U.S. Department of Transportation
Federal Highway Administration

Pavement Performance Division
Long-Term Pavement Performance Program

Specific Pavement Studies
Materials Sampling and Testing Requirements
Experiment SPS-9A
SUPERPAVE™ Asphalt Binder Study

Federal Highway Administration
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PREFACE

Guidelines for development and implementation of a material sampling and testing program for each test site included in the Specific Pavement Studies (SPS), experiment 9A, (SPS-9A), SUPERPAVE™ Asphalt Binder Study are presented in this document. These guidelines should be followed by the FHWA-LTPP Regional Coordination Office Contractor (RCOC) to develop a material sampling and testing plan tailored to each SPS-9A project. The plan should be presented in a bound document prepared by the LTPP RCOC prior to the start of construction. The FHWA-LTPP RCOC office and the participating highway agency must coordinate all materials field sampling and testing activities to obtain the needed samples, data and test results.

Performance of the field materials sampling and testing should be performed with the guidelines presented in this report and those contained in **SHRP-LTPP Guide for Field Material Sampling, Testing and Handling**. All laboratory testing should conform to the guidelines contained in the **SHRP-LTPP Guide for Laboratory Material Handling and Testing**.

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1. Introduction

Guidelines for the development and implementation of a material sampling and testing program for Specific Pavement Studies (SPS) 9A experiment test sections are presented in this document. These guidelines must be followed by the FHWA-LTPP Regional Coordination Office Contractor (RCOC) to develop a material sampling and testing plan tailored to the conditions encountered on each project.

1.1 SPS-9A Experiment

The SPS-9A experiment is the first part of a multi-stage approach to validation of the Strategic Highway Research Program's (SHRP) SUPERPAVE™ Asphalt Binder Study. The objectives of the SPS 9A experiment are:

- Evaluate and improve the practical aspects of implementing the SUPERPAVE™ system through a hands-on field trail by interested highway agencies.
- Comparison of the performance of the SUPERPAVE™ mixes against mixes designed with current highway agencies' asphalt specifications, asphalt-aggregate specifications and mix design procedure.
- To provide long-term performance data for evaluation and refinement of the SUPERPAVE™ specifications, design procedures and models.
- Test the sensitivity of the SUPERPAVE™ asphalt binder specification relative to low temperature cracking, fatigue, or permanent deformation distress factors.
- Provide highway agencies the opportunity to evaluate the performance of other experimental features by the construction of supplemental sections.

The SPS-9A experiment requires construction of a minimum of three test sections at each project site. Construction can include new construction, reconstruction or overlay The minimum three test sections consist of:

Section 01. Highway agencies' standard mix.
Section 02. SUPERPAVE™ designed standard mix
Section 03 SUPERPAVE™ mix with alternate binder.

Since this is a material comparison study, the pavement structure and thicknesses of the layers containing the experimental mixtures should be the same on all test sections Agencies are encouraged to take the opportunity afforded by construction of these experimental test sections whose performance will be uniformly monitored over the long-term, to construct supplemental sections investigating experimental factors of specific agency interest.

To test the sensitivity of the SUPERPAVE™ asphalt binder specification relative to distress factors, the alternate binder for test section 03 is defined as a binder with a grade either higher or lower than the required SUPERPAVE™ binder such that the performance characteristic of interest relative to the climate and pavement structure (either fatigue, low temperature or permanent deformation) may be expected to exhibit deterioration earlier in the service life of the pavement relative to the SUPERPAVE™ designed standard mix section (test section 02).

1.2 Materials Sampling and Testing Overview

A materials sampling and test plan must be developed for each project to characterize the unique engineering properties of the paving materials and the pavement structure on all experimental test sections constructed. The materials sampling and testing plan must be designed to quantify material variations between test sections The criteria for selecting test section locations require that all test sections at each site have the same structural cross section and be constructed of the same materials under the same contract. To accommodate likely deviations from this and other established criteria, the test plan must be devised so that all known or suspected variations can be characterized. Generally, 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 and other soils information can help determine the location of cut/fill sections and possible variations in subgrade materials.

The following general process is used to obtain and report the necessary materials information from SPS-9A projects:

1. Review of project site layout and soil profile logs Variations in the subgrade material, embankments, or other material related pavement features should be identified.

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

3 Development of a field sampling plan report. This report should specify sampling area locations, type and number of material samples from each location, and include a tracking table that specifies all tests and testing sequence to be performed on each sample. This report should be submitted to the FHWA for review prior to implementation

4. Field sampling and testing of materials. All field tests and sampling must be performed in accordance with LTPP standard protocols and reported on standard LTPP data forms Adjustments to the sampling and testing plan made

in the field must be recorded and a modified sampling and testing report produced.

5. Testing of material samples in the laboratory. All test must be performed in accordance with LTPP test protocols and reported on standard LTPP data forms.

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 Information Management System (NIMS).

1.3 Reference Documents

The following documents serve as reference to other aspects of the SPS-9 study and LTPP procedural guidelines.

Specific Pavement Studies, Experimental Design and Research Plan for Experiment SPS-9A, SUPERPAVE™ Asphalt Binder Study, Federal Highway Administration, January 1995.

Specific Pavement Studies, Construction Guidelines for Experiment SPS-9A, SUPERPAVE™ Asphalt Binder Study, Federal Highway Administration, August, 1994.

Specific Pavement Studies, Guidelines for Nomination and Evaluation of Candidate Projects for Experiment SPS-9A, SUPERPAVE™ Asphalt Binder Study, Federal Highway Administration, August, 1994.

SHRP-LTPP Guide for Field Materials Sampling, Handling, and Testing, Operational Guide No SHRP-LTPP-OM-006, Strategic Highway Research Program, National Research Council, May 1990.

SHRP-LTPP Interim Guide for Laboratory Materials Handling and Testing, Strategic Highway research Program, National Research Council, Revised July, 1993

Specific Pavement Studies, Pavement Layering Methodology, Federal Highway Administration, Long-Term Pavement Performance Division, January, 1994

2. Material Sampling and Testing Requirements

2.1 General

The material sampling and testing guidelines presented in this document are based on the minimum three test sections specified in the experimental design. As shown in Figure 1, these sections include a design based upon the highway agency's standard hot mix asphalt (HMA) mixture design, SUPERPAVE™, and using a SUPERPAVE™ mixture with a SHRP binder grade either higher or lower than required by the SUPERPAVE™ design method. If additional or supplemental test sections are constructed, the tests performed on these samples must be made to provide equivalent information as appropriate.

Test sections may consist of new/re-construction or overlay projects. Sampling and testing of materials on project involving new construction or complete reconstruction of the pavement structure can be performed as each layer is constructed. On overlay projects, coring and auguring must be used to obtain samples of the existing materials. Sampling of the existing pavement materials on overlay projects can be performed prior to placement of the overlay, or after.

The scope of the field material sampling and tests to be performed on SPS 9A projects includes:

Subgrade

- Bulk sampling of the subgrade for material classification tests
- Elevation survey on prepared surface for new/re-construction
- Auger probe 6 m below the surface to detect the presence of a rigid layer
- In situ density and moisture measurements for new/reconstruction.

Base Layers

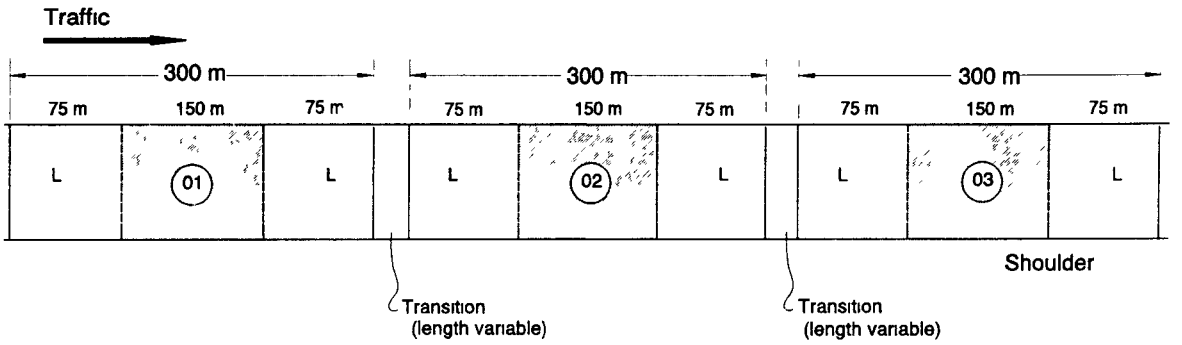
- Visual material classification
- Bulk sampling for material classification tests (New/Reconstruction Projects)
- Layer thickness measurement
  - from cores of bound base
  - from auger holes in unbound base
  - from elevation measurements for new/re-construction
- In situ density and moisture measurements for new/reconstruction.

Existing Pavement Surface Layer (Overlays)

- Coring for thickness measurement and visual damage assessment
- In situ density measurement.

New HMA Surface Layer

- Bulk samples of the HMA mix
- Bulk samples of the unmixed HMA binder and aggregates
- Coring of the HMA layer for laboratory testing



LEGEND

(01) Agency mix design test section

(02) SUPERPAVE mix design test section

(03) SUPERPAVE Alternate Binder test section

L - Sampling area

Figure 1. SPS-9A test section layout

- Before and after elevation measurements to determine layer thickness
- In situ density measurement.

The specifics of the location and amount of samples, field tests, and laboratory tests to be performed, are presented in the remaining portion of this document.

