with Section 3.7 of the SHRP-LTPP Guide for Field Material Sampling, Handling and Testing. Sampling Data Sheet 8 shall be used to record the results of the nuclear density/moisture tests.

3.2.11.2 Auger Probe - Auger probes shall be carried out in accordance with Section 3.8 of the SHRP-LTPP Guide for Field Material Sampling, Handling and Testing at the locations designated on the sampling plans prepared for the test site.

3.2.12 Assembly of Data Sheets and Transmittal

The following is a description of the format that should be used for the assembly of the data sheets from each SPS-7 test site. The forms will appear in the final assembled data packet in the order illustrated in Figures 3, 4 and 5 for pre-construction, during construction and post-construction activities, respectively. The title page will be the first (top) sheet of the data packet and it will include the following:

1 - SHRP Region
2 - State
3 - State Code
4 - SPS Project Code
5 - Experiment Name
6 - Highway Number
7 - Date(s) of Field Material Sampling and Field Testing
8 - Submitting Contractor/Agency
9 - Total Sheets, Including the Title Page.

To determine the number of sheets (item 9 above), all of the pages in the packet should be counted. Then the pages should be numbered consecutively starting with the title page. For example, if there are 100 pages in the packet, the title page would be page "1 of 100" followed by page "2 of 100" and so forth until item 8 of the last page would read "page 100 of 100". This will insure that any lost sheets can be quickly identified and found.

After the packet has been assembled and numbered, the original and appropriate number of duplicates should be made. The original and one copy should be forwarded to the SHRP regional office. Also, copies should be forwarded to the participating highway agency and those laboratories designated by the agency to perform the laboratory tests on the samples.

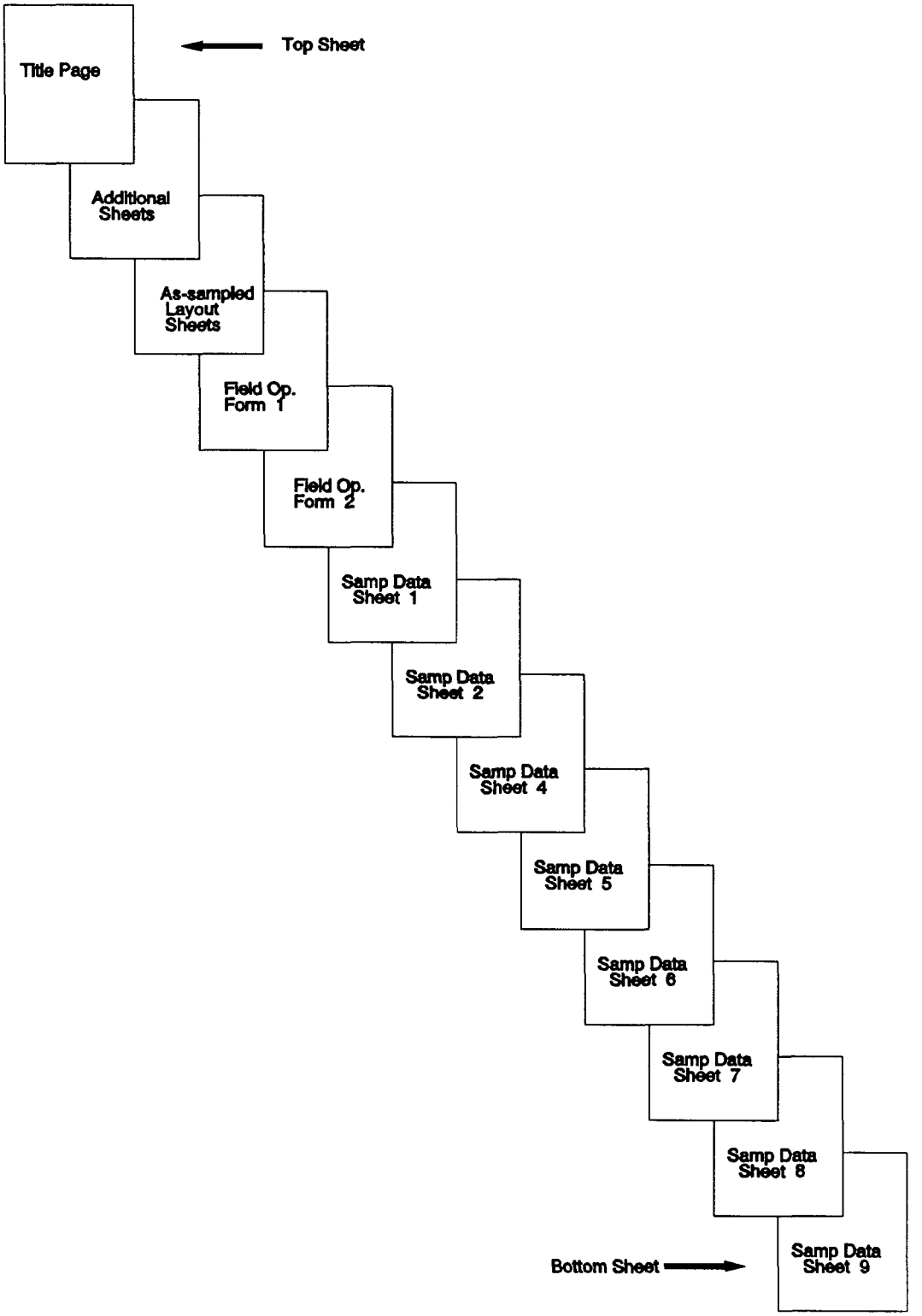


Figure 3. Assembly of "Pre-Construction" Sampling and Testing Forms

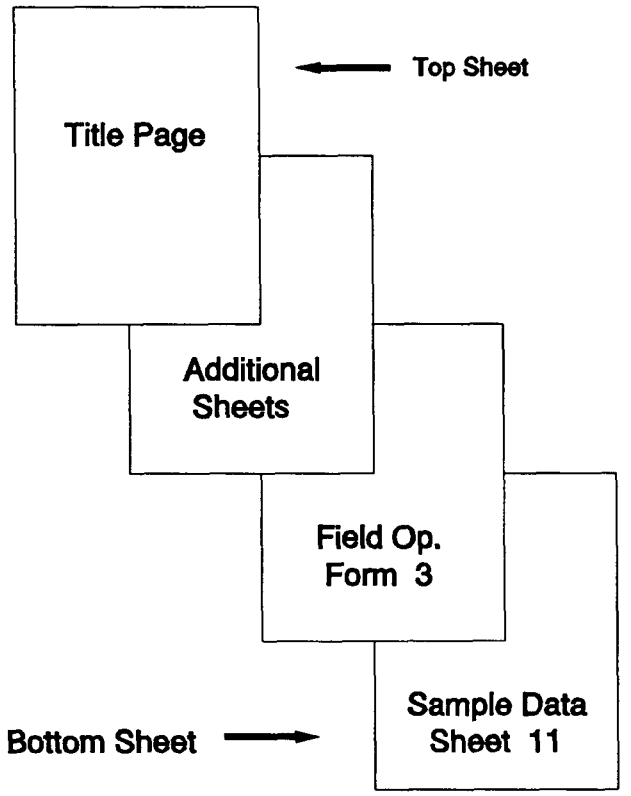


Figure 4. Assembly of "During Construction" Sampling and Testing Forms

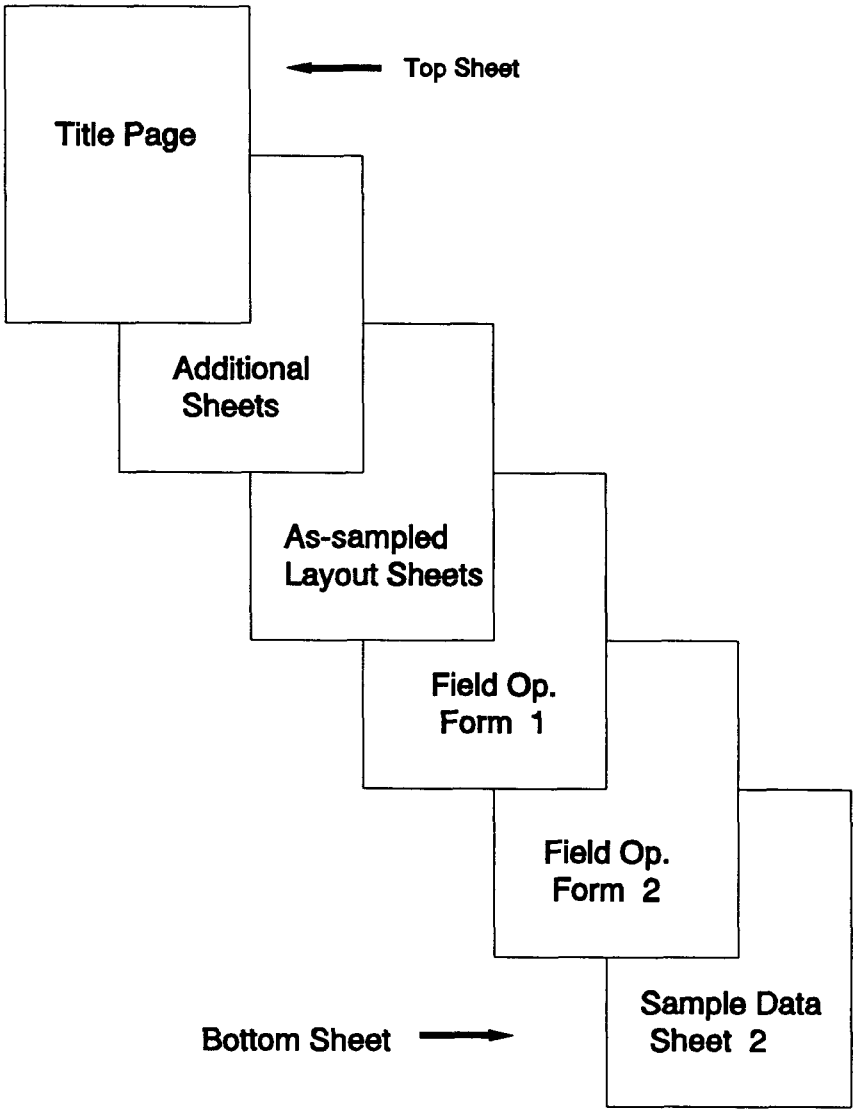


Figure 5. Assembly of "Post-Construction" Sampling and Testing Forms

4. LABORATORY MATERIALS TESTING

Table 8 lists the laboratory test procedures which will be used to characterize the materials obtained from each SPS-7 site. When implementing the sampling plan for an SPS-7 site, it is imperative that a sufficient type and amount of samples be retrieved for each material type to ensure completion of all tests. Therefore, a laboratory testing plan, similar to that shown in Tables 2, 3 and 4, shall always be developed in conjunction with the field material drilling and sampling plan. The plan shall list the tests to be performed and the samples to be used for each test. The laboratory testing plan summarized in Tables 2, 3 and 4 is an example of a plan that addresses the minimum laboratory tests required to characterize the materials at a test site.

Table 8. Laboratory Material Testing Procedures.

MATERIAL TEST	SHRP TEST DESIGNATION	SHRP PROTOCOL
PORTLAND CEMENT CONCRETE MIX - FRESH		
Air Content	(ASTM C231)	TBA
Slump	(ASTM C143)	TBA
PORTLAND CEMENT CONCRETE - HARDENED		
Compressive Strength	PC01	P61
Splitting Tensile Strength	PC02	P62
Coefficient of Thermal Expansion	PC03	P63
Static Modulus of Elasticity	PC04	P64
Flexural Strength	PC09	P69
Interface Bond Strength	PC07	P67
Air Content of Hardened Concrete	PC08	P68
PCC Unit Weight	PC05	P65
Core Examination/Thickness	PC06	P66
BOUND (TREATED) BASE AND SUBBASE		
Type and Classification of Material and Treatment	TB01	P31
Pozzolanic/Cementitious:		
Compressive Strength	TB02	P32
Asphalt treated:		
Resilient Modulus	TB03	P33
HMAC:		
Resilient Modulus	AC07	P07
UNBOUND GRANULAR BASE AND SUBBASE		
Particle Size Analysis	UG01	P41
Sieve Analysis (washed)	UG02	P41
Atterberg Limits	UG04	P43
Moisture-Density Relations	UG05	P44
Resilient Modulus	UG07	P46
Classification	UG08	P47
Permeability	UG09	P48
Natural Moisture content	UG10	P49
SUBGRADE		
Sieve Analysis	SS01	P51
Hydrometer to 0.001mm	SS02	P42
Atterberg Limits	SS03	P43
Classification	SS04	P52
Moisture-Density Relations	SS05	P55
Resilient Modulus	SS07	P46
Unit Weight	SS08	P56
Natural Moisture Content	SS09	P49

APPENDIX A - EXAMPLE OF PRE-CONSTRUCTION SAMPLING PLAN

This appendix contains an example of a pre-construction field sampling layout plan for an SPS-7 test site which provides the minimum requirements for materials characterization considered essential for the experiment. The plan should be adjusted with consideration to the condition and details of the specific test site.

A schematic layout of a test site illustrating the location of the test sections and sampling areas is shown in Figure A.1. An example of a pre-construction sampling plan for an "ideal" test site is illustrated in Figures A.2 through A.10 for Test Sections 1 through 9, respectively.