2.2 Sampling and Field Testing Plan

When developing the field sampling plan for a SPS-9A site, it is imperative that a sufficient type and amount of samples be obtained to ensure completion of all test procedures. Therefore, a laboratory testing plan 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 in a format similar to that shown later in this document. In addition to the laboratory tests required to characterize the materials used in the SPS test sections, other tests may be required to characterize the properties of materials used on the supplemental test sections constructed at the test site. The laboratory and field test plan should address the testing requirements for both the primary SPS experiment test sections and other supplemental test sections.

The site specific field material sampling, field testing, and laboratory testing plan for each SPS-9A site should include the following elements:

- Project layout plan
- Detailed sampling layout
- Detailed field testing layout
- Laboratory testing plan
- Sample tracking tables specifying the sequence of test to be performed on each material sample

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

The sampling and field testing layout plans are used to identify the location of testing and sampling areas relative to the test sections for each sampling and testing activity. Since sampling and testing is required for each material layer, layouts must be developed for each layer i.e prepared subgrade, base course, surface course, and/or overlay The approximate transition lengths between test sections should be indicated on the plan.

To ensure consistency in data reporting, a detailed pavement layer structure should be developed prior to sampling and testing for the entire SPS project (termed "Project Level") and for each individual pavement section (termed "Section Level"). In the Project Level scheme, each unique layer is designated by a letter of the alphabet. An example project level layer structure is shown in Table 1 for a newly constructed SPS-9A project.

Table 1. Example project layer numbering scheme

Project Layer Code	Material Code	Comments
A	104	Natural Soil
B	107	Embankment
C	303	Dense Graded Aggregate Base
D	319	Dense Graded Asphalt Treated Base
E	01	HMA Binder Course
F	01	HMA Surface Course

The first issue in developing a layer number scheme is the designation of subgrade and embankment material. If a project or test section is located on fill material, then the project layer numbering shall contain an embankment layer.

It must be noted that if a fill (embankment) layer is present and is greater than 1.2 m in thickness, the natural subgrade will **NOT** be sampled or tested. The fill (embankment) layer **only** will be sampled and tested as if it were the natural subgrade.

The layering for the bound and unbound bases and subbases is rather straight forward. However, if any test section is located on a treated subgrade layer, this is considered a treated subbase layer in the project layering table.

The hot mix asphalt surface course may contain two (or more) layers. If the entire surface course is comprised of the same mix design, then only one layer code is needed to represent the layer. However, if the hot asphalt mix layer is comprised of a surface and binder course which have different mix composition (asphalt content, aggregate gradation, etc.) then these must be treated as two separate layers and coded and sampled accordingly. It should be noted that multiple **lifts** of the same material **shall not** be identified as separate layers.

After the project level layering is completed, each individual test section will use the appropriate project layer codes to designate their layer structure. Table 2 contains an example pavement layer structure.

The establishment of this project and test section level layer structure is essential to maintain consistency within the project. These layer numbers will follow the project and each test section throughout the field sampling and laboratory testing programs. Details of the proper procedures to be used to perform this layering activity can be found in the latest version of the **Specific Pavement Studies, Pavement Layering Methodology** report, previously referenced.

2.3 Subsurface Layers

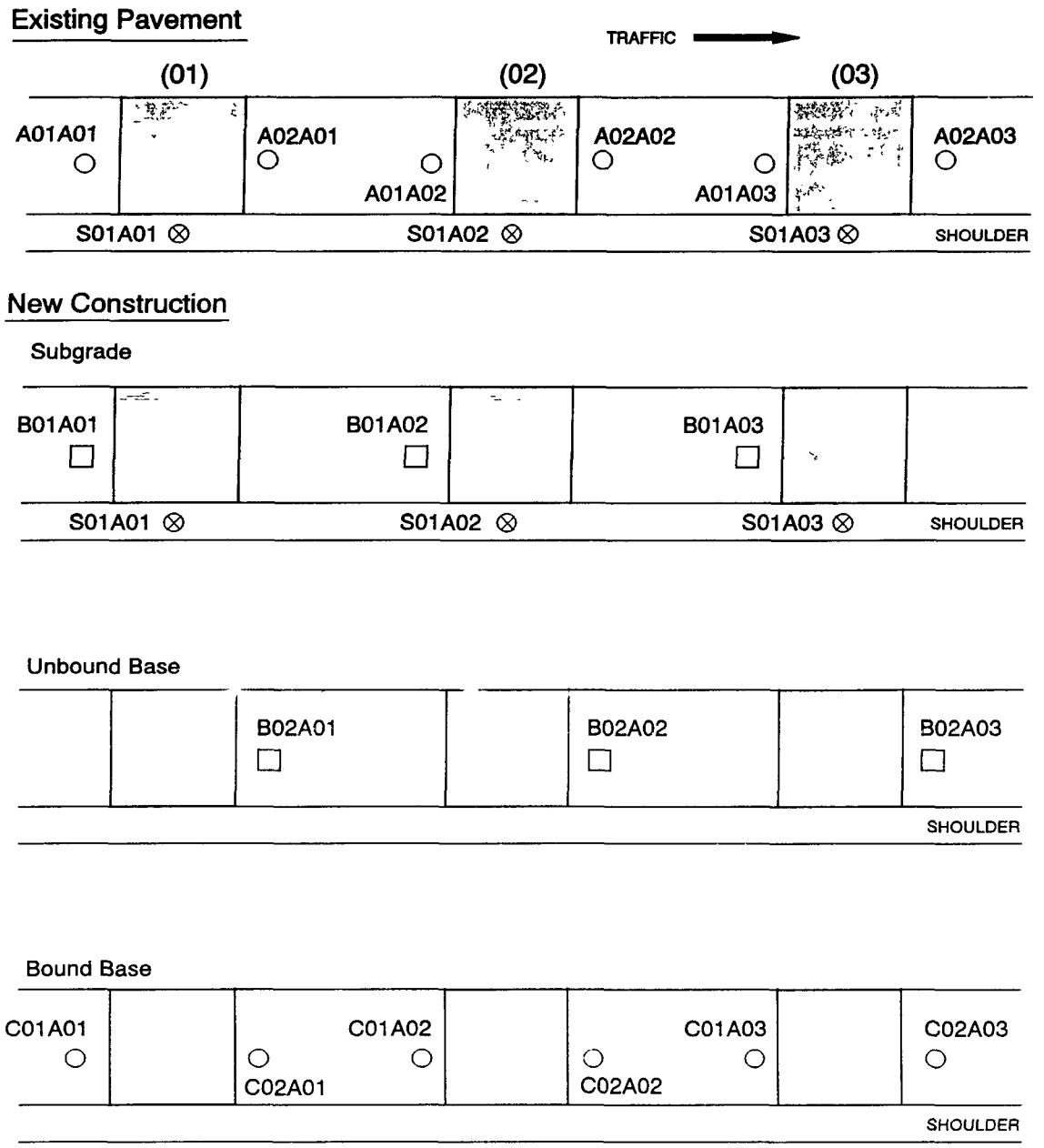
Figure 2a presents a layout for sampling to be performed on the material layers below the experimental HMA surface layer The tests to be performed on these materials are presented in Table 3. The laboratory and field testing procedures, number of tests and the location reference for the test samples are shown in this table.

2.3.1 Subgrade

The subgrade is the natural soil under the pavement structure This is always designated as layer 1. An embankment is fill material placed on top of the naturally occurring subgrade If the embankment layer is greater than 1.2 m thick, the embankment material should be sampled and tested in accordance with the instructions contained in this document for subgrade. In this situation, samples or tests are not required to be performed on the subgrade beneath the embankment layer. If the thickness of the embankment varies

Table 2. Example test section layer numbering scheme

LAYER NUMBER	PROJECT LAYER CODE	LAYER THICKNESS (INCHES)	MATERIAL CODE	COMMENT
1	A	N/A	104	Natural Soil
2	C	4	303	Dense Graded Aggregate Base
3	D	8	319	Dense Grade Asphalt Treated Base
4	E	4	01	HMA Binder Course
5	F	3	01	HMA Surface Course



○ A-type core locations - 150mm dia. core of bound layers, auger to top of subgrade, retrieve base materials, auger to 1.2m below top of subgrade, obtaining cuttings

○ C type core locations - 150mm dia. core of bound layers

⊗ Shoulder auger probe to 6m below surface

□ Bulk sample locations - 0.6m x 0.6m x 0.3m below surface

Figure 2a. Sampling of layers below the final surface layer

Table 3. Sampling and testing of subsurface layers to be performed by participating highway agency

Test Type	LTPP Designation	LTPP Protocol	Minimum No. of Tests	Sample Designation
New/Re-Construction				
Subgrade Soils				
Sieve Analysis	SS01	P51	3	B01A01,B01A02,B01A03
Atterberg Limits	SS03	P43	3	B01A01,B01A02,B01A03
Classification	SS04	P52	3	B01A01,B01A02,B01A03
Natural Moisture Content	SS09	P49	3	B01A01,B01A02,B01A03
Depth to Rigid Layer		Note 1	3	S01A01,S01A02,S01A03
In Situ Density/Moisture			3 per section	See Figure 2b.
Base Course				
Particle Size Analysis	UG01	P41	3	B02A01,B02A02,B02A03
Sieve Analysis (Washed)	UG02	P41	3	B02A01,B02A02,B02A03
Atterberg Limits	UG04	P43	3	B02A01,B02A02,B02A03
Classification	UG08	P47	3	B02A01,B02A02,B02A03
In Situ Density/Moisture			3 per section	See Figure 2b.
Core Examination/Thickness (bound base)	AC01/TB01	P01/P31	6	C01A01,C02A01,C01A02, C02A02,C01A03,C02A03
Surface Course				
In Situ Density			3 per section	See Figure 2b.
Existing Pavement (Overlay Construction)				
Existing Surface Layers				
In Situ Density			3 per section	See Figure 2b.
Core Examination/Thickness	AC01/PC06	P01/P66	6	A01A01,A02A01,A01A02, A02A02,A01A03,A02A03
Subgrade				
Sieve Analysis	SS01	P51	3	A01A01,A01A02,A01A03
Atterberg Limits	SS03	P43	3	A01A01,A01A02,A01A03
Classification	SS04	P52	3	A01A01,A01A02,A01A03
Natural Moisture Content	SS09	P49	3	A01A01,A01A02,A01A03
Depth to Rigid Layer		Note 1	3	S01A01,S01A02,S01A03
Base/Subbase				
Classification (Unbound base field only)		Note 2	3	A02A01,A02A02,A02A03
Core Examination/Thickness (bound base)	AC01	P01	6	A01A01,A02A01,A01A02, A02A02,A01A03,A02A03

1 Follow procedures contained in Appendix C of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling

2 Visually classify materials in accordance with Appendix C of the SHRP-LTPP Guide for Field Materials Sampling Testing and Handling.

beneath the test section, engineering judgement must be used to decide if samples material classification tests should be performed on samples from both the subgrade and embankment layers. Treated subgrade should be classified and treated as a subbase layer for materials sampling and testing purposes.

2.3.1.1 Bulk Samples

Bulk samples of the subgrade should be obtained adjacent to the ends of the test sections in the general locations indicated in Figure 2a. One bulk sample should be obtained for each section. Bulk samples should consist of a minimum of 25 kg obtained from the prepared surface of the subgrade on new/re-construction projects. If the maximum aggregate or particle size is greater than 76 mm, then a 65 kg size sample should be obtained. For existing pavements, A-type auger sampling locations will be used to obtain bulk material samples from the auger cuttings. A-type sampling locations consist of a 150 mm diameter core through the bound layers and auguring of the underlying unbound base and subbase materials to depth of 1.2 m below the top of the natural subgrade or fill embankment material directly beneath the base and/or subbase layers. If rock, boulders or other forms of dense material are encountered within 1.2 m of the top of natural subgrade or fill, another attempt for sampling the subgrade shall be made at a different location with a longitudinal offset 1.5 to 3 m. If rock, boulders or refusal is encountered at the second location, sampling shall be terminated. The sampling operation should be performed following the procedures contained in Section 3.5 of the **SHRP-LTPP Guide for Field Materials Sampling**.

For each bulk sample obtained, two jar samples of the material from the bulk sample should be obtained for laboratory moisture measurements The jar samples shall be placed in the bulk sample bags prior to the bags being tied shut.

2.3.1.2 Shoulder Auger Probes

Auger probes through the shoulder to a depth of 6 m below the surface of the prepared subgrade or embankment should be performed at the locations shown in Figure 2a The purpose of these probes are to determine if bedrock or other very dense layers exist within this depth below the pavement. This information is needed for proper interpretation of deflection measurements. Auguring should be performed using a continuous flight, helical auger greater than 100 mm in diameter. If the bedrock or other very dense layer of material occurs at less than 6 m, auguring operations must be terminated and reported. Refusal caused by the presence of cobbles, boulders, etc. should not be reported as bedrock or a dense/stiff layer.

2.3.1.3 Elevation Survey

On all projects, elevation surveys should be performed to determine the thickness of each pavement layer Measurements should be performed at stations spaced on 15 m intervals from the start to the end of the monitoring portion of the test section. At each elevation survey station, measurements should be performed at offsets of 0, 0.9, 1.8, 2.7 and 3.6 m

from the planned outside pavement edge at the location where the outside lane stripe will be placed. These offset locations roughly correspond to the outside lane edge, outside wheel path, lane center, inside wheel path, and inside lane edge of a 3.6 m wide lane. If the lane is greater than 3.6 m wide, the 5 offsets should be adjusted so that measurements are performed in the wheel path locations.

The offsets should be specified in the material sampling plan document relative to a convenient reference that will be marked or staked in the field. Many highway agencies use either the pavement center line or project center line on divided highway facilities to reference offsets for surveying measurements.

A reproducible location referencing system must be established in the field so that once the elevation survey locations are established, they can be relocated for subsequent measurements on the surface of each new pavement layer placed.

2.3.1.4 In Situ Density and Moisture Measurements

On the construction, or reconstruction projects, in situ density/moisture testing will be conducted on finished subgrade. The density/moisture measurements shall be made using the direct transmission method for density and the backscatter method for moisture determination. Density determination shall be conducted using AASHTO T238-86, "Standard Method of Test for Density of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth)" Method B - Direct Transmission. In this approach, the rod shall be imbedded 100 to 200 mm below the surface.

Moisture measurements shall be conducted using AASHTO T239-86, "Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depths)" Backscatter Method. For both the density and moisture, four readings of one minute each shall be conducted with the nuclear testing instrument rotated 90° between each reading. Figure 2b shows the minimum number of locations for in situ density/moisture testing The testing must be done within the monitoring section.

Report the density, moisture, type of material, rod end depth, and thickness of the layer (from plans) for each test point Report any unusual findings during the testing such as visible voids, oversize aggregate or cobbles, foreign material, trapped water, etc. which may have affected the measurements. Sampling Data Sheet 8-1 shall be the standard form used to record this data Tests are not required on subgrades containing an amount of rock sufficient to preclude accurate testing.

It is recommended that two nuclear gauges be available at the test site. One gauge will serve as a stand-by in the event the primary test gauge becomes inoperative or is of questionable accuracy Nuclear equipment and testing shall be conducted in full compliance with all federal, state, and local regulations Any special regulations for the use of nuclear density devices in any state shall be followed

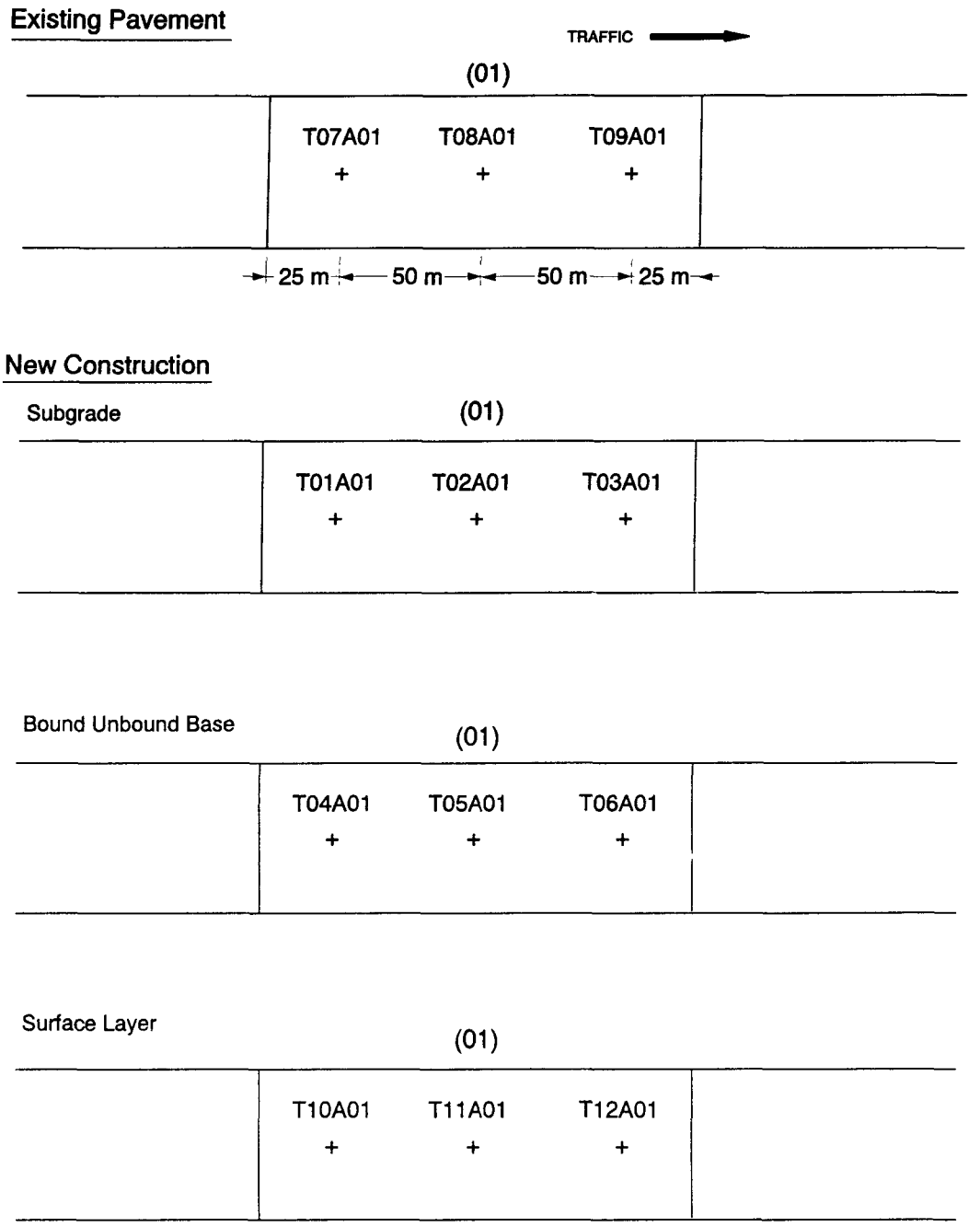


Figure 2b. In situ density/moisture measurements using nuclear density/moisture gage for a typical section

2.3.2 Unbound Base Layers

Base and subbase layers which are composed of unbound materials should be sampled and tested following the same guidelines. The only tests on these materials are classification and layer thickness measurement.