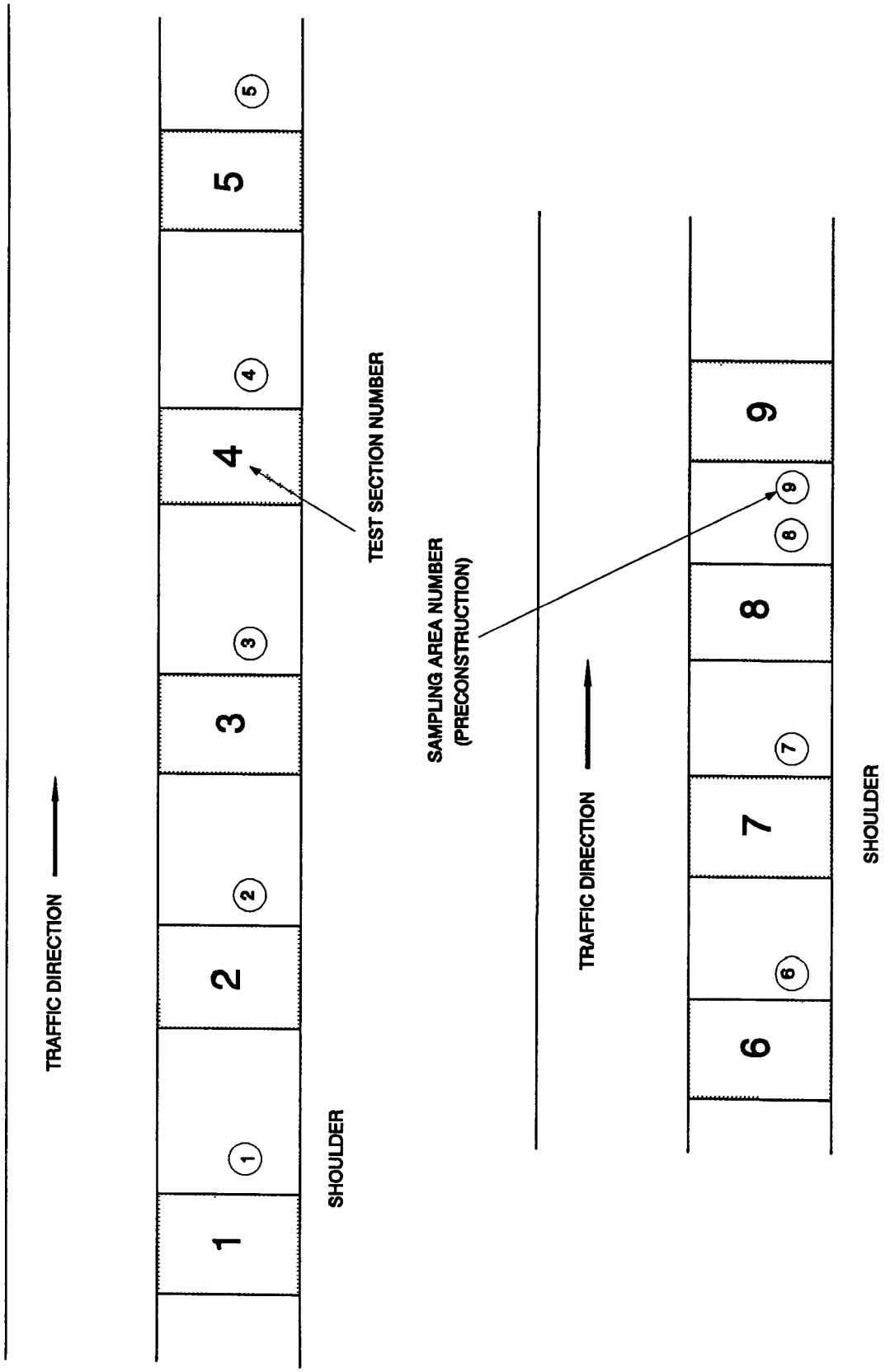


Figure A.1 Example of "Pre-Construction" Sampling Area Plan

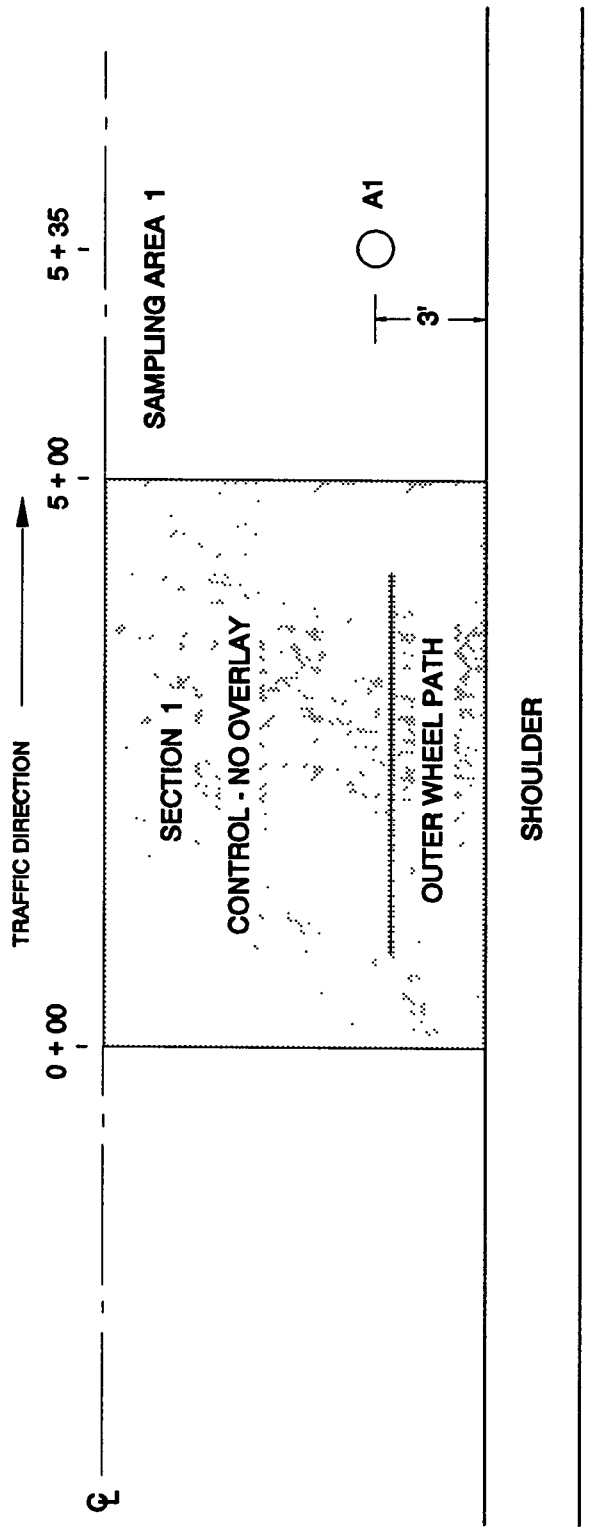
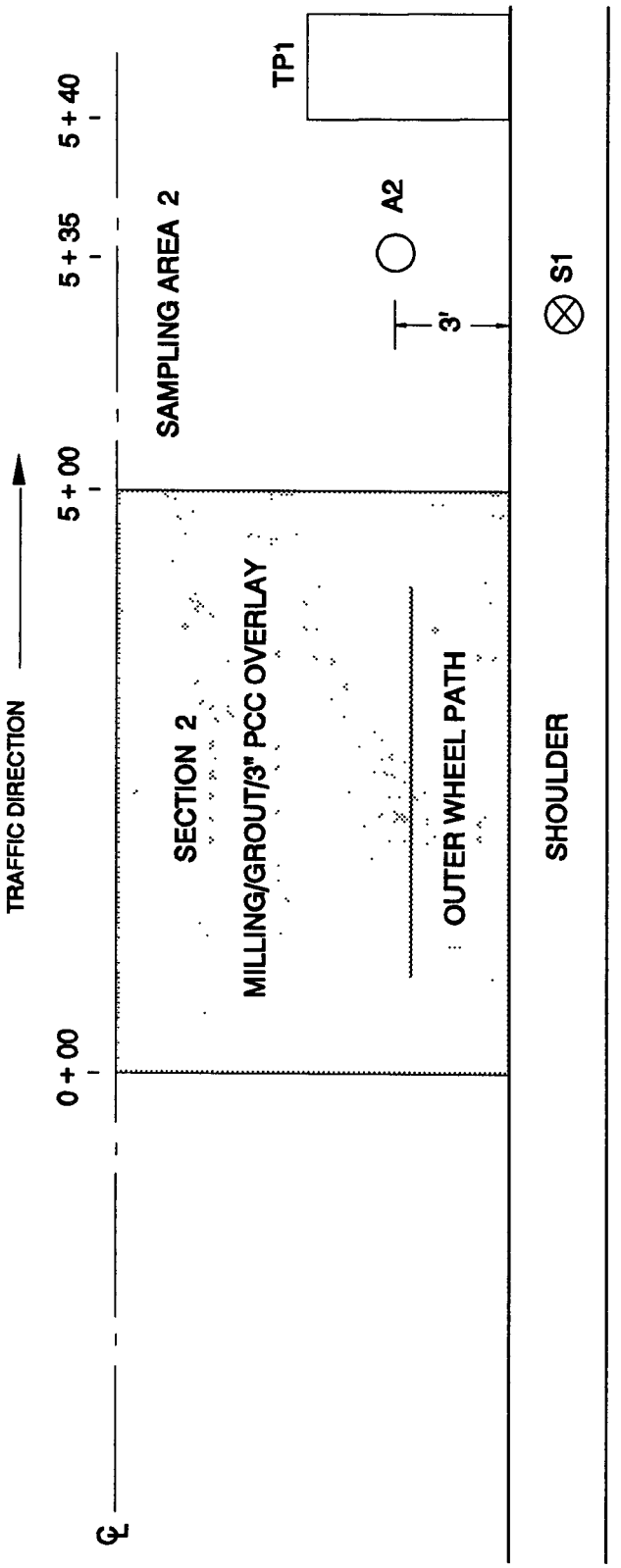