2.3.2.1 Material Classification

For new/re-construction projects, a 25 kg bulk sample of all unbound base and subbase materials shall be obtained from one end of each test section, as illustrated in Figure 2a, for laboratory classification tests. If the maximum aggregate or particle size is greater than 76 mm, then a 65 kg size sample should be obtained. These samples should be obtained from excavations in the surface of the layer after the base layer has been fully prepared. After sampling, the excavation shall be repair with similar material and satisfactorily compacted.

Sampling of base and subbase layers on overlay projects is not required. A visual manual classification should be performed on the unbound base material from the auger holes at the A-type sampling locations used to obtain subgrade samples as shown in Figure 2a. The classification should be performed using the material codes and procedure from Appendix C of the SHRP-LTPP Guide for Field Materials Sampling, Handling, and Testing. Although not required, agencies are encouraged to obtain samples and perform the material classification tests on the unbound base materials. If this option is selected, then multiple auger samples would be needed to obtain the required material quantity.

2.3.2.2 Thickness Measurement

The thickness of unbound base layers should be determined from elevation surveys on new/re-construction projects. These surveys must be performed at the same locations as the previous survey of the underlying material.

The thickness of base layers on overlay projects must be obtained from inspection and measurement of the auger borings.

2.3.2.3 In Situ Density and Moisture Measurements

On new construction, or reconstruction projects, in situ density/moisture testing will be conducted on the finished base layer as discussed in item 2.3 1 4. See Figure 2b for test locations.

2.3.3 Bound Base Layers

Cores of bound base layers should be obtained, from the locations indicated in Figure 2a, and sent to the laboratory for measurement and inspection. On new/re-construction projects, elevation measurements to determine layer thickness should be performed at the same locations as the previous survey of the underlying material. Depending on the type of

bound material, the laboratory test will either be AC01 for high quality asphalt concrete base material, or TB01 for other types of bound bases.

On new construction, or reconstruction projects, in situ density testing will be conducted on the finished bound base layer. This testing shall be performed at the locations as shown in Figure 2b using AASHTO T238-86, backscatter mode. As with the unbound materials, each testing location shall have four readings with the instrument rotated 90° between each reading. Please follow the operational and reporting instructions as discussed in item 2.3.1.4.

2.3.4 Existing Surface Layer (Overlay Projects)

The existing surface layer, prior to application of the experimental HMA overlay, should be cored at the locations shown in Figure 2a. This coring should not be performed until after completion of milling or other treatment which affects the thickness of this layer. The core examination test for HMA is AC01 and PC06 for portland cement concrete.

On overlay projects, in situ density testing will be conducted on the finished bound base layer. This testing shall be performed at the locations as shown in Figure 2b using AASHTO T238-86, backscatter mode. As with the unbound materials, each testing location shall have four readings with the instrument rotated 90° between each reading. Please follow the operational and reporting instructions as discussed in item 2.3.1.4.

2.4 HMA Surface Layer

For the purposes of binder and mix characterization tests, the SPS-9A projects will be classified into **Main Study** projects and **Level III Study** projects. The amount of SUPERPAVE™ level III performance tests defines the difference between the Main Study and Level III Study projects. On the Main Study projects, level III performance tests will be performed only on the standard SUPERPAVE™ mixture immediately after construction. On the Level III Study projects, level III performance testing will be performed on all HMA mixes starting immediately after construction and at 1, 2, and 4 year intervals.

Bulk samples of the HMA mixes and constituent materials are needed for quality control testing during production, SUPERPAVE™ materials and mixture tests, mixture performance tests, and shipment to the LTPP Materials Reference Library (MRL) to store for future tests. Cores of the HMA mixtures will be used for volumetric mixture tests, characterization of the recovered binder, and mixture performance testing.

All mixture testing will be performed at the proportions determined by the laboratory mix design at design AC content. The variations in AC content will be performed only during the mix design phase of the project. Only a material characterization of the "as-placed" HMA is performed in this study For that reason, minor modifications to the sample preparation/compaction prior to testing must be performed. These modifications are limited to using only the "design AC" content for laboratory samples or the "as mixed" AC content for field samples and compact these specimens to the two levels of Air Voids required by the

SUPERPAVE™ tests (3% Air Voids for tertiary creep, Repeated Shear at Constant Stress Ratio, and 7% Air Voids for the remaining testing).

2.4.1 Bulk Samples

Bulk samples of the HMA mixtures and constituent materials are needed for quality control tests, SUPERPAVE™ materials and mixture tests, binder characterization, and shipment to the MRL for future tests.

2.4.1.1 Bulk Constituent Materials for Laboratory Tests

Aggregate and binder materials will have SUPERPAVE™ characterization tests performed to assess conformance with the specifications. Materials from all test sections will be obtained and tested using the protocols presented in Table 4. Mixture testing will be performed as detailed in Table 5 and Table 6.

2.4.1.2 Bulk Samples of HMA Materials for SUPERPAVE™ Mix Design Tests

One 10-liter sample of the asphalt cement and ten 25-kg samples, or equivalent larger bulk sample(s), of the combined aggregate should be collected for each HMA surface layer mixture used on the SPS-9A project. The SUPERPAVE™ mix design tests, as presented in Table 5 and Table 6, should be performed on these samples by the participating highway agency.

For the SUPERPAVE™ based mix designs used on test sections 02 and 03, the aggregate and binder tests should be run as part of the mix design procedure. For test section 01 and other non-SUPERPAVE™ based design mixtures, these tests should be run in addition to the tests used for their design. The binder information, specifically the viscosity values, will be required to determine the mixing and compaction temperatures of the non-SUPERPAVE™ mixtures. The tests on the compacted specimen should be performed on samples mixed at the design asphalt content determined from the mix design procedure. All test results on the mixes for sections 02 and 03 should be reported to the FHWA-LTPP team for review and evaluation prior to construction. All gyratory compaction shall be conducted according to the published values for N_{Init}, N_{Design} and N_{Max} based upon the appropriate Traffic loading and environmental conditions as listed in Table 3 4 of "The SUPERPAVE™ Mix Design Manual for New Construction and Overlays, SHRP-A-407".

The SUPERPAVE™ Level I (Gyratory Compaction to N_{max}) mix design tests on the non-SUPERPAVE™ design mixes are desired so that their properties can be assessed against the SUPERPAVE™ specifications. Comparisons may be estimated by use of the gyratory compaction curves to determine the corrected bulk specific gravity and consequently the volumetric properties at N_{Design}. This will aid in interpretation of the SUPERPAVE™ specifications relative to their observed field performance. These materials should be proportioned, mixed, and compacted in accordance with the selected mixture design values.

Table 4. SUPERPAVE™ aggregate and binder tests to be performed by participating highway agency on HMA surface layer materials from all test sections

Test Name	Test Designat.	Protocol	No. Tests	Material Source
Aggregate Tests[a]				
Aggregate Gradation	AG04	LTPP P14	1	BU10AXX
Specific Gravity of Coarse Aggregate	AG01	LTPP P11	1	
Specific Gravity of Fine Aggregate	AG02	LTPP P12	1	
Specific Gravity of -200 material		AASHTO T100	1	
Coarse Aggregate Angularity		Penn DOT TM 621	1	
Fine Aggregate Angularity		ASTM C1252	1	
Toughness		AASHTO T96	1	
Soundness		AASHTO T104	1	
Deleterious Materials		AASHTO 112	1	
Clay Content		AASHTO T176	1	
Thin, Elongated Particles		ASTM D 4791	1	
Asphalt Cement				
Penetration @ 5° C		AASHTO T49	1[e]	BC01AXX
Penetration @ 25° & 46° C	AE02	LTPP P22	1[e]	
Viscosity @ 60° & 135° C	AE05	LTPP P25	2	
Specific Gravity @ 16° C	AE03	LTPP P23	2	
Dynamic Shear @ 3 temperatures		AASHTO TP5	2	
Brookfield Viscosity @ 135° & 165° C		ASTM D4402	1	
Rolling Thin Film Oven (RTFOT)		AASHTO T240	b	
Dynamic Shear on RTFOT residue @ 3 temperatures[d]		AASHTO TP5	3	
Pressure Aging (PAV) of RTFOT residue		AASHTO PP1	b	
Creep Stiffness of RTFOT-PAV residue @ 2 temperatures - 24 h conditioning[c, d]		AASHTO TP1	2	
Creep Stiffness of RTFOT-PAV residue @ 2 temperatures[d]		AASHTO TP1	2	
Dynamic Shear on RTFOT-PAV residue @ 3 temperatures[d]		AASHTO TP5	2	
Direct Tension on RTFOT-PAV residue @ 2 temperatures[d]		AASHTO TP3	2	

Notes:

a Only one set of aggregate tests required for each unique aggregate combination used on the project.

b Sufficient material should be conditioned for the required tests.

c Conditioning time extended to 24 h ± 10 min at 10°C above the minimum performance temperature

d See section 4.5 1.2 for temperature selection guidelines

e Three penetration values obtained from each test

Table 5. SUPERPAVE™ mixture design tests to be performed by participating highway agency on HMA surface layer materials from section 01 and section 03

Test Name	Test Designat.	Protocol	No. Tests	Material Source
Mixed and Compacted HMA				
Gyratory Compaction @ design asphalt content at N_{Max}		AASHTO M-002	3	BC01AXX BU01AXX-BU03AXX
Gyratory Compaction @ 7% Air Voids		AASHTO M-002	6	BC01AXX BU04AXX-BU09AXX
Bulk Specific Gravity	AC02	LTPP P02	3	LA01AXX-LA03AXX
Maximum Specific Gravity	AC03	LTPP P03	1	NA01AXX
Moisture Susceptibility	AC05	LTPP P05	6	LA04AXX-LA09AXX
Volumetric Calculations				
Volume Percent of Air Voids		AASHTO PP19	3	LA01AXX-LA03AXX
Percent Voids in Mineral Aggregate		AASHTO PP19		
Voids Filled with Asphalt		AASHTO PP19		

Notes

(i) NA01AXX is laboratory mixed HMA combining BC01AXX and BU10AXX

(ii) LA??AXX is a laboratory compacted specimen produced from BC01AXX and BU??AXX

(iii) Estimate the corrected bulk specific gravity from the gyratory compaction curves at N_{Design} and use this value for the Volumetric Calculations

Table 6. Tests on compacted bulk samples of HMA from test section 02 on all projects

Test Name	Test Desig.	Protocol	No Tests	Material Source Material Sample
HMA Specimen Compaction by Participating Highway Agency				
Gyratory Comp @ N_{Max}(lab samples)		AASHTO M-002	6	NA01A02 - NA06A02[a]
Gyratory Comp. @ 3% AV(lab samples)		AASHTO M-002	2	NA07A02 , NA08A02[a]
Gyratory Comp. @ 7% AV(lab samples)		AASHTO M-002	32	NA09A02 - NA40A02[a]
Gyratory Comp. @ 3% AV(Field samples)		AASHTO M-002	2	BA01A02 , BA34A02[a]
Gyratory Comp. @ N_{Max}(field samples)		AASHTO M-002	6	BA02A02 - BA04A02[a] BA31A02 - BA33A02[a]
Gyratory Comp. @ 7% AV(field samples)		AASHTO M-002	26	BA05A02 - BA30A02[a]
Mix and Compacted HMA Tests by Participating Highway Agency				
Bulk Specific Gravity	AC02	LTPP P02	18	LA01A02-LA07A02, LA15A02, LA38A02, DA02A02, DA03A02, DA04A02,DA06A02, DA16A02, DA22A02,DA31A02, DA32A02 DA33A02
Asphalt Content (Extraction) (Uncompacted material)	AC04	LTPP P04	6	BA01A02, BA06A02, BA11A02 BA16A02, BA22A02, BA34A02
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	2	BA06A02, BA22A02
Maximum Specific Gravity	AC03	LTPP P03	3	NA15A02, BA06A02, BA22A02
Moisture Susceptibility	AC05	LTPP P05	6	LA09A02 - LA14A02
Volumetric Calculations				
AV, VMA, VFA		AASHTO PP-19	6[d]	LA01A02-LA06A02
LTPP Performance Tests by LTPP Contract Laboratory				
Indirect Tensile Strength	AC07	LTPP P07	2[c]	LA15A02, DA09A02
Resilient Modulus	AC07	LTPP P07	2[b c]	LA16A02, LA17A02, LA18A02 DA05A02, DA17A02, DA29A02
Creep Compliance	AC06	LTPP P06	8[c]	LA19A02, LA20A02, LA21A02, LA22A02 DA15A02, DA16A02, DA18A02, DA30A02
SUPERPAVE™ Shear Tester Performance Tests by SUPERPAVE™ Regional Test Center				
Frequency Sweep at Constant Height & Simple Shear at Constant Height	SST-1	AASHTO M-003, P-005	6 2[e]	LA23A02, LA24A02, LA25A02, LA26A02 DA06A02, DA10A02, DA24A02, DA28A02
Volumetric Test & Uniaxial Strain	SST-2	AASHTO M-003, P-005	6 2[e]	LA27A02, LA28A02, LA29A02, LA30A02 DA07A02, DA11A02 DA23A02 DA27A02
Repeated Shear at Constant Stress Ratio	SST-3	AASHTO M-003, P-005	4	LA07A02, LA08A02, DA01A02 DA34A02
SUPERPAVE™ Indirect Tensile Tests by SUPERPAVE™ Regional Test Center				
Indirect Tensile Creep Compliance & Indirect Tensile Strength	SP-IT	AASHTO M-005	18 2[e]	LA31A02 LA32A02 LA33A02 LA34A02 LA35A02 LA36A02 LA37A02 LA38A02 LA39A02 LA40A02 DA08A02 DA12A02 DA13A02 DA14A02 DA19A02 DA20A02 DA21A02 DA22A02 DA25A02 DA26A02

Note

a For the purposes of this table, a single specimen is compacted from each bulk sample Test specimen DA01A02 is produced from BA01A02 and LA01A02 is produced from NA01A02 , etc Up to three specimens can be produced from the sample depending on its size

b Three specimens are needed for one test

c Test specimen of 100 mm diameter will be cored from compacted 150 mm specimens produced by the gyratory compactor

d The corrected bulk density at N_{Design} shall be estimated from the gyratory compaction curves for calculation of the volumetric properties

e Spare specimens (one laboratory and one field compacted sample)

2.4.1.3 Bulk Laboratory HMA Mix Samples for Performance Tests

On test section 02 on Main Study projects, and for all test sections on Level III Study projects, after the final mix design of the HMA surface material is completed, a total of 300 kg of material should be mixed in the laboratory to the final mix design proportions. Six (6) samples shall be compacted into 150 mm by 115 mm specimens to N_{Max}. An additional set of samples shall be compacted into 34, 150 mm diameter by 140 mm height cylindrical specimens in the SHRP gyratory compactor using the number of gyrations to achieve 7 percent air voids for 32 of these and 3 percent air voids for the remaining 2 following test protocol AASHTO M-002. The 6 specimens for use in testing for moisture susceptibility are included in the above 32. Tertiary creep behavior is typically determined at a high asphalt content (AC% where AV = 3% at N_{design}). Since this asphalt content may not be available from field samples, the laboratory mixture, at design AC, shall be gyratory compacted for the number of gyrations corresponding to 3 % AV on the gyratory compaction curve (If at N_{max}, the estimated AV is greater than 3%, the compaction shall be terminated at N_{max}). The SHRP performance and volumetric tests should be performed on these compacted samples as shown in Table 6. The corrected bulk specific gravity used in the volumetric computations shall be estimated from the corrected bulk specific gravity off the gyratory compaction curves.

For simplification, in Table 6, a single test specimen is specified as being produced from each bulk HMA mix sample. Test specimen DA01A02 is produced from sample BA01A02, etc. For field and laboratory expedience, up to three compacted specimens can be produced from the same sample. To obtain the needed quantities for the volumetric computations, percent asphalt and maximum specific gravity will be determined from portions of the uncompacted material samples. The aggregate properties (Specific Gravities) will be obtained from the aggregate testing within Table 4 The bulk specific gravity for the HMA sample shall be estimated from the corrected gyratory compaction curves at N_{Design}.

2.4.1.4 Bulk HMA Mix Samples for Quality Control Tests

One benefit of the SUPERPAVE™ mix design procedure is the ability to use the SHRP gyratory compactor to monitor the consistency of the mix during construction The objective of this testing is to evaluate this procedure and to document any variations in the mixes. These tests are not intended to replace the highway agency's conventional quality control tests. Six samples of each HMA surface layer mixture, not including friction courses, used on the test sections should be obtained and compacted in the SHRP gyratory compactor to N_{Max} following test protocol AASHTO M-002 These tests are shown in Table 7. Two 25 kg samples shall be obtained to prepare six gyratory samples. The samples should be obtained at the test site either from haul vehicles or at the paver The two samples shall be obtained at equal intervals over the production run and test section lay down process. Samples should be obtained in conformance with AASHTO T168 "Sampling Bituminous Paving Mixtures", stored in insulated containers, and compacted prior to significant loss of heat. These samples should take precedence in compaction as the information gathered from the Compaction-Gyration curves can be used to determine the number of gyrations necessary for the compaction of the performance samples at both 7 percent and 3 percent Air Voids

Table 7. Quality control related tests on compacted specimen from test sections 01, 03 and other Level III Study test sections to be performed by participating highway agency

Test Name	Test Designation	Protocol	No. of Tests	Material Source Material Sample
HMA specimen compaction				
Gyratory Compaction @ N_{max}		AASHTO M-002	6	BA01AXX-BA06AXX[a]
Volumetric tests				
Bulk Specific Gravity	AC02	LTPP P02	6	DA01AXX - DA06AXX
Asphalt Content (Extraction)	AC04	LTPP P04	2	BA02AXX, BA04AXX
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	2	BA02AXX, BA04AXX
Maximum Specific Gravity	AC03	LTPP P03	2	BA02AXX, BA04AXX
Volumetric Calculations				
Volume Percent of Air Voids		AASHTO PP19	6	BA01AXX-BA06AXX
Percent Voids in Mineral Aggregate		AASHTO PP19	6	BA01AXX-BA06AXX
Voids Filled with Asphalt		AASHTO PP19	6	BA01AXX-BA06AXX

Note:

a. A single test specimen is produced from each bulk HMA mix sample. Test specimen DA01AXX is produced from sample BA01AXX, etc.

b. Estimate the corrected bulk specific gravity from the gyratory compaction curves at N_{Design} and use this value for the Volumetric computations.