Figure A.2 Example of "Pre-Construction" Sampling Plan for Test Section 1



6" OD CORE AND AUGER BORING TO 4' BELOW TOP OF SUBGRADE

4' x 6' TEST PIT

AUGER PROBE IN SHOULDER

Figure A.3 Example of "Pre-Construction" Sampling Plan for Test Section 2

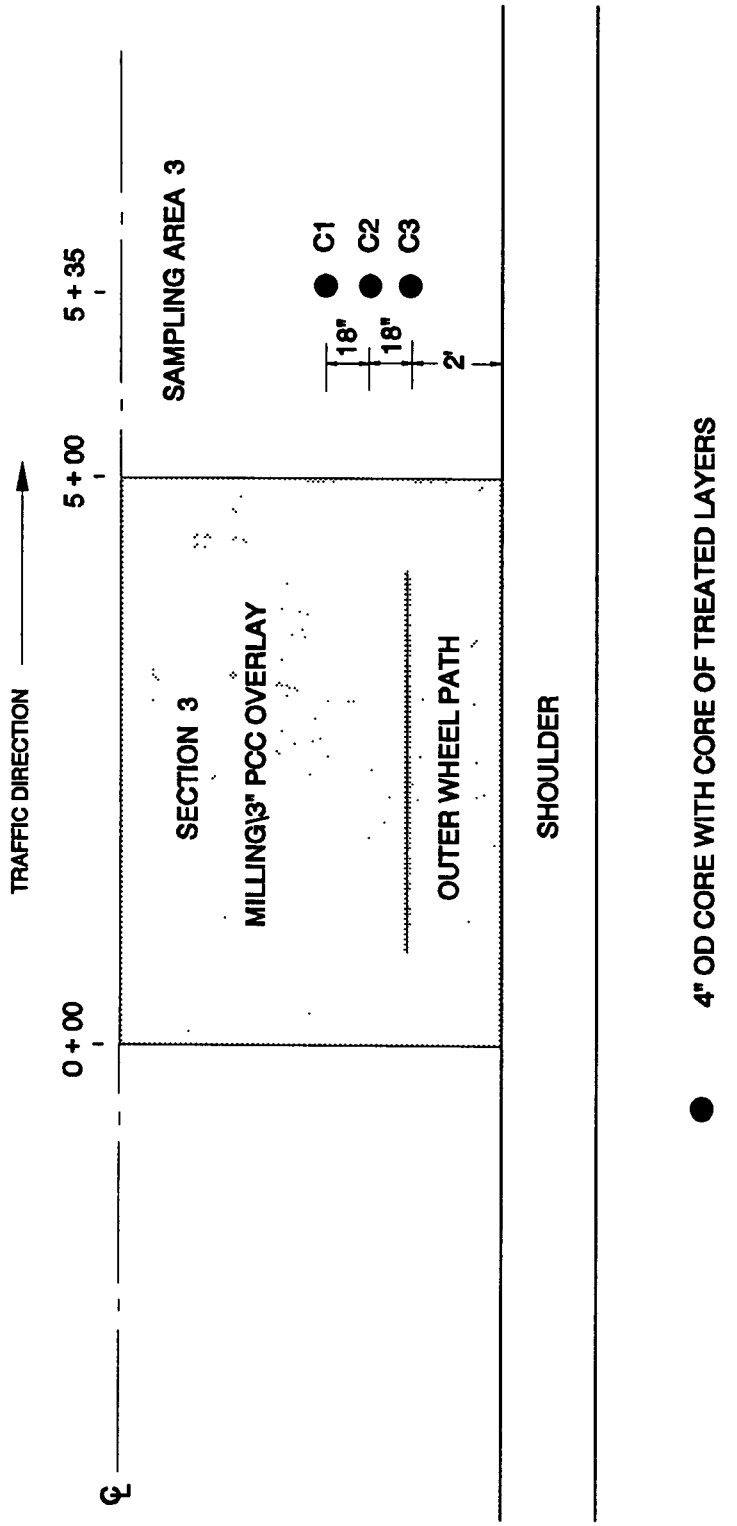


Figure A.4 Example of "Pre-Construction" Sampling Plan for Test Section 3

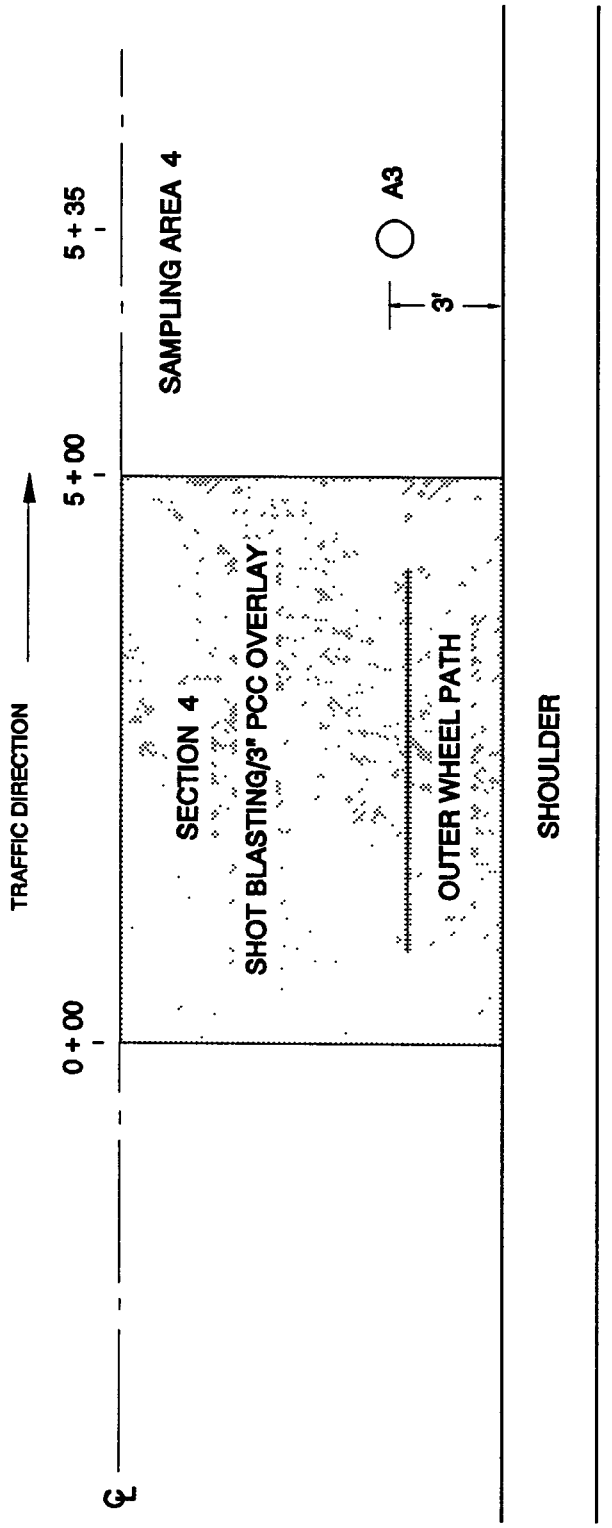


Figure A.5 Example of "Pre-Construction" Sampling Plan for Test Section 4

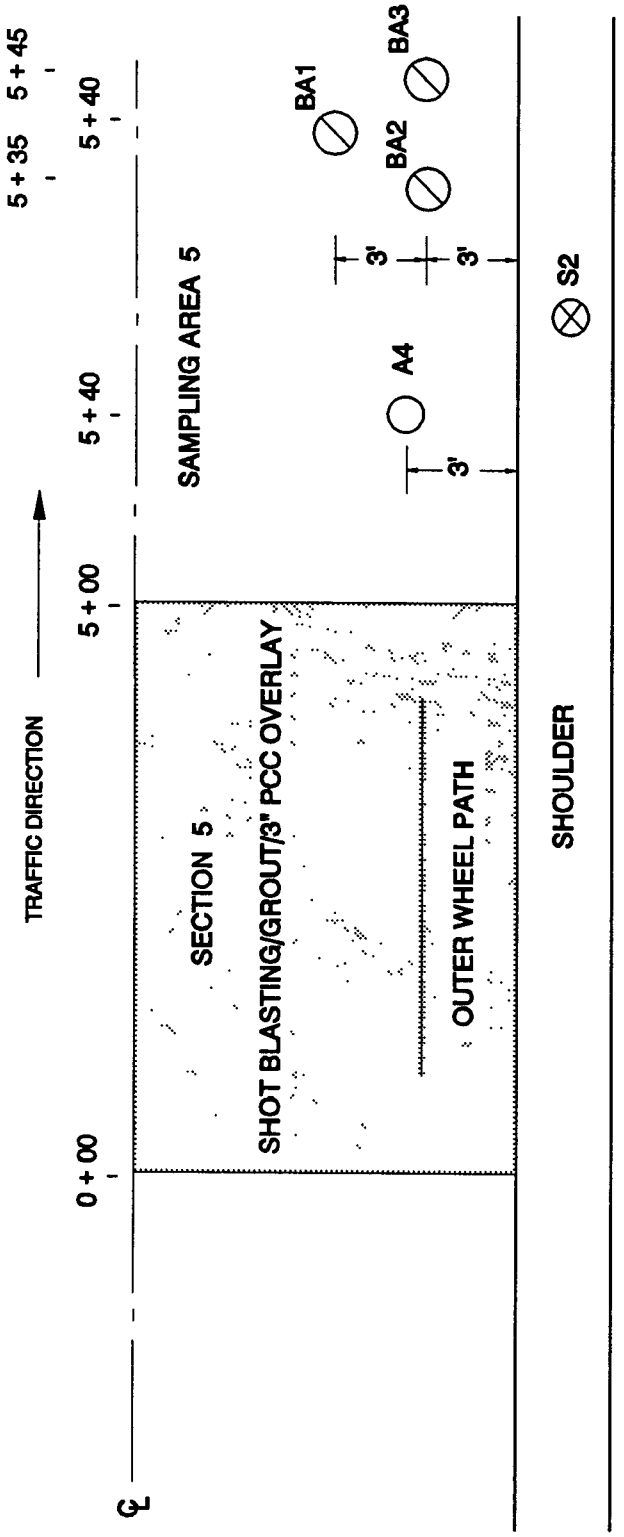


Figure A.6 Example of "Pre-Construction" Sampling Plan for Test Section 5

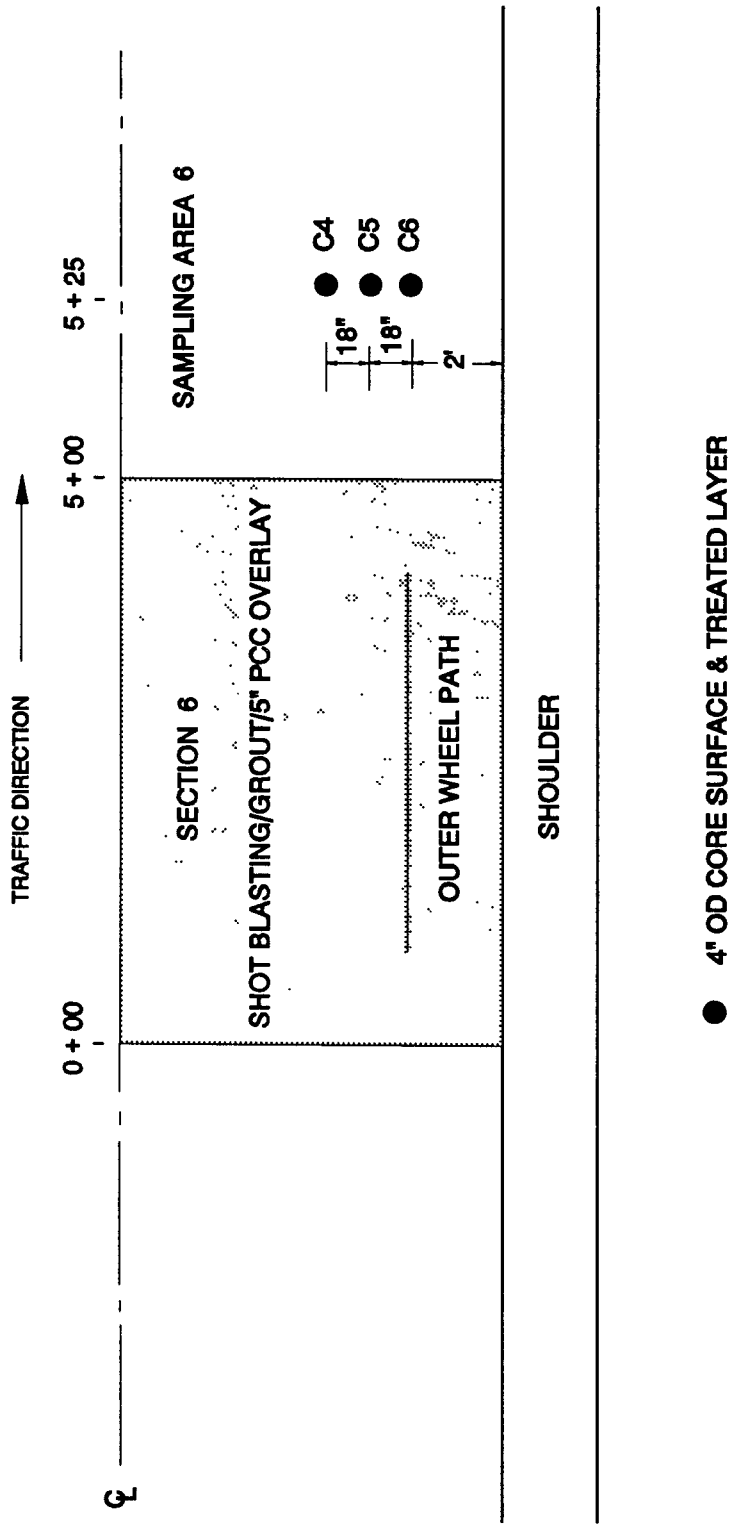
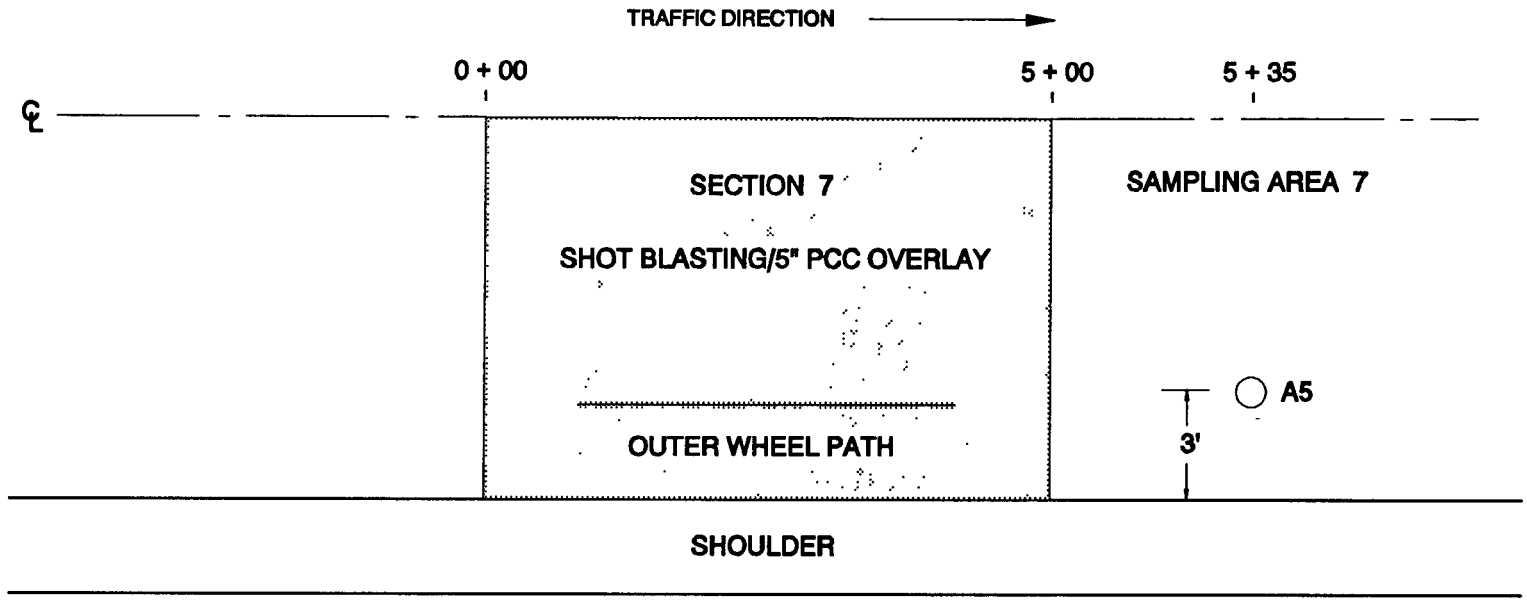
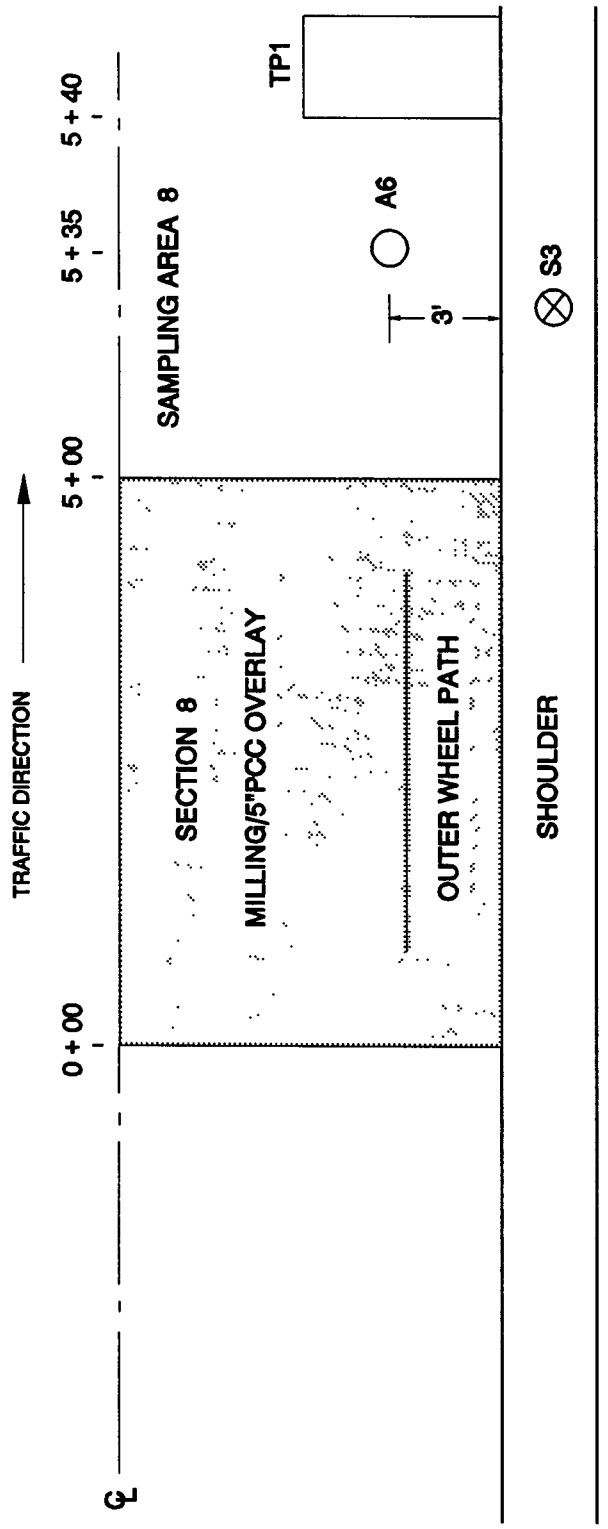


Figure A.7 Example of "Pre-Construction" Sampling Plan for Test Section 6



○ 6" OD CORE AND AUGER BORING TO 4' BELOW TOP OF SUBGRADE

Figure A.8 Example of "Pre-Construction" Sampling Plan for Test Section 7



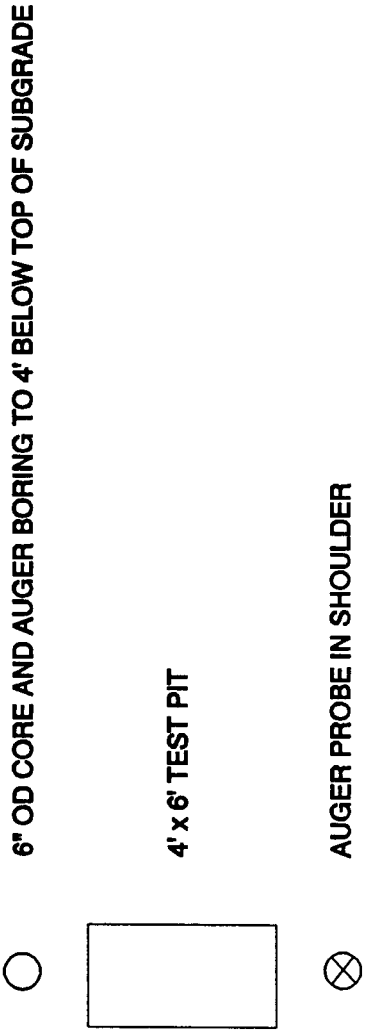


Figure A.9 Example of "Pre-Construction" Sampling Plan for Test Section 8

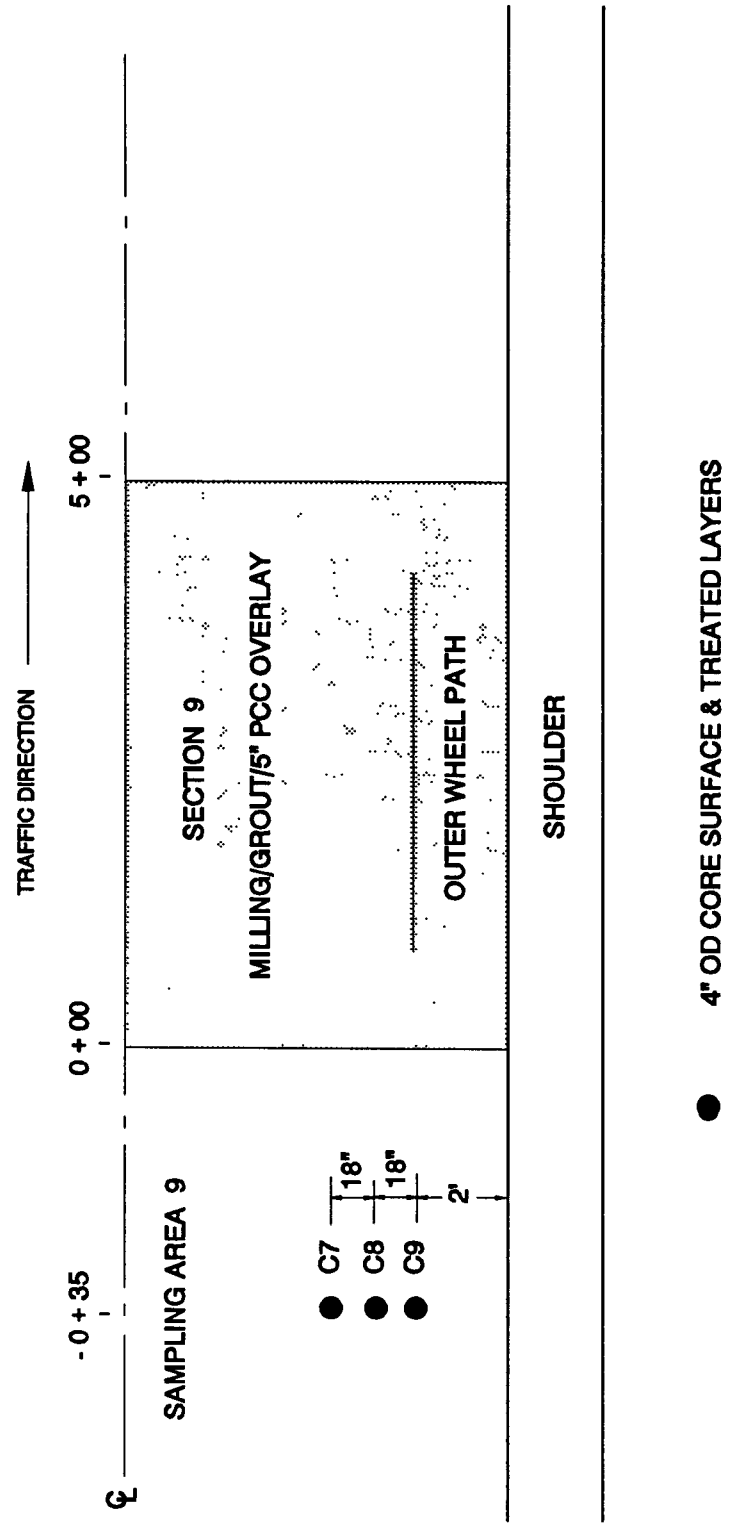
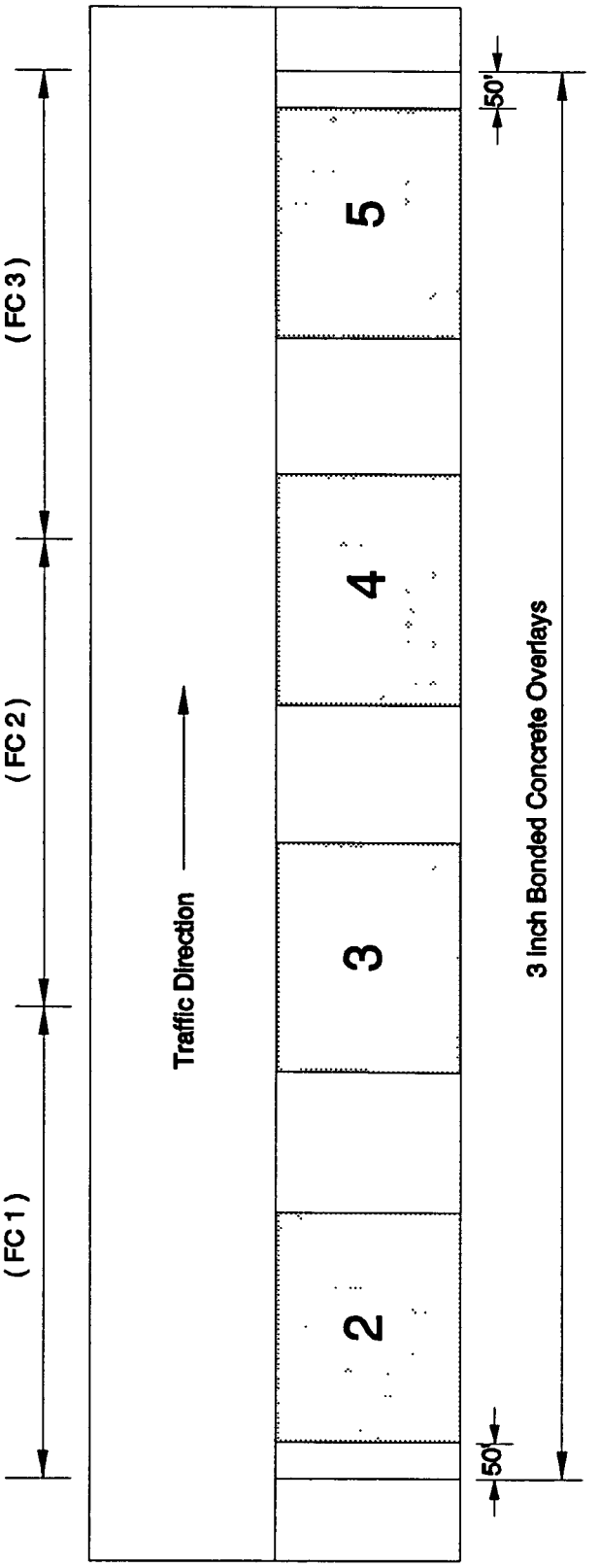