If the samples are within 5°C of compaction temperature, no reheating of the asphalt mix is required prior to compaction. Otherwise the asphalt mix shall be reheated to compaction temperature. In no event should reheating time be greater than 30 minutes. If the time required to bring the asphalt mix at compaction temperature is greater than 30 minutes, the sample must discarded as longer heating times may change the physical and chemical properties of asphalt binder. In addition, it is also recommended that the temperature at the time of sample splitting must be greater than 80°C. This is important for the reasons of workability and uniformity during splitting of the samples from a bulk sample.

2.4.1.5 Bulk Field HMA Mix Samples for Performance Tests

On test section 02 on Main Study projects and on Level III Study projects, bulk samples of the HMA surface mixture should be obtained. Of these, 26 specimens are compacted in the SHRP gyratory compactor to 7 percent air voids and 2 specimens are compacted to 3 percent air voids, following test protocol AASHTO M-002. These specimens will then be tested according to the performance testing schedule of the Level III mix design using only the design asphalt content. Tertiary creep behavior is typically determined at a high asphalt content (AC% where AV = 3% at N_{design}). Since this asphalt content may not be available from field samples, the mixture shall be gyratory compacted for the number of gyrations corresponding to 3 % AV on the gyratory compaction curve. (If at N_{max}, the estimated AV is greater than 3%, the compaction shall be terminated at N_{max}). The SHRP performance tests should be performed on these compacted samples as shown in Table 6. For convenience, 34 bulk samples (including the 6 Quality Control samples) are shown with one specimen compacted from each sample. In practice multiple specimens can be compacted from each bulk sample.

Ideally, bulk samples of the HMA should be obtained at the construction site, either at the paver or from a haul vehicle, in conformance with AASHTO T168 "Sampling Bituminous Paving Mixtures", stored in insulated containers, and compacted in the SHRP gyratory compactor prior to significant loss of heat However, this process would require the use of a significant number of molds and possibly more than one gyratory compactor. Therefore, it is recommended to compact all the Quality Control samples first, then proceed to the compaction of the performance samples. The determination of number of gyrations for compaction may be closely estimated by plotting the compaction - gyration curves for the Quality Control samples and determining the required number of gyrations as the average number of gyrations at which the desired density (Air Voids) is reached.

Typically, this process will result in the compaction of the performance specimens after significant loss of heat has occurred. Thus, it is recommended to split the samples upon arrival to the laboratory and that the temperature at the time of sample splitting must be greater than 80°C. This is important for the reasons of workability and uniformity during splitting of the samples from a bulk sample.

2.4.1.6 Samples of HMA Materials for MRL

The asphalt cement shall be sampled from the plant following AASHTO T40, "Sampling Bituminous Materials," after the asphalt has been heated for mixing. During pavement construction, bulk samples of the aggregate and asphalt binders used in all of the HMA mixes used in the SPS-9A test section should be collected, packaged and shipped to the LTPP Materials Reference Library for storage and future testing as shown in Table 8.

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

Containers for the storage and shipment of these samples will be provided to the participating state agencies by the LTPP Materials Reference Library (MRL) at no cost to the state. These containers are of special manufacture to accommodate long-term storage. It will be necessary that scheduling information be furnished to the LTPP Materials Reference Library contractor as soon as this information is available. This information should, at the minimum, contain: (1) date containers needed, (2) state agency contact name. (3) shipping address, and (4) telephone number The contact names and telephone numbers for the LTPP Materials Reference Library are as follows:

CONTACT NAME	AFFILIATION	PHONE NO.
Mr. Doug Frith	Nichols Consulting Engineers Chtd.	702-358-7574
Mr. Cal Berge	FHWA LTPP Regional Engineer	702-329-5019

Shipping of samples to the MRL will be performed by a common carrier and the costs borne by the MRL contractor. The participating agency should contact the MRL office for coordination and sample shipping details Mr. Doug Frith is the primary MRL contact point for the participating agencies.

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

If necessary, cores and compacted specimens for SPS-9A projects can also be shipped and stored at the MRL if the SUPERPAVE™ Regional Test Center is not yet able to test or store the material designated for it to test. The MRL should be contacted for shipping containers and instructions.

Table 8. Bulk material samples to be shipped to the LTPP Material Reference Library

Material	Number
Asphalt cement collected from the plant in 10-liter pails	1 for each type of binder
Combined coarse and fine aggregate obtained from the plant and stored in 10-liter pails	10 for each aggregate combination

Notes:

The MRL will provide containers and will pay for shipping costs.

Contact the MRL @ 702-358-7574 prior to construction to make arrangements for sample containers and to receive specific shipping instructions.

Only one sample of each unique asphalt binder used in the SPS-9A mixes is needed. If the same binder is used in more than one mix, then only one sample of that binder should be obtained.

A copy of LTPP Field Operations Information Form 1 should be completed and attached to all MRL shipments. Another copy of the form should be mailed separately to the MR.

2.4.2 Cores of HMA Materials

Cores from each HMA surface layer mixture used on the SPS-9A projects will be needed for volumetric testing, extracted binder testing, and mixture performance tests. These cores will be obtained at the time intervals specified in Table 9 so that aging characteristics can be assessed. All cores obtained should be 150 mm in diameter with depth equal to the thickness of the surface layer for new construction or the total thickness of the overlay.

All cores must be obtained outside the monitoring portion of each test sections. The designated coring areas are made up of 75 m long zones on each end of a test section as shown in Figure 3. Each of these zones is further subdivided into 6, 8-m long sub-zones corresponding to the six sampling time intervals occurring after construction. Sequential letter designations are used for each sampling time interval specified in months after completion of paving; A-0, B-6, C-12, D-18, E-24, and F-48 months. At each designated coring time interval, cores will be obtained from the pair of coring zone subsections corresponding to that interval.

The core locations for sections 01 and 03 in the Main Study are shown in Figure 4. The coring pattern and locations for section 02 of the Main Study are shown in Figure 5. The coring pattern and locations for all test sections in the Level III study are shown in Figure 6. Core locations are designated by numbers on these figures and in practice the numbers will be used in a section specific sample identification scheme which will incorporate information as to the sampling interval, test section sampled and the number assigned in the core layout plan. For each field set (sampling interval), a unique sample identification will exist.

In sections where coring is required for performance testing (SUPERPAVE™ Level III sites), asphalt binder will also be extracted from some of the cores for volumetric and binder stiffness characterization. However, on Main Study test sections requiring volumetric and binder testing only, at least 8-150 mm diameter cores must be obtained to provide enough extracted asphalt for binder characterization.

The coring operations shall be carried out in accordance with AASHTO T24-B6, "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete." Carbide or diamond bit drilling is to be performed. Mist or air cooled drilling is preferred as the best method to minimize water contamination of the underlying layers. The coring may be performed by a truck mounted drill rig or other coring equipment approved by the participating highway agency The cores shall be dried before packaging. The pavement may be cooled by dry-ice or other means prior to coring if necessary to obtain cores of suitable quality Full depth cores may be broken in the field to retrieve only the layer of interest as long as the sample is not unduly disturbed Otherwise, cores of multiple layers shall be wrapped and shipped as a single core.

It is essential for laboratory material testing that the direction of traffic be indicated on the test cores Therefore, all cores of pavement surfaces shall be marked on the top with an arrow to show the direction of traffic. This marking should be made prior to removal of

Table 9. Number of cores and coring time intervals for SPS-9A test sections

Project Type	Test Section (No.)	Time After Paving, months - Interval Identifier -					
		0 - A -	6 - B -	12 - C -	18 - D -	24 - E -	48 - F -
Main Study	Agency (01)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
	SUPERPAVE™ Binder (02)	34 (S*)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
	Alternate SUPERPAVE™ Binder (03)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)	8 (V)
Level III Study	Agency (01)	34 (S)		34 (S)		34 (S)	34 (S)
	SUPERPAVE™ Binder (02)	34 (S*)		34 (S)		34 (S)	34 (S)
	Alternate SUPERPAVE™ Binder (03)	34 (S)		34 (S)		34 (S)	34 (S)

Note · The numbers in the cells represent the number of 152 mm diameter cores needed to perform the required tests

V = Volumetric and binder stiffness tests on cores
S = Performance testing and volumetric and binder stiffness tests on cores
S*= Performance testing at t=0 months will be performed on 3 sets of specimens,

- compacted specimen from design mixtures produced in the laboratory
- compacted specimen from bulk samples obtained during construction
- cores obtained immediately following construction

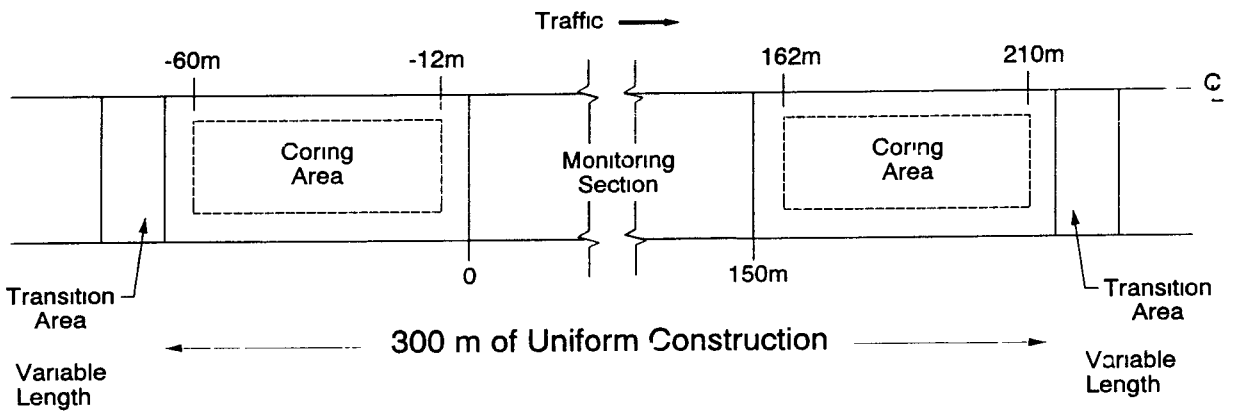


Figure 3. Coring area for SPS-9A test sections

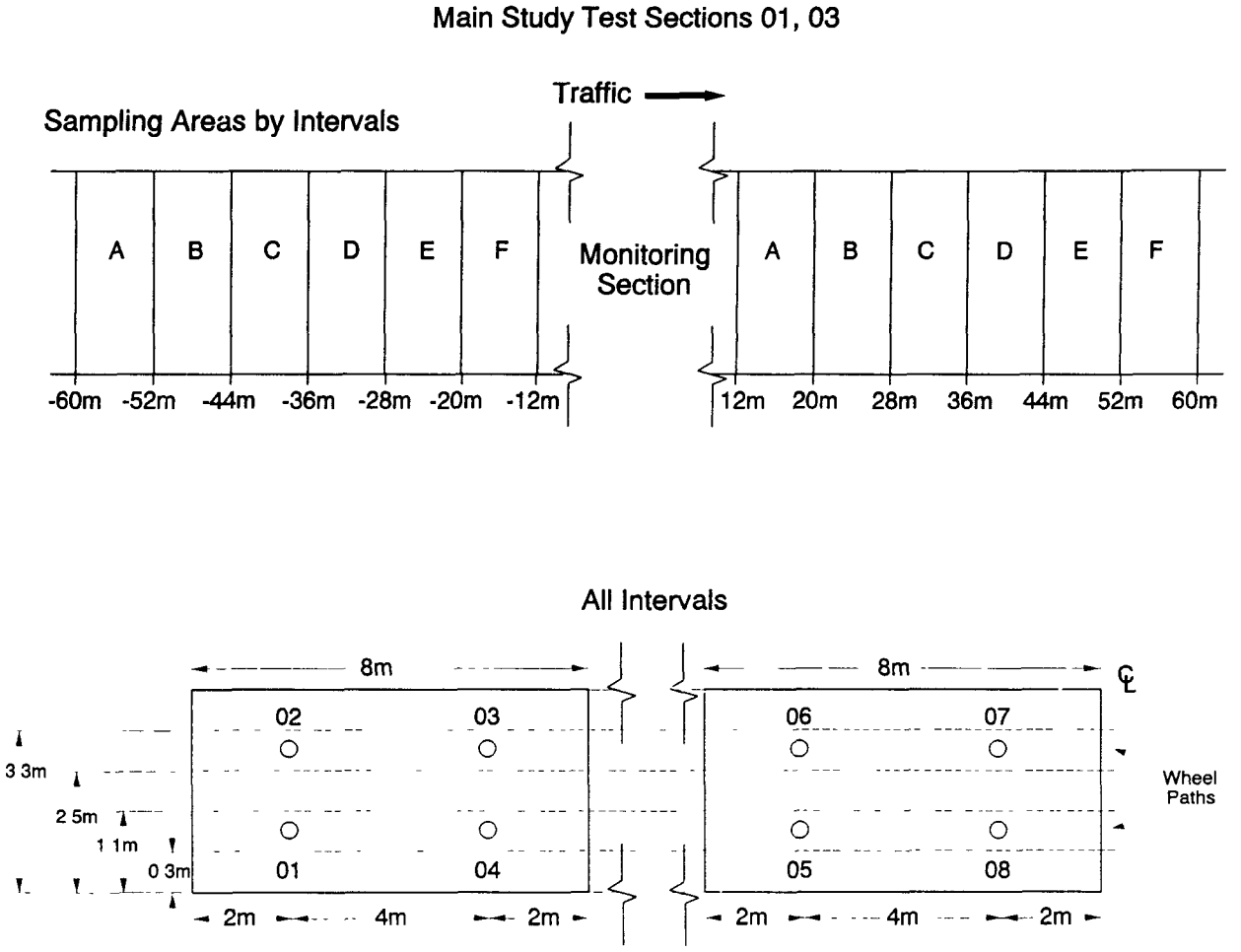


Figure 4. Core locations for Main Study test sections 01 and 03

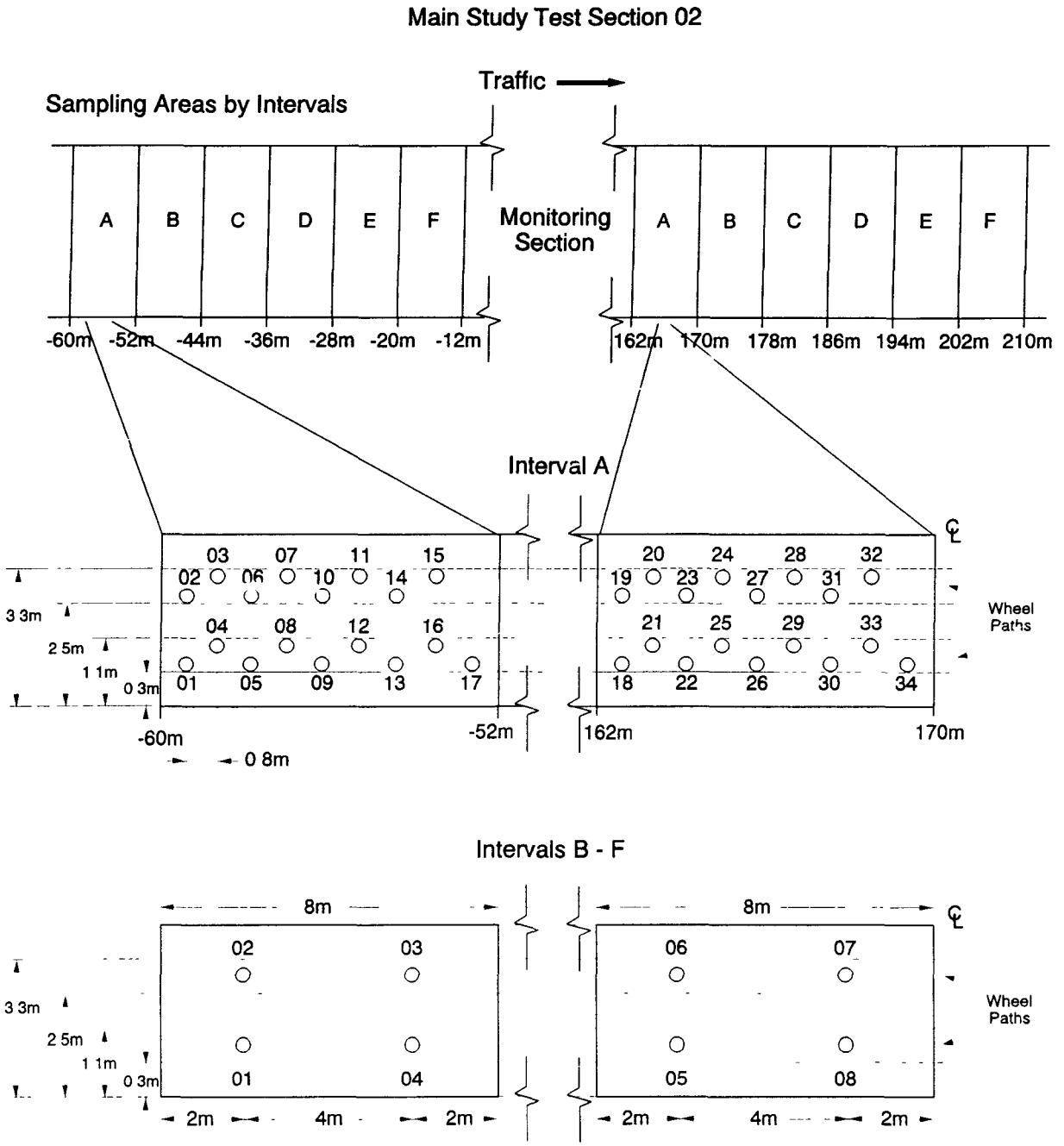
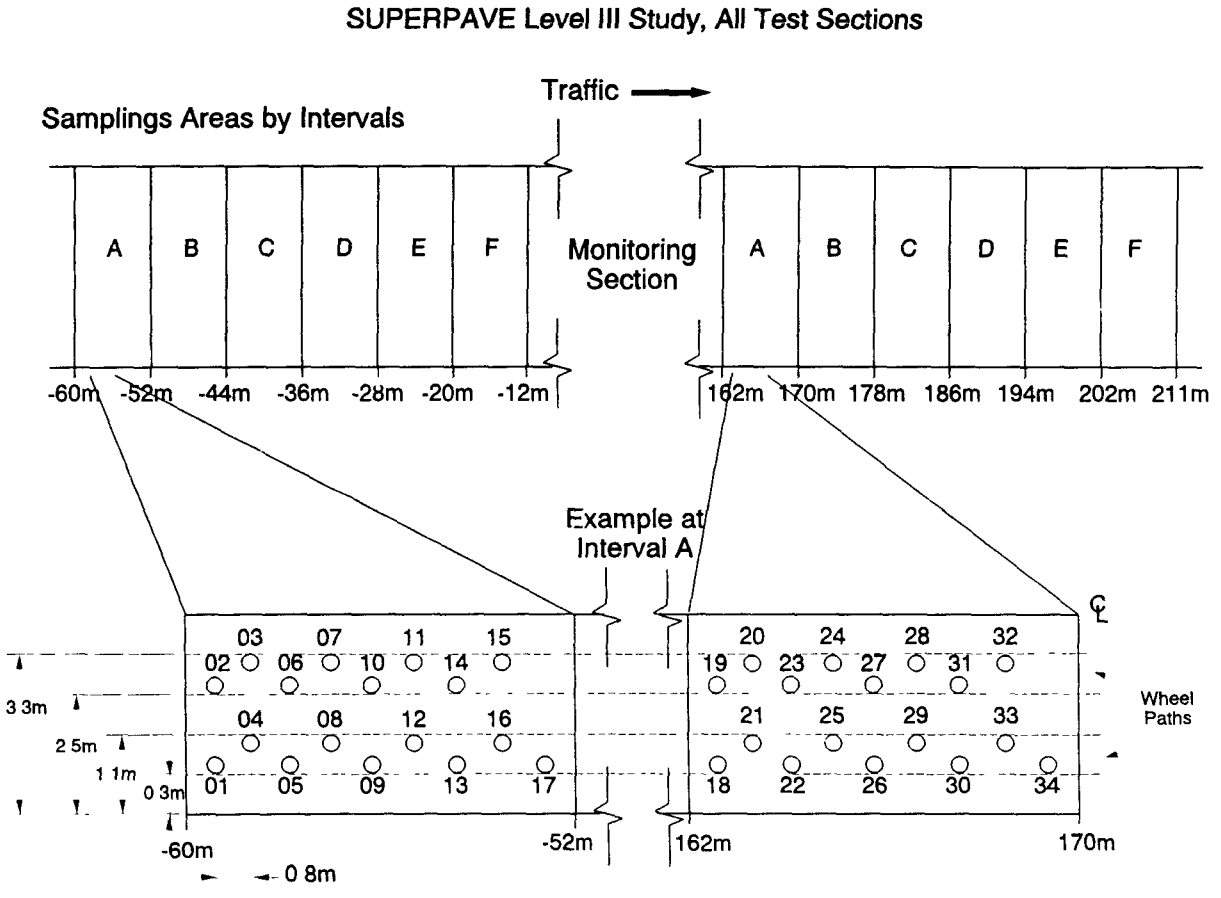