Figure A.10 Example of "Pre-Construction" Sampling Plan for Test Section 9

APPENDIX B - EXAMPLE OF AS-DELIVERED CONCRETE SAMPLING PLAN

This appendix contains an example of an as-delivered concrete field sampling layout plan for an SPS-7 test site which provides the minimum requirements for materials characterization considered essential for the experiment. The plan should be adjusted with consideration to the condition and details of the specific test site.

A schematic layout of a test site illustrating sampling of the as-delivered concrete relative to the overlay placement on the test sections is shown in Figure B.1.



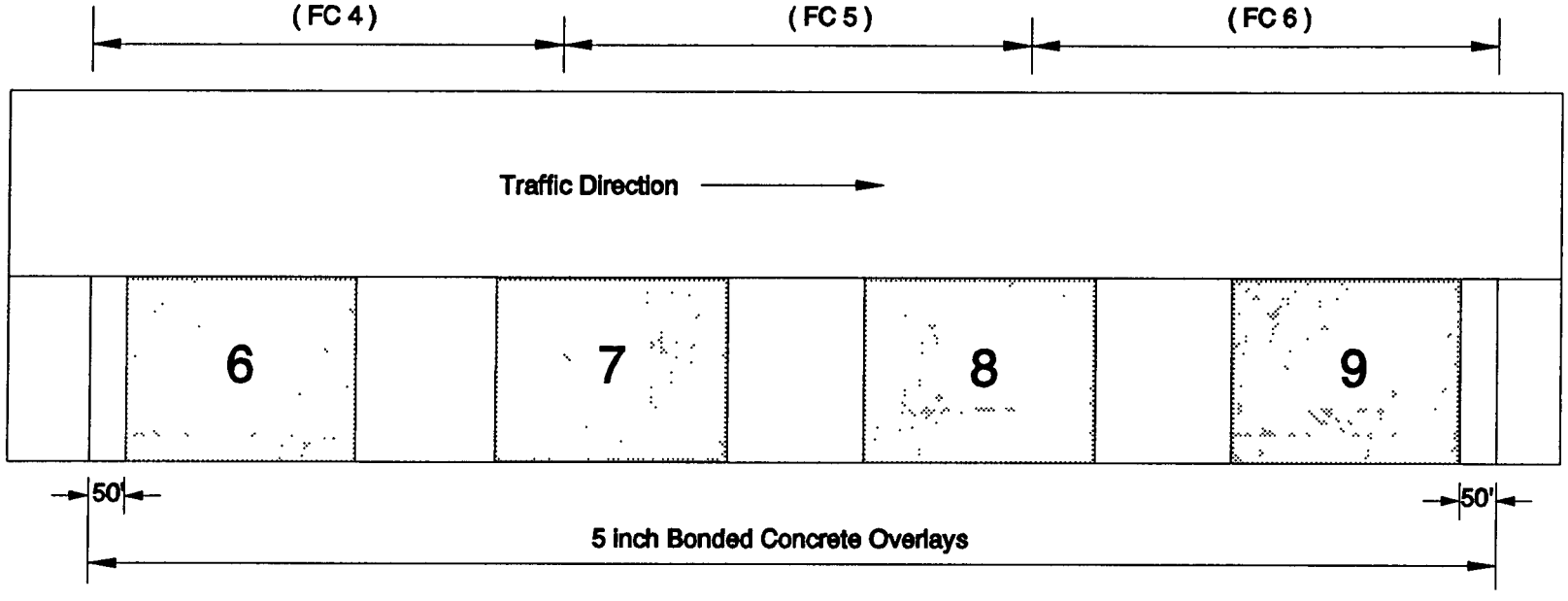
Bulk Sampling of Fresh Concrete Minimum Requirements

FC1 - Sample from Bulk Sampling Area 1, concrete for Test Sections 2/3

FC2 - Sample from Bulk Sampling Area 2, concrete for Test Sections 3/4

FC3 - Sample from Bulk Sampling Area 3, concrete for Test Sections 4/5

Figure B.1 Example of As-Delivered Concrete Sampling Plan



Bulk Sampling of Fresh Concrete Minimum Requirements

FC4 - Sample from Bulk Sampling Area 4, concrete for Test Sections 6/7

FC5 - Sample from Bulk Sampling Area 5, concrete for Test Sections 7/8

FC6 - Sample from Bulk Sampling Area 6, concrete for Test Sections 8/9

Figure B.1 Example of As-Delivered Concrete Sampling Plan (continued)

APPENDIX C - EXAMPLE OF POST-CONSTRUCTION SAMPLING PLAN

This appendix contains an example of a post-construction field sampling layout plan for an SPS-7 test site which provides the minimum requirements for materials characterization considered essential for the experiment. The plan should be adjusted with consideration to the condition and details of the specific test site.

A schematic layout of a test site illustrating the location of the test sections and sampling areas is shown in Figure C.1. An example of a post-construction sampling plan for an "ideal" test site is illustrated in Figures C-2 through C-9 for Test Sections 2 through 9, respectively, which will be rehabilitated with a concrete overlay. Post-construction sampling will not be required for the control section (Test Section 1) since an overlay is not required for this section.

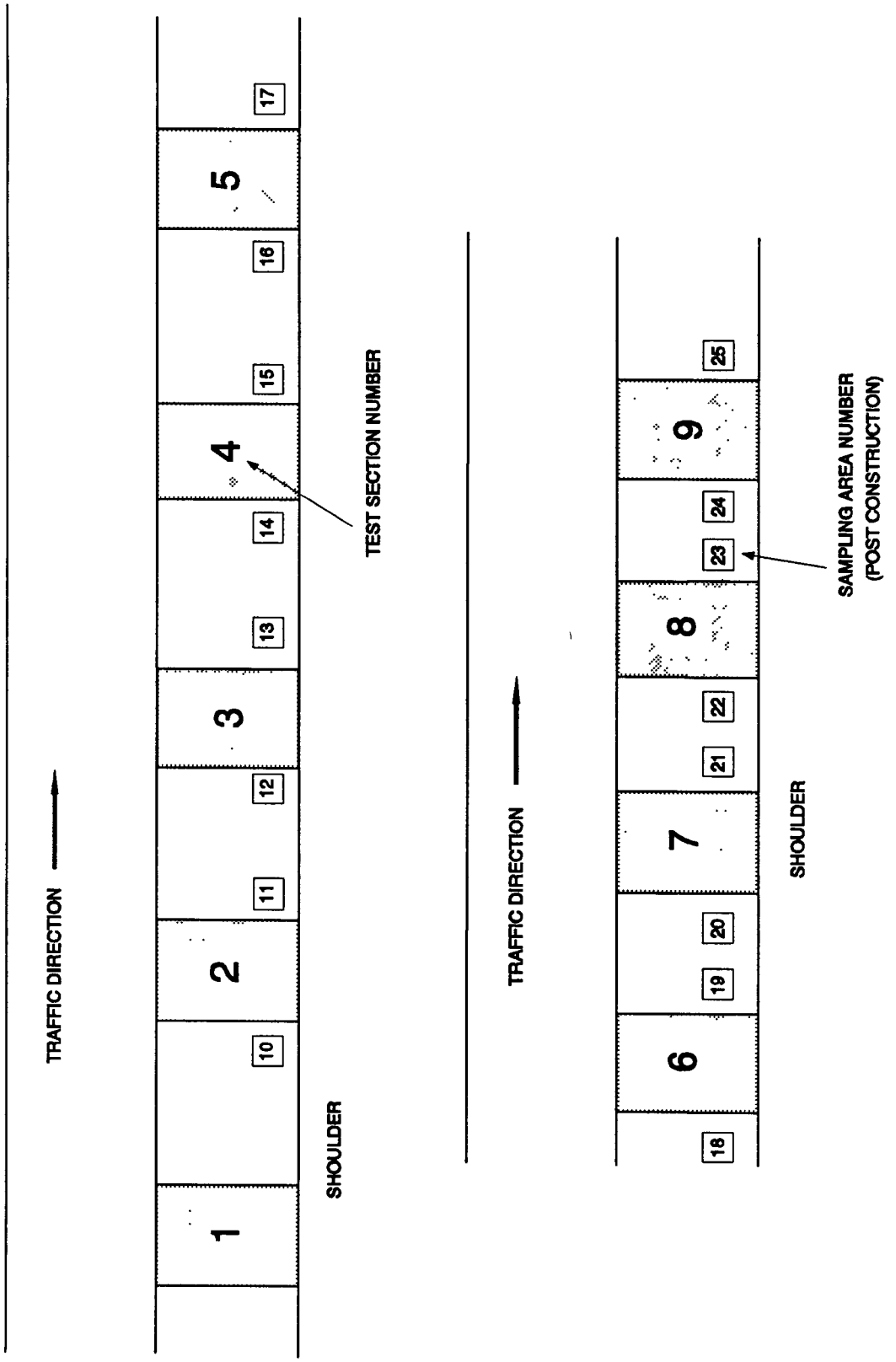
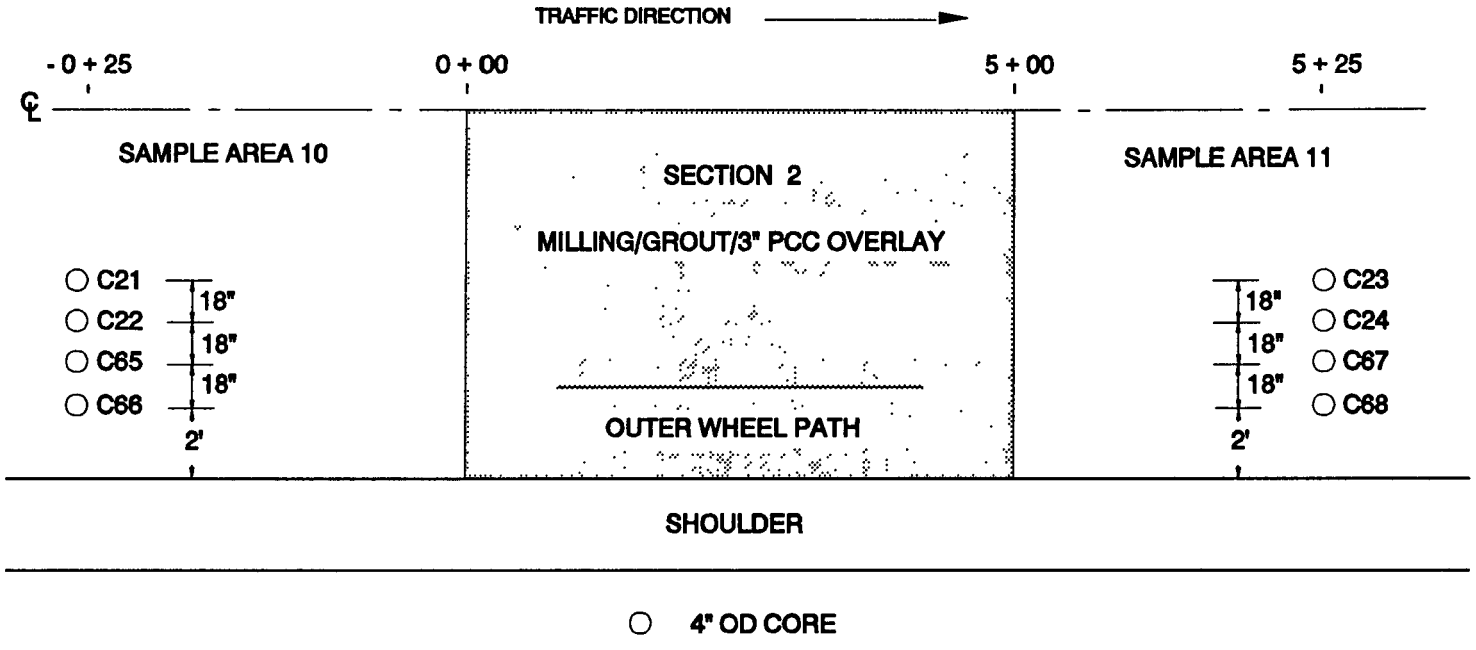


Figure C.1 Example of "Post-Construction Sampling Area Plan



Coring at 14 days After Placement

None for this section

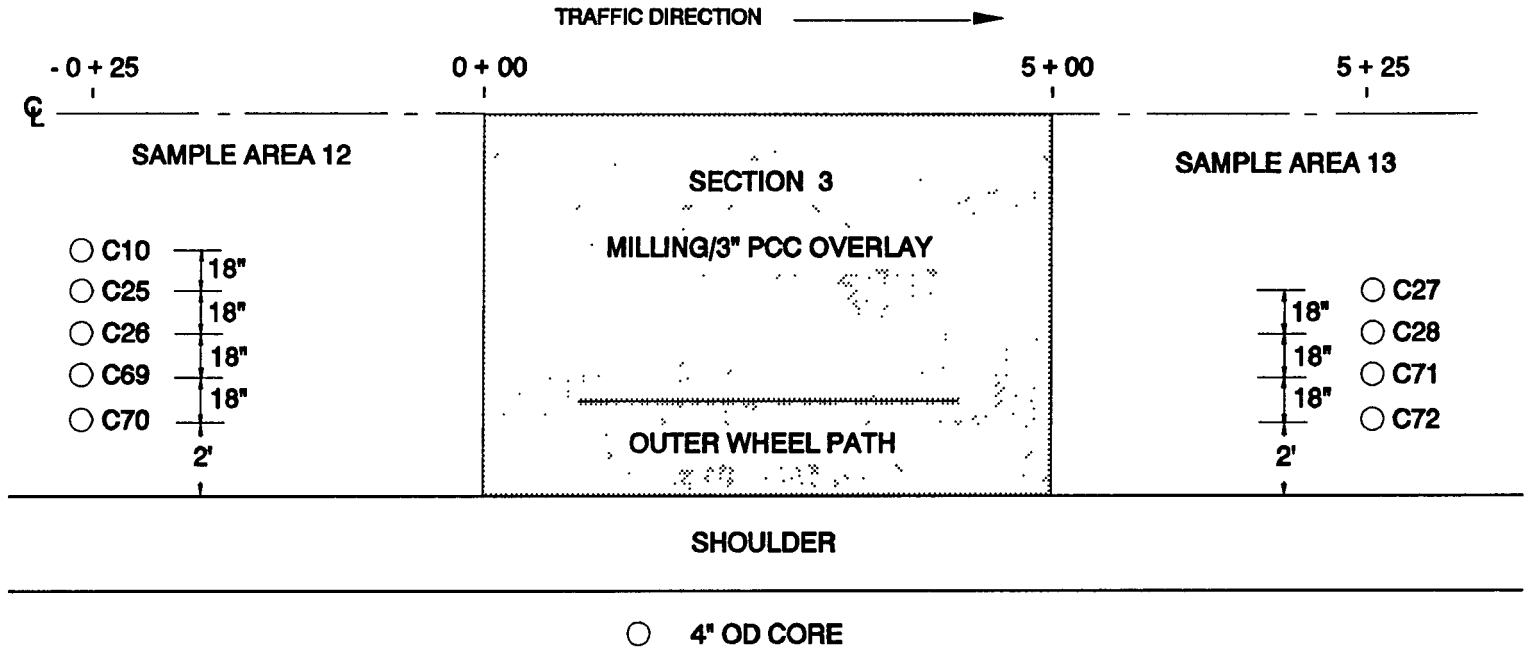
Coring at 28 days After Placement

C21, C22, C23, C24

Coring at 365 days After Placement

C65, C66, C67, C68

Figure C.2 Example of "Post-Construction" Sampling Plan for Test Section 2



Coring at 14 days After Placement

C10

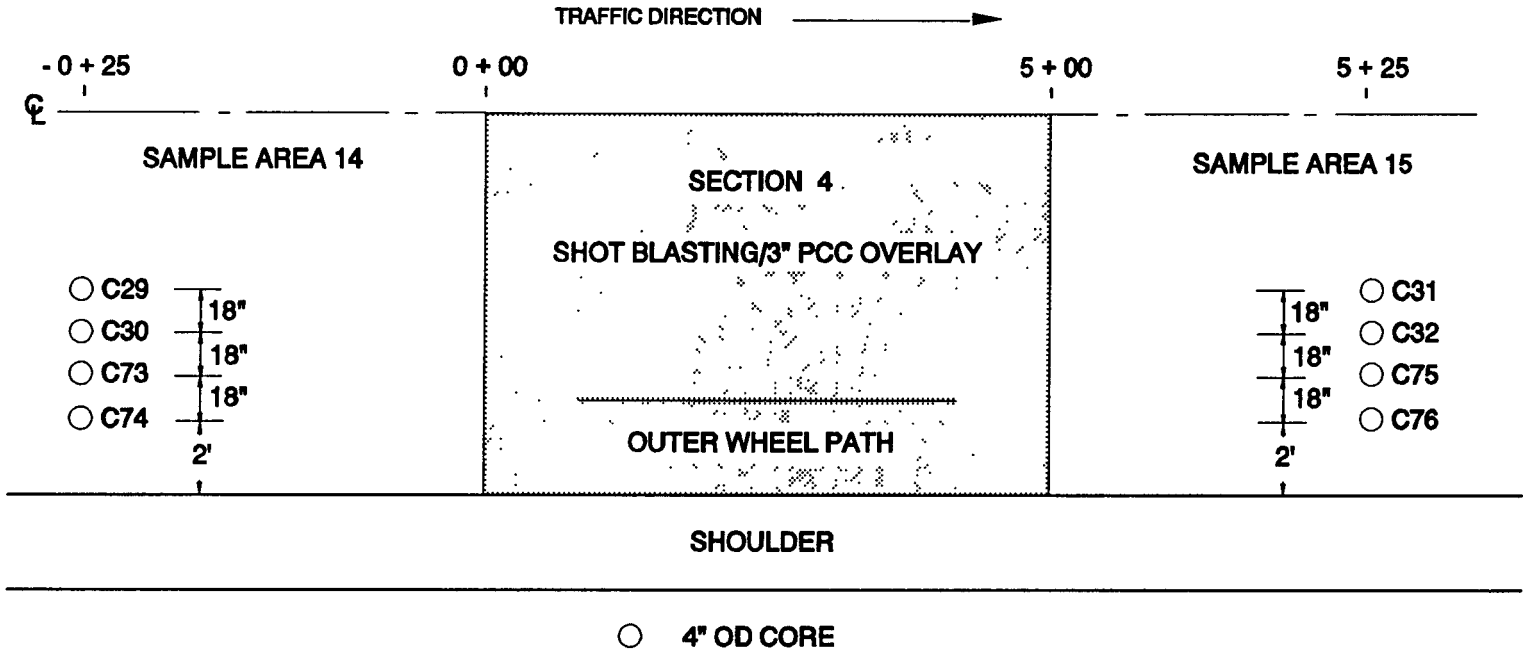
Coring at 28 days After Placement

C25, C26, C27, C28

Coring at 365 days After Placement

C69, C70, C71, C72

Figure C.3 Example of "Post-Construction" Sampling Plan for Test Section 3



Coring at 14 days After Placement

None for this section

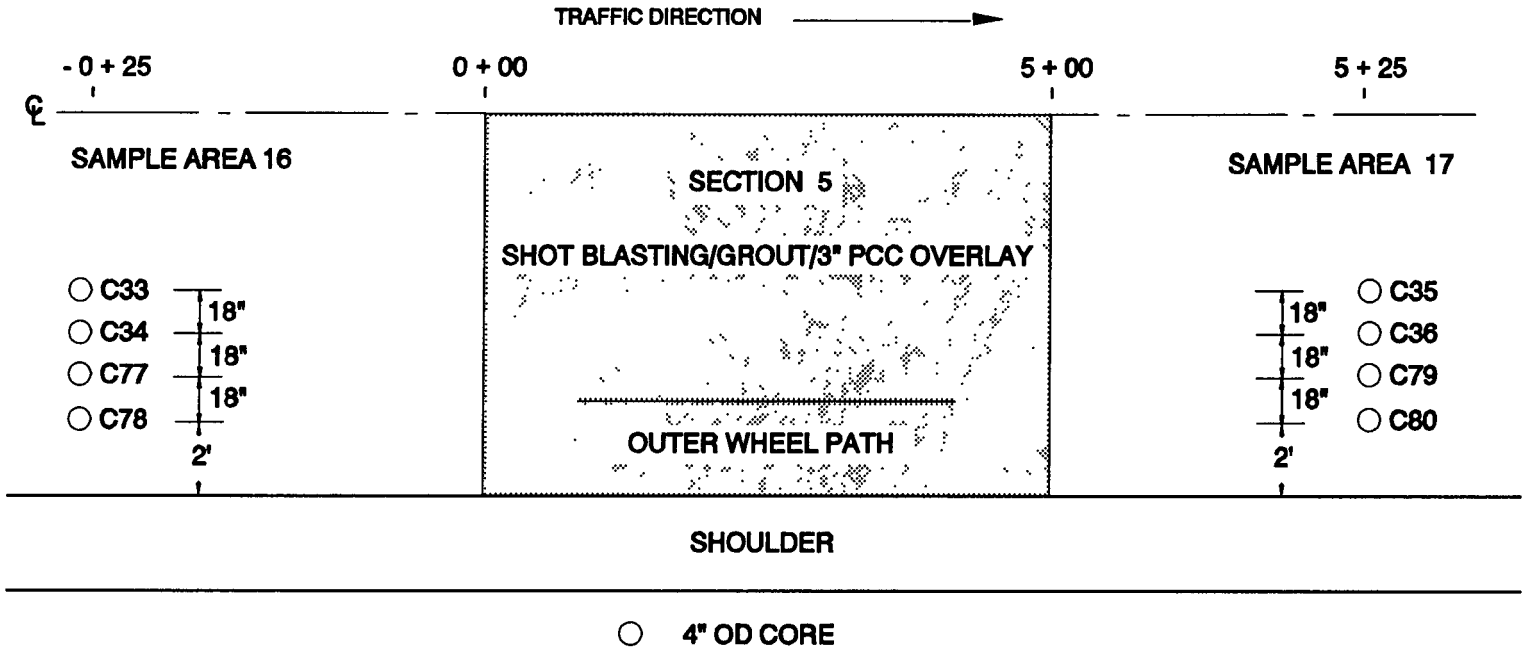
Coring at 28 days After Placement

C29, C30, C31, C32

Coring at 365 days After Placement

C73, C74, C75, C76

Figure C.4 Example of "Post-Construction" Sampling Plan for Test Section 4



Coring at 14 days After Placement

None for this section

Coring at 28 days After Placement

C33, C34, C35, C36

Coring at 365 days After Placement

C77, C78, C79, C80

Figure C.5 Example of "Post-Construction" Sampling Plan for Test Section 5

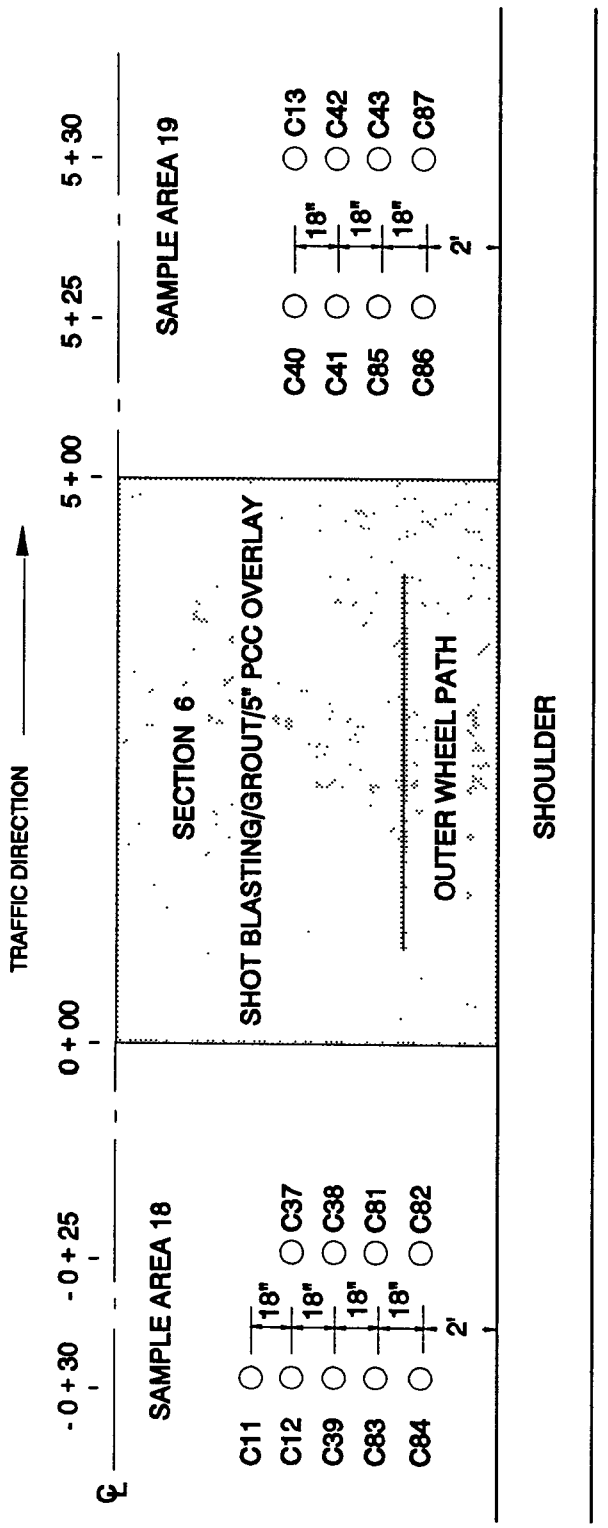
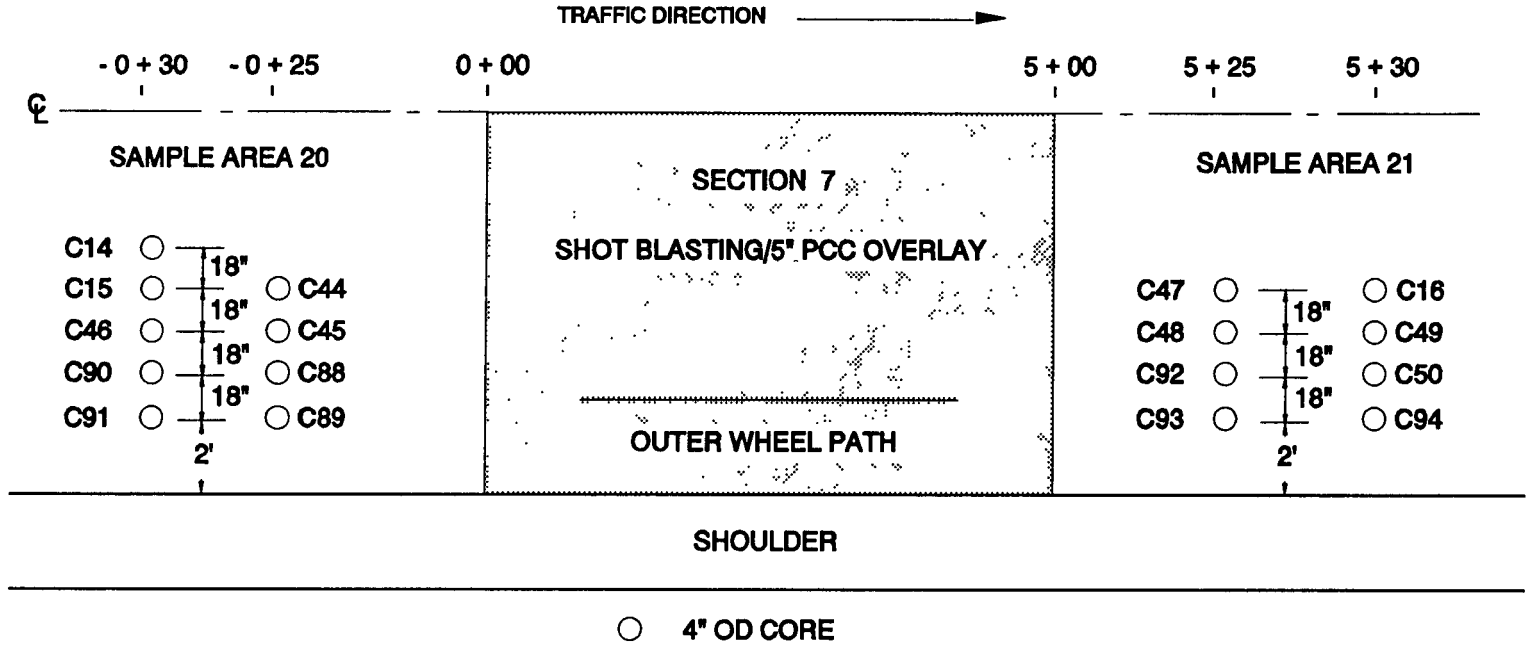


Figure C.6 Example of "Post-Construction" Sampling Plan for Test Section 6



Coring at 14 days After Placement

C14, C15, C16

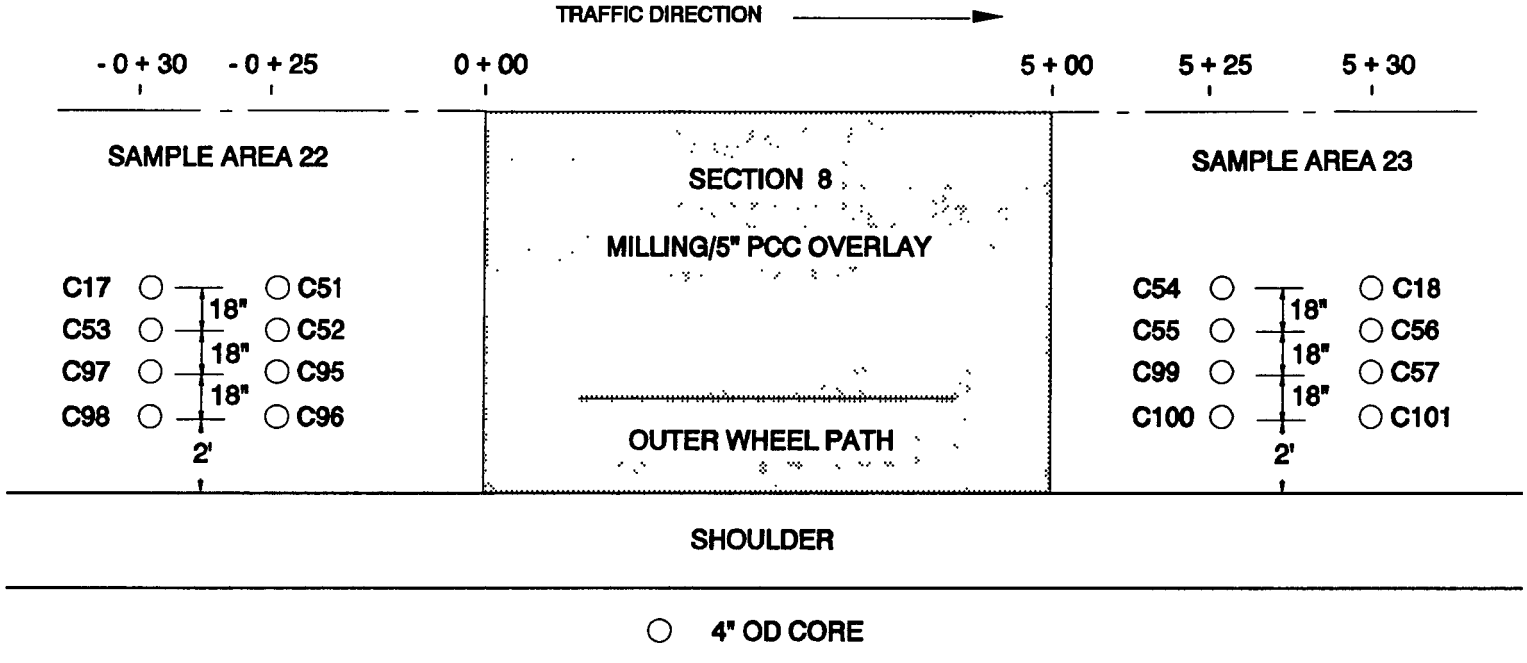
Coring at 28 days After Placement

C44, C45, C46, C47, C48, C49, C50

Coring at 365 days After Placement

C88, C89, C90, C91, C92, C93, C94

Figure C.7 Example of "Post-Construction" Sampling Plan for Test Section 7



Coring at 14 days After Placement

C17, C18

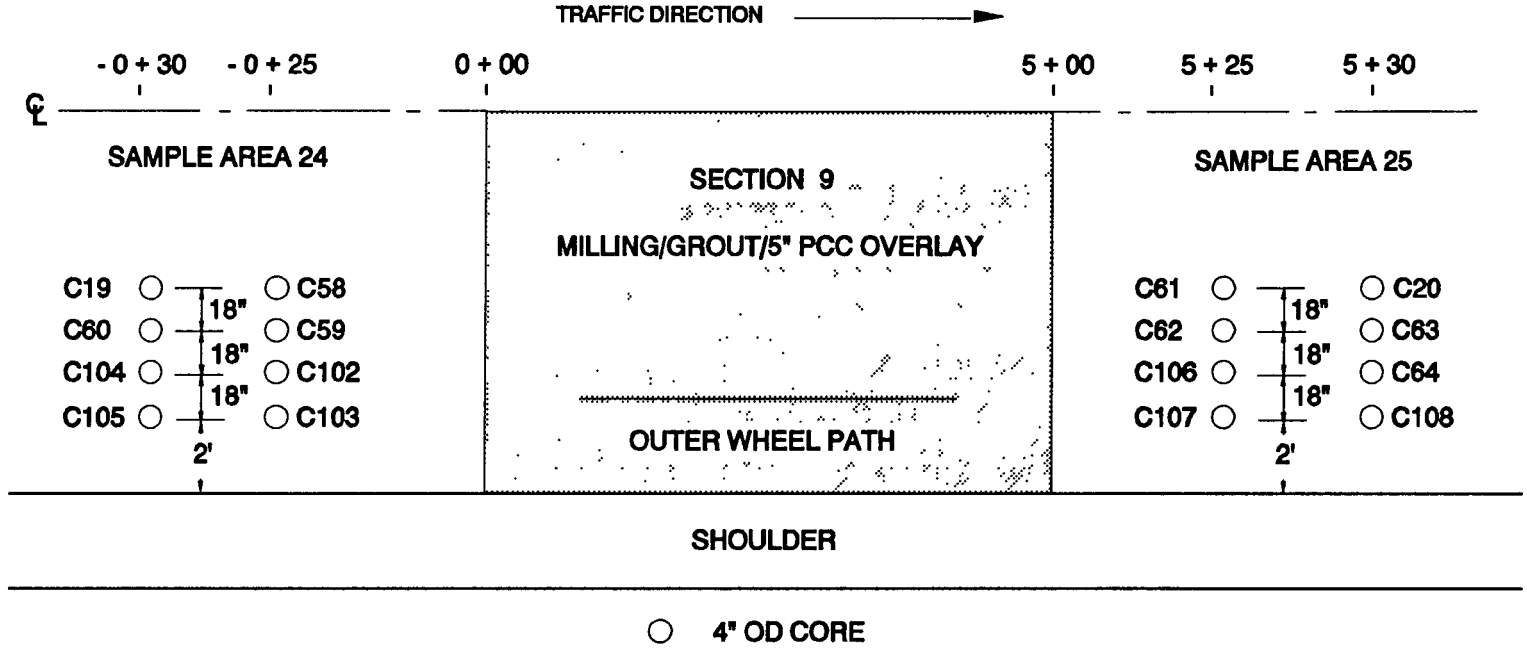
Coring at 28 days After Placement

C51, C52, C53, C54, C55, C56, C57

Coring at 365 days After Placement

C95, C96, C97, C98, C99, C100, C101

Figure C.8 Example of "Post-Construction" Sampling Plan for Test Section 8



Coring at 14 days After Placement

C19, C20

Coring at 28 days After Placement

C58, C59, C60, C61, C62, C63, C64

Coring at 365 days After Placement

C102, C103, C104, C105, C106, C107, C108

Figure C.9 Example of "Post-Construction" Sampling Plan for Test Section 9

APPENDIX D - FIELD MATERIALS SAMPLING AND TESTING DATA FORMS

In general, the field materials sampling and testing for the SPS-7 test sites should be performed following the guidelines provided in Operational Guide No. SHRP-LTPP-OG-006, "SHRP-LTPP Guide for Field Materials Sampling, Testing, and Handling", May 1990. However, field data forms have been revised and data sheets have been included to report data for portland cement concrete materials sampled during construction. These changes and/or additions have been made to accommodate the specific needs of the experiment.

REVISED FIELD DATA FORMS

Due to differences between the sampling requirements for GPS and SPS projects, the field materials sampling and testing data forms used in the GPS program were modified. The primary changes common to each from related to test section number, sample location referencing system, and sampling area number. These forms are included at the end of this appendix.

Test Section Number. The six digit test section identification numbers on the data forms have been subdivided into three, two digit fields representing the state code, SPS project code, and test section number. The structure of this number is described under SPS Test Section Numbering Scheme later in this document.

Sample Location Reference System. All material sampling and field testing data forms which reference the location of a sample or test use a station, offset and sampling area number. The sampling area number is a two digit number used to reference all the samples taken from one area of the project. The sampling numbers are developed as part of the materials sampling plan for the test site and should run in sequential order in the direction of traffic.

The station to be specified on these data forms is referenced from either the beginning or end of the test section adjacent to the sampling area. For expediency in the field, the station number designated on the form is relative to the test section number designated on the data form. Thus, if the sampling area occurs after the referenced test section, the station number should be

greater than 5+00. If the sampling area occurs in front of the designated test section, the station number should be negative. The offset distance is measured from the interface of the outside edge of the test section lane and the outside shoulder to the core location (measured from the outside edge of the pavement slab).

Figure 2 illustrates the location referencing system to be used for SPS material samples. In this example, designated sampling area SA-12 is situated between sections 200706 and 200707. In SA-12, two 4-inch diameter C-Type cores are specified, C-16 and C-17, to be 5 feet apart and three feet from the edge of the lane. The location of these two cores can be specified relative to either test section 200606 (alternative 1) or test section 200707 (alternative 2). In alternative 1, the station number of core C-16 is 5+95 since it is 95 feet past the end of section 200706 and core C-17 is at station 6+00. In alternative 2, the station numbers of cores C-16 and C-17 are -1+05 and -1+00, respectively, since they occur in advance of test section 200707. Thus, when specifying the sampling locations on the field data form, the station number must correspond to the test section indicated.

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING DATA SHEETS

Common Data Elements

Most of the LTPP-SPS Material Sampling and Field Testing data sheets use the same top block of information related to the test section and project.

SHEET NUMBER. Since multiple data sheets will be required for the samples and tests from the multiple sampling areas on the project, room is provided on all data forms to sequentially order the data sheets. The first field is the sequential number of the data sheet and the second field is the total number of data sheets submitted.

SHRP REGION. Indicate the SHRP-LTPP region in which the state or province is located: North Atlantic, North Central, Southern, or Western.

STATE. Indicate the name of the state, District of Columbia, Puerto Rico, or the Canadian Province in which the project is located.

STATE CODE. Enter the two-digit numeric code corresponding to the state or province as shown in Table C.1 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

SPS PROJECT CODE. The two digit SPS project code. The first digit (from the left) of this code should either be a 0 (zero), for the first project constructed in a state or province, or a letter (assigned in alphabetical order) for additional projects of the same SPS experiment constructed in the same state or province. The second digit corresponds to the SPS experiment number, i.e. 7 for SPS-7 experiment.

TEST SECTION NO. The two digit number assigned to the test section. If a GPS project is co-located on the SPS project and GPS data sheets are used for the material sampling and field testing, the four digit SHRP SECTION ID should be divided into two-two digit fields and the first two digits (from the left) should be entered as the SPS PROJECT CODE and the last two digits entered as the TEST SECTION NO. Enter the test section number marked on the project in the field.

SPS EXPERIMENT NO. The SPS experiment number for the project. This should be "SPS-7" for projects in the SPS-7 experiment, "Bonded Portland Cement Concrete Overlays".

ROUTE/HIGHWAY. Record the signed designation for the route or highway the project is located upon.

Lane. Drilling and sampling shall always occur on the outside lane for the SPS program. Record a "1" for sampling occurring on the outside lane and a "2" for sampling on the inside lane.

Direction. Record the direction of travel at the project site. Use the following abbreviations:

E for eastbound traffic direction
W for westbound traffic direction
N for northbound traffic direction
S for southbound traffic direction

SAMPLE/TEST LOCATION. Check "Before Section" if the sampling location is before the beginning of the test section indicated under TEST SECTION NUMBER on the form (station 0-). Check "After Section" if the sampling location is after the end of the test section indicated on the form (station 5+, or station 10+).

FIELD SET NO. The field set number is a sequentially assigned number to indicate the different time periods in which sampling and field testing were conducted on the project. These time periods usually refer to different stages in the pavement life, such as prior to overlay construction, after overlay construction, end of test, etc. A field set number can apply to more than one day since sampling of SPS test sections usually requires more than one day. As a general rule, the same field set number should be applied to all material samples and field tests conducted in a continuous 30 day period, unless a construction event occurs between the two sampling sessions. Enter 1 for the first time that material sampling and field testing are conducted on the project. For SPS-7 projects, the first sampling should occur prior to overlay placement. Enter 2, 3, etc. for the second, third and subsequent sampling and field testing activities on the project.

SAMPLING DATA SHEET 1. LOG OF PAVEMENT CORE AT BOREHOLE LOCATIONS

This form is similar to Form S01 used for GPS test sections, and is used to log pavement cores taken at the borehole locations (either 6-inch A-Type cores or 12-inch BA-Type cores). Use the core sample coding system given in the sampling plan developed for the project to designate the core number reported on the data forms. Depth should be measured from the pavement surface to the bottom of the core of each layer and recorded to the nearest tenth of an inch.

OPERATOR. Record the coring equipment operator's name.

EQUIPMENT USED. Indicate the generic type of the coring equipment used.

CORING DATE. Record the month, date, and year the core was taken.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

LOCATION: STATION. This is the station number of the core, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System)

LOCATION: OFFSET. This is the distance from the interface of the pavement lane and the outside shoulder to the center of the core location (measured from the outside edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

CORE HOLE NO. Enter the core hole sample code number following the sample coding system specified in the material sampling plan developed for the project. Core hole numbers designated with either an A- or a BA- should be used with this sheet.

CORE BARREL SIZE. Record the rated inside diameter of the core barrel to the nearest tenth of an inch.

COOLING MEDIUM. Record the material used for cooling during the coring operation.

DEPTH. Under the depth column, draw horizontal lines to designate the approximate depths of changes in the bound materials. Also write the depths in

this column to the nearest tenth of an inch. All depths should be referenced from the pavement surface. The total depth cored should be indicated in this column even if a useable sample was not recovered.

CORE RECOVERED. Record the thickness of the recovered core. This should be the thickness of the testable (intact) portion of the core. This thickness may be less than the depth recorded in the depth column due to breakage of the material. On pavement sections with bound base layers, the thicknesses of the base layers in the core should be indicated separate of the concrete surface layer. The approximate average thickness of the core, or portion of the core, to the nearest tenth of an inch should be recorded.

CORE SAMPLE NO. Record the core sample number for the recovered core. Separate sample numbers should be assigned to surface and bound base layers from the same core, even if the bound base adheres to the surface layer.

MATERIAL DESCRIPTION. Enter the appropriate material description based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide For Field Materials Sampling, Testing and Handling.

MATERIAL CODE. Enter the appropriate material code number from Table C.2 in the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling corresponding to the described type of material.

SAMPLING DATA SHEET 2. PAVEMENT CORE LOG AT C-TYPE CORE LOCATIONS

This is similar to Form S01A used for GPS test sections. It is used to log 4-inch and 6-inch diameter pavement cores extracted from C-Type core locations.

Each sheet can be used to record data for cores taken from six different core hole locations in one sampling area. A separate sheet should be used to record core data from each sampling area. Space is provided in each column to record data for up to 4 layers from one core hole. The pavement surface layer core should be recorded first, followed by other layers in the column. The first

column from the left should always start with the lowest numbered core hole in the sampling area.

OPERATOR. Record the coring equipment operator's name.

EQUIPMENT USED. Indicate the generic type of the core equipment used.

CORING DATE. Record the month, date, and year the core was taken.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

CORE BARREL SIZE. Record the rated inside diameter of the core barrel to the nearest tenth of an inch.

COOLING MEDIUM. Record the material used for cooling during the coring operation.

CORE HOLE NO. Enter the core hole sample code number following the sample coding system as specified in the materials sampling plan developed for the project.

LOCATION: STATION. This is the station number of the core, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the interface of the pavement lane and the outside shoulder to the center of the core location (generally measured from the outside edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

CORE RECOVERED. Circle the appropriate response to indicate if an intact and suitable core was recovered from the indicated core hole.

REPLACEMENT CORE HOLE NO. Record the sample number of the core that will replace a core which was deemed unacceptable during field sampling operations. This entry should only be used when a "No" was recorded in the "Core Recovered" data entry space of this form.

CORE SAMPLE NO. Record the core sample number for the recovered core. Separate sample numbers should be assigned to surface and bound base layers from the same core hole, even if the bound base adheres to the surface layer.

DEPTH. Depth should be measured from the pavement surface to the bottom of the material interface in the core and expressed to the nearest tenth of an inch.

MATERIAL DESCRIPTION. Enter the appropriate material description based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing.

MATERIAL CODE. Enter the appropriate material code number from Table C.2 in the SHRP-LTPP Guide for Field Material Sampling, Handling and Testing corresponding to the described type of material.

SAMPLING DATA SHEET 3. * NOT USED IN SPS-7 EXPERIMENT *****

SAMPLING DATA SHEET 4. A-TYPE BORE HOLE LOG

This form is similar to Form S02A used for GPS test sections. It is designed to record logs of A-Type bore holes and any other similar type sampling areas. The following data is recorded on this form.

OPERATOR. Record the boring equipment operators name.

EQUIPMENT USED. Indicate the generic type of the drill equipment used.

BORING DATE. Record the month, date, and year the operation was performed.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

LOCATION: STATION. This is the station number of the bore, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the interface of the pavement lane and the outside shoulder to the center of the bore location (generally measured from the outside edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

BORE HOLE NO. Enter the core hole sample code number following the sample coding system specified in the material sampling plan developed for the project.

BORE HOLE SIZE. Record the borehole size (diameter) in inches to the nearest inch.

STRATA CHANGE. Record the depth of strata changes to the nearest tenth of an inch. The depth of strata changes should always be measured from the top of the pavement surface. Draw a horizontal line across the form which indicates the depth of each strata change.

Also, record the depth of sampling for each sample taken. For example, if a thin-walled tube sample was obtained at a depth from 18 inches to 36 inches, a line should be drawn at the 18 inch mark and the 36 inch mark along with the appropriate sample code number, material description, etc. See example data

sheets in the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling for further clarification.

SAMPLE NUMBER. Record the sample number for splitspoon or thin-walled tube samples obtained from the subgrade.

BLOWS. **The next four columns (*# Blows, Refusal?, DLR (Driving Length to refusal, IOP (Inches of Penetration)*) shall be used only if a splitspoon sample recovery was attempted.** Standard practice for recording the blow count for splitspoon samples requires the following format: A - B - C, where:

A = number of blows for first 6 inches of penetration by the splitspoon sampler. This is considered a seating drive.

B = number of blows for second 6 inches of penetration by the splitspoon sampler.

C = number of blows for third 6 inches of penetration by the splitspoon sampler.

Record the blow count from the first 6 inches of seating penetration by the splitspoon sampler in the left most column under number of blows. ("A" from above example of blow count record). Record the blow count from the second 6 inches of penetration by the splitspoon sampler in the middle column under number of blows ("B" from above example of blow count record). Record the blow count from the third 6 inches of penetration by the splitspoon sampler in the right most column under number of blows. ("C" from above example of blow count record).

Refusal of the splitspoon sampler is defined as having advanced less than one inch with 100 blows (or no observed advance of the sampler during the application of 10 blows) or the test is aborted at the discretion of the SHRP Representative to avoid damage to the splitspoon sampler.

If the splitspoon sampler is "refused" in the first 6 inches indicate the blow count to refusal in the left most column, place a "Y" in the ***Refusal?*** column

and indicate in the ***DLR*** (Driving Length to Refusal) column, the distance, measured to the nearest tenth of an inch, from the top of the pavement surface to refusal. Also, record the penetration depth of the splitspoon sampler in the ***IOP*** column (distance penetrated in "A").

If the splitspoon is refused during the second 6 inches of penetration, indicate the blow count to refusal in the middle column, place a "Y" in the ***Refusal?*** column and indicate in the ***DLR*** column the distance, measured to the nearest tenth of an inch, from the top of the pavement surface to refusal. Also, record the penetration depth of the splitspoon sampler in the ***IOP*** column (distance penetrated in "A" + "B").

If the total blow count ("A" + "B") reaches 100 before penetrating deeper than 12 inches, the splitspoon sampling procedure should be stopped and the blow count for the second 6 inch increment should be recorded in the middle column and the total depth of penetration recorded under the ***IOP*** column (the depth of penetration shall be measured from the beginning of penetration of the splitspoon sampler.)

In the case of refusal during the third 6 inch increment, the same instructions outlined previously for the left and middle columns will be followed. The penetration depth of the splitspoon sampler will be recorded in the ***IOP*** column (distance penetrated in "B" + "C").

If the second and third 6 inch increment blow count ("B" + "C" only) reaches 100 before prior to penetrating 18 inches, the splitspoon sampling procedure should be stopped and the blow count for the third 6 inch increment recorded in under number of blows. The total depth of penetration ("B" + "C" only) should be recorded under the ***IOP*** column (measured from the beginning of penetration of the splitspoon sampler minus the 6 inch seating drive).

REF?. Record a "Y" if splitspoon sampler is refused (see explanation under ***# Blows*** above). Record a "N" if the full 18 inch sample is recovered and the splitspoon is not refused. This column is only used if a splitspoon sampler is utilized.

Refusal is defined as occurring when the splitspoon sampler advances less than one inch in 100 blows (or no observed advance of the sampler during the application of 10 blows) or when the test is aborted at the discretion of the SHRP representative to avoid damage to the splitspoon sampler.

DLR. Driving Length to Refusal - Record the penetration of the splitspoon sampler to refusal to the nearest tenth of an inch. This value is measured from the top of the pavement surface. This column is only used if a splitspoon sampler is utilized and refused. In the case of refusal, an entry is made in the ***DLR*** and ***IOP*** columns.

IOP. Inches of Penetration - Record the distance of penetration of the splitspoon sampler after 100 blows is reached in the first 6 inches ("A"), the first and second 6 inches of penetration ("A" and "B") or the second and third 6 inches of penetration ("B" and "C") (See explanation under # Blows above). This column is only used if a splitspoon sampler is utilized.

MATERIAL DESCRIPTION. Enter the appropriate material description for each strata based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling.

MATERIAL CODE. Enter the appropriate material code number for each strata from Table C.2 in the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling corresponding to the described type of material.

SAMPLING DATA SHEET 5. BA-TYPE BORE HOLE LOG

This form is similar to S02B used for GPS test sections. It is designed to record logs of BA-Type bore holes and any other similar type sampling areas. The following information is recorded on this form:

OPERATOR. Record the boring equipment operator's name.

EQUIPMENT USED. Indicate the generic type of the drilling equipment used.

BORING DATE. Record the month, date, and year the operation was performed.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

LOCATION: STATION. This is the station number of the bore, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the center of the bore location (generally measured from the outside edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

BORE HOLE NO. Enter the bore hole sample code number following the sample coding system specified in the material sampling plan developed for the project.

BORE HOLE SIZE. Record the bore hole size (diameter) in inches to the nearest inch.

STRATA CHANGE. Record the depth of strata changes to the nearest tenth of an inch. The depth of strata changes should always be measured from the top of the pavement surface. Draw a horizontal line across the form which indicates the depth of each strata change.

SAMPLE NUMBER. Record the sample number for the bulk samples obtained from unbound layers.

MOISTURE SAMPLE NUMBER. Record sample numbers for samples taken from unbound base, subbase and subgrade for moisture content testing.

MATERIAL DESCRIPTION. Enter the appropriate material description for each strata based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing.

MATERIAL CODE. Enter the appropriate material code number for each strata from Table C.2 in the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing corresponding to the described type of material.

SAMPLING DATA SHEET 6. TEST PIT LOG

This form is similar to Form S03 used for GPS test sections. It is designed to record data from the field sampling and field testing from test pits. The following data is recorded on this form:

TECHNICIAN. Record the name of the technician who retrieved the samples and recorded the information on the data form.

EQUIPMENT USED. Indicate the generic type of the equipment used to cut and excavate the test pit.

EXPLORATION DATE. Record the month, date, and year the operation was performed.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

LOCATION: STATION. This is the station number of the test pit, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the outside edge of the test pit (Generally measured from the outside edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

TEST PIT NUMBER. Enter the test pit code number shown in the sample coding system specified in the material sampling plan developed for the project.

TEST PIT SIZE. Record the length and width of test pit to the nearest half foot.

STRATA CHANGE. Record the depth of strata changes to the nearest tenth of an inch. The depth of strata changes should always be measured from the top of the pavement surface. Draw a line across the form to indicate strata changes.

MOISTURE SAMPLE NUMBER. Record sample numbers for samples taken from unbound base, subbase and subgrade for moisture content testing.

BULK SAMPLE NUMBER. Record the sample number for bulk samples taken from the unbound pavement layers and the subgrade.

MATERIAL DESCRIPTION. Enter the appropriate material description for each strata based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing.

MATERIAL CODE. Enter the appropriate material code number for each strata from Table C.2 in the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing corresponding to the described type of material.

SAMPLING DATA SHEET 7. TEST PIT SKETCH

The sheet is similar to Form S03A used for GPS test sections. It is designed to provide the field sampling personnel with an appropriate form to record any sketches of the excavation of the test pit that may be appropriate. This sketch should at least include: (a) dimensions of the test pit; (b) depth

of each layer in the test pit; (c) material type of each layer and (d) the direction of traffic. All of the other information requested on this form is the same as that provided on Sampling Data Sheet 6, Test Pit Log. See the example completed field data packet contained in Appendix E of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing for an example of how to complete this form.

SAMPLING DATA SHEET 8. IN SITU DENSITY AND MOISTURE TESTS

This sheet is similar to Form S04 used for GPS test sections. It is designed to record data from the in situ density and moisture tests performed on all unbound layers in the test pits with a nuclear moisture and density gauge. The following data is recorded on this form.

OPERATOR. Record nuclear density gauge operator's name.

NUCLEAR DENSITY GAUGE I.D. Record the identification number of the nuclear density gauge.

TEST DATE. Record the month, date, and year the test was performed.

SAMPLING AREA NO. The sampling area number is a two digit number used to reference all of the samples taken from one area of the project. It has the form SA-##. This number is developed as part of the materials sampling plan for the project.

LOCATION: STATION. This is the station number of the test pit, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the location the test was performed (generally measured from the edge of the pavement slab). This distance should be indicated to the nearest tenth of a foot.

TEST PIT NUMBER. Enter the test pit code number shown in the sample coding system specified in the material sampling plan developed for the project.

DATE OF LAST MAJOR CALIBRATION. Record the date of the last major calibration of the nuclear density gauge. All dates should be recorded as mm-dd-yy. A major calibration is defined as that calibration/verification performed as directed in Section 4 of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing. Daily calibrations performed in the field do not constitute a major calibration.

DEPTH FROM SURFACE TO THE TOP OF THE LAYER. This information is obtained from Sampling Data Sheet 5 for each unbound granular layer. Record to the nearest tenth of an inch and measure from the top of the pavement surface for each test performed.

LAYER DESCRIPTION. Write in the generic description of the type of layer tested, such as BASE, SUBBASE, or SUBGRADE.

MATERIAL TYPE. Report a "G" if the material is unbound (granular) and report a "T" if the material is other than unbound (treated). In practice, all entries should be a "G" since nuclear density testing is not required on bound materials.

IN SITU DENSITY. For each unbound layer, record four nuclear density gauge results. These measurements should be taken at the top of each unbound layer using the direct transmission test method. Record to one decimal place in pounds per cubic foot (pcf).

AVERAGE. Calculate and record the average in situ density for each unbound layer. Record to one decimal place.

METHOD (A,B,or C). Record the test method used to perform the in situ density test as per AASHTO T238-86, "A" - Backscatter, "B" - Direct Transmission, or "C" - Air Gap. The direct transmission method ("B") should always be used.

ROD DEPTH. Record the depth of the nuclear density gauge probe to the nearest tenth of an inch.

IN SITU MOISTURE CONTENT. For each unbound layer, record four in situ moisture content test results. These tests should be conducted at the top of each layer. Record as a percentage moisture content to one decimal place. The backscatter method should always be used for this measurement.

AVERAGE. Calculate and record the average of the four in situ moisture content test results for each unbound layer. Record to one decimal place.

SAMPLING DATA SHEET 9. SHOULDER PROBE LOG

This data sheet is similar to Form S05 used for the GPS test sections. It is used to record the results of the shoulder auger probe to determine the depth to a rigid layer.

OPERATOR. Record the auger equipment operator's name.

EQUIPMENT USED. Indicate the generic type of the auguring equipment used.

AUGERING DATE. Record the month, date, and year the operation was performed.

LOCATION: STATION. This is the station number of the bore, relative to the test section specified under TEST SECTION NO. on the form. This number should be greater than 5+00 for sampling locations that occur after the test section specified, and less than 0+00 for sampling locations which occur before the test section specified. (See discussion under Sample Location Reference System in this document.)

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the center of the auger location (generally measured form the outside edge of the pavement slab). For shoulder probes, this distance will be measured toward the outside edge of the shoulder. This distance should be indicated to the nearest tenth of a foot.

AUGER PROBE NUMBER. Record the auger probe number; an S1 for the first auger and increasing consecutive numbers for subsequent auger probes, in the direction of traffic.

TOP OF ROCK BASED ON. Enter "Auger Refusal" if auger is refused. If the top of rock is based on some other observation describe the source, e.g. historical records.

DEPTH FROM SURFACE. Record the depths of strata changes to the nearest tenth of a foot.

MATERIAL DESCRIPTION. Enter the appropriate material description for each strata based on the generic material type. These material descriptions are contained in Table C.2, Appendix C, of the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing.

MATERIAL CODE. Enter the appropriate material code number for each strata from Table C.2 in the SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing corresponding to described type of material.

REFUSAL WITHIN 20 FEET (Y/N). Record a "Y" for "yes" or a "N" "no" as appropriate to indicate whether or not a rigid layer was encountered within 20 feet from the pavement surface.

DEPTH TO REFUSAL. Record the depth to refusal to the nearest tenth of a foot if the auger refused.

SAMPLING DATA SHEET 10. * NOT USED IN SPS-7 EXPERIMENT *****

SAMPLING DATA SHEET 11. SAMPLING FRESH PORTLAND CEMENT CONCRETE

This data sheet is used to record information concerning sampling of fresh portland cement concrete for LTPP material testing purposes. Sampling shall be performed according to AASHTO T-141, "Sampling Fresh Concrete".

PERSON PERFORMING SAMPLING. Record the name, title and affiliation of the person performing the sampling.

SAMPLING LOCATION. Enter the code number shown on the data form corresponding to the location from which the sample was taken.

SAMPLE NUMBER. This is a 4 digit code starting with the letters FC (Bulk Portland Cement Concrete) and followed with a sequentially assigned two digit number, which uniquely designates each bulk portland cement concrete sample.

PCC MIX TEMPERATURE WHEN SAMPLED. Enter the temperature in degrees Fahrenheit of the sampled PCC mix.

AMBIENT TEMPERATURE WHEN SAMPLED. Enter the ambient temperature in degrees Fahrenheit when the material sample was obtained.

SPECIMEN NUMBER. This is a 4 digit code starting with the letters FP (Formed Beams of Portland Cement Concrete) or GP (Formed Cylinders of Portland Cement Concrete) and followed with a sequentially assigned two digit number, which uniquely designates each formed bulk portland cement concrete beam or cylinder specimen.

TIME. Enter the time of day when the specimen was formed.

TEMPERATURE. Enter the temperature of the formed PCC specimen.

SLUMP. Enter the slump test results of the sampled material, if tested.

AIR CONTENT. Enter the air content of the sampled material, if tested.

DATE SHIPPED. Enter the date the material was shipped to the laboratory indicated on the form.

GENERAL REMARKS. Provide any general remarks concerning the representativeness of the obtained sample, comments concerning the quality or uniformity of the mix, or any other pertinent miscellaneous comments.

FIELD OPERATION INFORMATION FORM 1. LABORATORY SHIPMENT SAMPLES INVENTORY

This form is intended to provide a record of field activity and no information from this form will be included in the data base. This form is similar to Form SO6 used for GPS test sections, and provides the necessary information on where each sample was shipped for testing. Also, it provides a detailed inventory of material samples shipped to each materials testing laboratory. At least one form should be completed for each sampling area on the project. The inventory should be made in the following sequence of sample location numbers, starting from the pavement surface layer in each case.

1. Samples from C-Type locations, starting from cores of pavement surface layers.
2. Samples from A-Type bore holes and any additional similar bore holes.
3. Samples from BA-Type bore holes and any additional similar bore holes.
4. Samples from test pits.

Sample location numbers, sample numbers and sampling area numbers should be obtained from the appropriate Sampling Data Sheets. "Sample size" should be used to record the number of bags of bulk samples or the number of jar samples bearing a single sample number in each case. The bulk sample from one layer can be placed in more than one bag, if necessary. However, the sample number should be the same on all of these bags with an indication of the number of bags on the labels and in the column of the "Sample size." For core samples, record only diameter of the core in the "Sample size" column in inches.

Enter core, bulk, moisture, tube or splitspoon in the "Sample type" column as appropriate. Enter AC, PCC, Base, Subbase or Subgrade in the "Sample material" column as appropriate. The "Sample condition" should indicate a brief

description as to the overall quality of the sample - cores: good, poor, fractured; bulk samples: satisfactory, wet, insufficient quantity, contaminated.

Since more than one laboratory may be used to test samples in the SPS program, room is provided on this form to indicate up to three laboratories to receive samples from each sampling area. Enter the laboratory number, as noted at the bottom of the form, to which each sample is sent in the LAB column. Typically, samples will include:

- All PCC cores from C-Type, A-Type, and BA-Type locations.
- All treated base/subbase cores (including ATB, CTB and econocrete) of 4-inch diameter from C-Type locations.
- Bulk samples and jar samples of granular (untreated) layers and subgrade from BA-Type locations and test pits.
- Thin-walled tube samples and splitspoon samples from the subgrade.

FIELD OPERATION INFORMATION FORM 2. SUMMARY OF MATERIAL SAMPLES SENT TO EACH LABORATORY

This form provides a summary of the information provided on Field Operations Information Form 1 by testing laboratory. It is similar to Form S06A used for GPS test sections. A separate form should be completed for each set of samples sent to each separate laboratory.

This form requires that the samples be listed according to the layer number of their source. The layer number is assigned from the bottom (subgrade) to the pavement surface. Enter the layer number in the left hand column, starting with layer number 1 for the subgrade and increasing each layer number with the next layer. The last layer number should be assigned to the pavement surface layer. A description of the pavement layer material and sample type is provided in the next column on the right, followed by the total number of samples by sample type.

FIELD OPERATION INFORMATION FORM 3. LABORATORY SHIPMENT SAMPLES INVENTORY - MOLDED CONCRETE

This form is intended to provide a record of the field activity related to fresh PCC sampling and molding of PCC test specimens. No information from this form will be included in the data base. The form provides a detailed inventory of PCC samples shipped to the materials testing laboratory. One form should be completed for all fresh PCC sampling at the test site. Sample location, sample numbers and sampling area numbers should be obtained from Sampling Data Sheet 11.

The bottom portion of this form "MOLDED PCC SPECIMENS SENT TO LABORATORY" provides for the total number of molded cylinder and beams. This form requires that the samples be listed according to the layer number of their source. The layer number is assigned from the subgrade to the surface. Enter the layer number in the left hand column. A description of the specimen type is provided in the next column on the right, followed by the total number of samples by sample type.

OTHER GPS DATA FORMS

Other Field Materials Sampling and Testing data forms used for GPS test sections not referenced in this document should not be completed for the SPS activity. These forms include S07, S08, S09, S10, S11, S12, S13, S14A, S14B, S15A, S15B, S16A, and S16B.

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
PAVEMENT CORE LOG AT BOREHOLE LOCATIONS
SAMPLING DATA SHEET 1

SHEET NUMBER _____ OF_____

RP REGION _____ STATE _____ *STATE CODE* __ __
U.S EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ EQUIPMENT USED_____ *CORING DATE*___-___-___
SAMPLING AREA NO. SA-_____ *LOCATION: STATION*_____ *OFFSET*_____*feet from °/s*
CORE HOLE NUMBER _____ *CORE BARREL SIZE*_____(in. Inside Diam.) Cooling Medium_____

Scale (Inches)	*Depth (Inches)*	Core Recov. (Inches)	*Core Sample No.*	*Material Description*	*Material Code*
0					
5					
10					
15					
20					
25					

Note: "Depth" should be measured from the top of the pavement surface to the bottom of the cores of each layer and recorded to the nearest tenth of an inch.

GENERAL REMARKS:_____

CERTIFIED _____ VERIFIED AND APPROVED _____ DATE __ __-__ __-19__ __

eld Crew Chief SHRP Representative Month- Day - Year
Affiliation:_____ Affiliation:_____

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
PAVEMENT CORE LOG AT C-TYPE CORE LOCATIONS
SAMPLING DATA SHEET 2

SHEET NUMBER _____ OF _____

HRP REGION _____ STATE _____ *STATE CODE* __ __
_PS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ EQUIPMENT USED_____ *CORING DATE* ___-___-___

SAMPLING AREA NO SA-_____ CORE BARREL: Tip Type_____ Cooling Medium_____

Note: Record information for all cores extracted from each core hole in one column in the table below. Use a separate sheet for each sampling area. "Depth" should be measured from the pavement surface to the bottom of the core and recorded to the nearest tenth of an inch.

CORE HOLE NUMBER						
LOCATION: (a) STATION						
(b) OFFSET (Feet, O/S)						
Core Recovered?	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*
Replacement Core Hole No.						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks						

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED DATE

_____ _____ ____-____-19___

ield Crew Chief SHRP Representative Month- Day- Year
ffiliation:_____ Affiliation:_____

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
A-TYPE BORE HOLE LOG
SAMPLING DATA SHEET 4

SHEET NUMBER _____ OF _____

RP REGION _____ STATE _____ *STATE CODE* __ __
GLS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ EQUIPMENT USED_____ *BORING DATE*___-___-___
SAMPLING AREA NO: SA-_____ *LOCATION: STATION*_____ *OFFSET*_____ *feet from °/s*
*BORE HOLE NUMBER:*_____ *BORE HOLE SIZE:* _____ (inch Diam.)

Scale (Inches)	*Strata Change (Inches)*	*Sample Number* (1)	*#Blows*(2) 6"	6"	6"	*Ref? Y/N* (3)	*DLR (Inches)* (4)	*IOP* (5)	*Material Description*	*Material Code*
10.0										
20.0										
30.0										
40.0										
50.0										
60.0										
70.0										
80.0										
90.0										
100.0										

1. Record sample numbers for splitspoon/thin-walled tube samples taken from the subgrade.
2. For splitspoon samples, record the number of blows for the first, second and third 6 inches of penetration.
3. *Refused* - If the splitspoon is refused, place a Y in the *REFUSAL* column and complete *Driving Length To Refusal* column. Refusal is defined as less than 1 inch of penetration with 100 blows.
4. *Driving Length To Refusal* - Record penetration to refusal of splitspoon from the top of the pavement surface.
5. *Inches Of Penetration* - Record from start of splitspoon sampling procedure if 100 blows is reached before one foot of penetration. If penetration exceeds 12 inches before 100 blows is reached, enter middle 6 inches plus depth of penetration into the last 6 inches when 100 blows was reached (not including seating drive); record to nearest tenth of an inch.

GENERAL REMARKS:_____

CERTIFIED _____ VERIFIED AND APPROVED _____ DATE _____-_____-19___

ld Crew Chief SHRP Representative Month- Day- Year
liation:_____ Affiliation:_____

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
BA-TYPE BORE HOLE LOG
SAMPLING DATA SHEET 5

SHEET NUMBER _____ OF _____

RP REGION _____ STATE _____ *STATE CODE* __ __
__S EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ EQUIPMENT USED_____ *BORING DATE*___-___-___
SAMPLING AREA NO: SA-_____ *LOCATION: STATION*_____ *OFFSET*_____ *feet from °/s*
*BORE HOLE NUMBER:*_____ *BORE HOLE SIZE:* _____ (inch Diam.)

Scale (Inches)	*Strata Change (Inches)*	*Sample Number* (1)	*Moisture Sample Number* (2)	*Material Description*	*Material Code*
_____					
_10.0__					
_____					
_20.0__					
_____					
_30.0__					
_____					
_40.0__					
_____					
_50.0__					
_____					
_60.0__					
_____					
_70.0__					
_____					
_80.0__					
_____					
_90.0__					
_____					
_100.0_					

1. Record sample numbers for bulk samples taken from unbound layers and the subgrade.
2. Record sample numbers for samples taken from unbound base, subbase and subgrade for moisture content testing.

GENERAL REMARKS:_____

CERTIFIED _____
Field Crew Chief
liation:_____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation:_____

DATE
_____-_____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
TEST PIT LOG
SAMPLING DATA SHEET 6

SHEET NUMBER _____ OF _____

HRP REGION _____ STATE _____ *STATE CODE* __ __
PS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

TECHNICIAN_____ EQUIPMENT _____ *EXPLORATION DATE*___-___-___
SAMPLING AREA NO: SA-_____ *LOCATION: STATION*_____ *OFFSET*_____*feet from °/s*
*TEST PIT NUMBER*_____ *PIT SIZE:* (a) *Length*_____feet (b) *Width*_____feet

Scale (Inches)	*Strata Change (Inches)*	*Moisture Sample No.*	*Bulk Sample No.*	*Material Description*	*Material Code*
4					
8					
12					
16					
0					
24					
28					
32					
36					
40					
44					
48					

GENERAL REMARKS:_____

CERTIFIED _____
ield Crew Chief
ffiliation:_____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation:_____

DATE
____-____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
TEST PIT SKETCH
SAMPLING DATA SHEET 7

SHEET NUMBER _____ OF _____

SHRP REGION _____ STATE _____ *STATE CODE* __ __
SPS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

TECHNICIAN_____ EQUIPMENT _____ *EXPLORATION DATE*___-___-___
SAMPLING AREA NO: SA-_____ *LOCATION: STATION*_____ *OFFSET*_____*feet from* °/s
*TEST PIT NUMBER*_____ *PIT SIZE:* (a) *Length*_____feet (b) *Width*_____feet

This form is to be used to sketch the test pit as it was sampled. Show the dimensions of the test pit, the depth of each layer and the material type for each layer. Sketch the direction of traffic on the test pit illustration with an arrow in the direction of traffic.

GENERALREMARKS:_____

CERTIFIED _____ Field Crew Chief Affiliation:_____

VERIFIED AND APPROVED _____ SHRP Representative Affiliation:_____

DATE _____-____-19___ Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
IN SITU DENSITY AND MOISTURE TESTS
SAMPLING DATA SHEET 8

SHEET NUMBER _____ OF _____

IRP REGION _____ STATE _____ *STATE CODE* __ __
?S EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ *NUCLEAR DENSITY GAUGE I.D.*_____ *TEST DATE*___-___-____
SAMPLING AREA NO: SA-_____ *LOCATION: STATION*_____ *OFFSET*_____*feet from °/s*
*TEST PIT NO:*_____ DATE OF LAST MAJOR CALIBRATION___-___-___
Note: Use additional sheets if necessary

DEPTH FROM SURFACE TO THE TOP OF THE LAYER, INCHES (See Sheet 5)						
LAYER DESCRIPTION						
MATERIAL TYPE: (Unbound-G Other-T)						
IN SITU DENSITY, pcf 1						
2						
3						
(AASHTO T238-86) 4						
AVERAGE						
Method (A,B,or C)						
Rod Depth, inches						
IN SITU MOISTURE CONTENT, % 1						
2						
3						
(AASHTO T239-86) 4						
AVERAGE						

GENERAL REMARKS:_____

CERTIFIED _____
Field Crew Chief
ffiliation:_____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation:_____

DATE
_____-_____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
SHOULDER PROBE LOG
SAMPLING DATA SHEET 9

SHEET NUMBER _____ OF _____

SHRP REGION _____ STATE _____ *STATE CODE* __ __
S EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
UTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

OPERATOR_____ EQUIPMENT USED_____ *AUGERING DATE*___-____-____
*AUGER PROBE NUMBER*_____ *LOCATION STATION:*_____ *OFFSET:*_____*feet from °/s*
TOP OF ROCK BASED ON:_____

Scale (feet)	*Depth from Surface (Feet)*	*Material Description*	*Material Code*
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

*REFUSAL WITHIN 20 FEET (Y/N):*_____ *DEPTH TO REFUSAL:*_____*(FEET)*

GENERAL REMARKS:_____

CERTIFIED
_____
Field Crew Chief
Affiliation:_____

VERIFIED AND APPROVED
_____
SHRP Representative
Affiliation:_____

DATE
____-____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING SHEET NUMBER _____ OF _____

SAMPLING FRESH PORTLAND CEMENT CONCRETE MIXTURES

SAMPLING DATA SHEET 11

LTPP REGION _____ STATE _____ STATE CODE __ __

EXPERIMENT NUMBER _____ SPS PROJECT CODE __ __

ROUTE/HIGHWAY_____ Lane_____ Direction_____ TEST SECTION NO. __ __

FIELD SET NO. __

PERSON PERFORMING SAMPLING

NAME _____ EMPLOYER _____

TITLE _____

SAMPLING LOCATION [__]

Batch Plant ..... 1 Hauling Truck before Paving 2

Hauling Truck during Paving ..... 3 Paver 4

Other ..... 5 (specify) _____

SAMPLE NUMBER [__ __ __ __]

PCC MIX TEMPERATURE WHEN SAMPLED (°F) [__ __ __]

AMBIENT TEMPERATURE WHEN SAMPLED (°F) [__ __ __]

TIME SAMPLED (Military Time) [__ __ __ __]

DATE SAMPLED (Month - Day - Year) [__ __ - __ __ - __ __]

SPECIMENS FORMED FROM SAMPLE	SPECIMEN NUMBER
CYLINDERS	[G X __ __]
	[G Y __ __]
	[G Z __ __]
BEAMS	[F P __ __]

LABORATORY ID CODE [__ __ __ __]

DATE SHIPPED [__ __ - __ __ - __ __]

NOTES : X denotes 14 day cure Y denotes 28 day cure Z denotes 365 day cure

GENERAL REMARKS:_____

_____

_____

CERTIFIED VERIFIED AND APPROVED DATE

_____ _____ _____-____-19___

Field Crew Chief SHRP Representative Month- Day- Year

Affiliation:_____ Affiliation:_____

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
LABORATORY SHIPMENT SAMPLES INVENTORY
FIELD OPERATIONS INFORMATION FORM 1

SHEET NUMBER _____ OF _____

SHRP REGION _____ STATE _____ *STATE CODE* __ __
SPS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

SAMPLING AREA No: SA- _____ FIELD WORK COMPLETED ON ____-____-____

Note: Use a separate form for each sampling area. Use additional sheets if necessary. Include summary information (Field Operations Information Form 2) and "as actual" sampling location plan sheets with this material samples inventory.

SAMPLE LOCATION	SAMPLE NUMBER	SAMPLE SIZE	SAMPLE TYPE	SAMPLE MATERIAL	SAMPLE CONDITION	LAB*

* Enter number of laboratory, as specified below, each sample was sent to:

Lab No.(1) _____
Lab No.(2) _____
Lab No.(3) _____

GENERAL REMARKS: _____

CERTIFIED _____
Field Crew Chief
Affiliation: _____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation: _____

DATE ____-____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
SUMMARY OF MATERIAL SAMPLES SENT TO EACH LABORATORY
FIELD OPERATIONS INFORMATION FORM 2

SHEET NUMBER _____ OF _____

SHRP REGION _____ STATE _____ *STATE CODE* __ __
SPS EXPERIMENT NO _____ *SPS PROJECT CODE* __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ *TEST SECTION NO.* __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section *FIELD SET NO.* __

LABORATORY _____ WORK COMPLETED ON ____-____-____

NOTE: This is a summary of material samples sent to each laboratory based on the information from Field Operations Information Form 1. Complete one form for each laboratory that material samples were sent.

LAYER NO. (From Subgrade)	MATERIAL/SAMPLE TYPE		TOTAL NUMBER OF SAMPLES
_____	AC CORES:	4" Diameter_____ 6" Diameter_____ 12" Diameter_____	
		AC Cores with Bound Base/Subbase	_____
		AC Cores with PCC	_____
		AC Cores with PCC and Bound Base/Subbase	_____
		PCC Cores with Bound Base/Subbase	_____
_____	AC MIX BULK SAMPLES:	Fifty Pound Samples - Virgin	_____
		Recycled	_____
_____	PCC CORES:	4" Diameter_____ 6" Diameter_____	
_____	PCC BEAMS:		_____
_____	BOUND BASE CORES:	4" Diameter_____	
_____	UNBOUND BASE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
_____	BOUND SUBBASE CORES:	4" Diameter_____	
_____	UNBOUND SUBBASE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
1	SUBGRADE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
		(c) THIN-WALLED TUBES_____ (d) SPLITSPOON _____ JARS	

GENERAL REMARKS: _____

CERTIFIED

_____
Field Crew Chief
Affiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation:_____

DATE

_____-____-19___
Month- Day- Year

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING SHEET NUMBER _____ OF _____

LABORATORY SHIPMENT SAMPLES INVENTORY - MOLDED CONCRETE

FIELD OPERATIONS INFORMATION FORM 3

.P REGION _____ STATE _____ STATE CODE __ __

SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __

ROUTE/HIGHWAY_____ Lane_____ Direction_____ TEST SECTION NO. __ __

FIELD SET NO. __

FIELD WORK COMPLETED ON ____-____-____

Note: Use one form for all fresh PCC samples collected for all sampling areas. Use additional sheets if necessary. Include "as actual" sampling location plan sheets with this material samples inventory.

SAMPLE LOCATION	SPECIMEN NUMBERS OF MOLDED SPECIMENS

LABORATORY ID CODE [__ __ __ __]

MOLDED PCC SPECIMENS SENT TO LABORATORY

LAYER NO. (From Subgrade)	SPECIMEN TYPE	TOTAL NUMBER OF SAMPLES
_____	PCC Molded Cylinders	_____
_____	PCC Molded Beams	_____

GENERAL REMARKS:_____

_____

_____

TIFIED

_____

Field Crew Chief

Affiliation:_____

VERIFIED AND APPROVED

_____

SHRP Representative

Affiliation:_____

DATE

_____-____-19___

Month- Day- Year