Figure 5. Core locations for Main Study test section 02, SUPERPAVE™ standard design mixture



Note: This coring pattern is to be used for all required sampling time intervals.

Figure 6. Core pattern and locations for SUPERPAVE™ Level III Study test sections

the cores from the pavement using a waterproof marking material and in a manner that will ensure visibility after coring operations. Plugs shall not be inserted in cores intended for laboratory testing. Suction cups or wire pulls have been successfully used for core extraction.

Core locations shall be as shown on the sampling plan figures developed for the test site. It is important that the cores be taken perpendicular to the pavement surface, i.e. at a 90 degree angle to the surface, to ensure the recovery of straight, intact, smooth-surfaced specimens suitable for laboratory testing.

The quality of the AC cores shall be checked in the field to ensure suitability for laboratory testing. The suitability of the cores with respect to projections and depressions is as follows:

Excellent - The projections/depressions along the sides of the core are less than 0.25 mm in height/depth. Ship these cores to the appropriate laboratory.

Good - The projections/depressions along the sides of the core are between 0.5 mm to 2.5 mm in height/depth. These cores are considered marginal and should be shipped to the appropriate laboratory only if cores rated "excellent" can not be obtained.

Poor - The projections/depressions along the sides of the core are more than 2.5 mm in height/depth. These cores are **not** acceptable and should not be shipped to the laboratory unless no other suitable cores can be obtained. Another core should be drilled to replace cores rated as "poor." After two attempts to obtain a satisfactory core have been unsuccessful, the core to be shipped to the laboratory shall be selected from the "better" of the two drilled cores. The "worse" core of the two should be discarded. If a multitude of cores are retrieved in the "poor" condition, the on-site inspector should determine whether the drilling and sampling personnel are using the proper equipment and that the proper procedures are being followed.

The following are criteria for evaluating the surface AC cores in terms of the skew of each end of the core The suitability of the cores with respect to skewness is as follows

Good - The specimen departs from perpendicularity to the vertical axis by less than 0 5 of a degree (1 6 mm in 150 mm). The specimen is suitable for shipment to the laboratory.

Poor - The specimen departs from perpendicularity to the vertical axis by more than 0.5 of a degree. These cores are not acceptable and should not be shipped to the laboratory unless no other suitable cores can be obtained Another core should be drilled to replace cores rated as "poor " If, after two tries, a suitable core cannot be obtained, select the "better" core from

the two and ship to the appropriate laboratory. The "worse" core of the two shall be discarded.

2.4.2.1 Laboratory Tests on Cores from Main Study Test Sections 01 and 03

The tests to be conducted on the 8 cores to be obtained from Main Study test sections 01 and 03, as shown in Figure 4 for each sampling interval, are shown in Table 10. These tests should also be performed on Main Study test section 02 at all sampling time intervals, except for time interval **A** which is performed immediately after completion of paving. As illustrated in Figure 5, the sampling and testing on Main Study test section 02 at time interval A is the same as Level III Study sections, as presented in the next section.

2.4.2.2 Laboratory Tests on Level III Study Test Sections

The tests to be performed on the Level III Study test sections, and Main Study test section 02 immediately after completion of construction, are shown in Table 11. To complete all of the required tests, 34 cores are required at each specified time interval. As shown in Figure 6, seventeen cores are obtained from the corresponding sampling subsections at each end of the section.

2.4.3 Elevation Surveys

The thickness of HMA surface layers on all test sections should be determined from elevation surveys before and after placement. On overlay projects, the elevation measurement points on the prepared surface of the existing material should be located as described in section 2.3.1.3 of this document. The measurements on the finished surface must be performed at the same locations as the previous survey on the surface of the underlying material.

2.4.4 In Situ Density Measurements

In situ density testing will be conducted on finished bituminous surface layer. This testing shall be performed at the specified locations as shown in Figure 2b using AASHTO T238-86, backscatter mode As with the unbound materials, each testing location shall have four readings with the density instrument rotated 90° between each reading. Please follow the operational and reporting instructions as discussed in item 2.3 3.

Table 10. Laboratory tests by the participating highway agency on cores from Main Study test sec 01, 03 and supplemental sections at time interval A and on section 02 at all intervals after A

Test Name	Test Designation	Protocol	No. Tests	Material Source[b]
Core Examination/Thickness	AC01	LTPP P01	8	All Cores
Volumetric Analysis				
Bulk Specific Gravity	AC02	LTPP P02	8	All Cores
Asphalt Content (Extraction)	AC04	LTPP P04	8	All Cores
Aggregate Gradation (Extracted Aggregate)	AG04	LTPP P14	2	CA01tXX, CA08tXX
Volumetric Calculations[a]				
Volume percent of air voids		AASHTO PP19	2	CA01tXX, CA08tXX
Percent Voids in Mineral Aggregate		AASHTO PP19	2	CA01tXX, CA08tXX
Voids filled with Asphalt		AASHTO PP19	2	CA01tXX, CA08tXX
Recovered Asphalt Cement				
Abson Recovery	AE01	LTPP P21	8	CA01tXX - CA08tXX
Penetration @ 5° C		AASHTO T49	1[d]	
Penetration @ 25° & 46° C	AE02	LTPP P22	1[d]	
Viscosity @ 60° & 135° C	AE05	LTPP P25	2	
Specific Gravity @ 16° C	AE03	LTPP P23	2	
Dynamic Shear @ 3 temperatures[c]		AASHTO TP5	2	
Creep Stiffness @ 2 temperatures[c]		AASHTO TP1	2	
Direct Tension @ 2 temperatures[c]		AASHTO TP3	2	

Notes:

a. Estimate the maximum theoretical specific gravity using the extracted AC content and aggregate effective specific gravity determined during construction.

b The cores shown in this table are for each test section to be tested at each designated testing time interval t, where t represents the sampling time interval after construction as follows.

t = A at time 0 immediately following construction
t = B at 6 months after construction
t = C at 12 months after construction
t = D at 18 months after construction
t = E at 24 months after construction
t = F at 48 months after construction

For example, core CA01E03 is obtained and tested 24 months after construction form Section 03

c The test temperatures should be the same as those used for the tests on the RTFOT-PAV conditioned samples performed during the initial binder grading.

d Three penetration readings required from a single container

Table 11. Tests on core samples: Main Study test section 02 @ Interval A; all Level III - Study test sections @ all intervals

Test Name	Test Designat.	Protocol	No. Tests	Material Source Material Sample[a]
Volumetric Tests by Participating Highway Agency				
Core Examination and Thickness	AC01	LTPP P01	8	CA02tXX, CA06tXX, CA11tXX, CA15tXX CA19tXX, CA24tXX, CA28tXX, CA33tXX
Bulk Specific Gravity	AC02	LTPP P02	8	CA02tXX, CA06tXX, CA11tXX, CA15tXX CA19tXX, CA24tXX, CA28tXX, CA33tXX
Asphalt Content (Extraction)	AC04	LTPP P04	8	CA02tXX, CA06tXX, CA11tXX, CA15tXX CA19tXX, CA24tXX, CA28tXX, CA33tXX
Aggregate Gradation (Extracted)[a]	AG04	LTPP P14	2	CA11tXX, CA24tXX
Maximum Specific Gravity	AC03	LTPP P03	2	CA11tXX, CA24tXX
Volumetric Calculations by Participating Highway Agency				
Volume Percent of Air Voids		AASHTO PP19	2	CA11tXX, CA24tXX
Percent Voids in Mineral Aggregate		AASHTO PP19		
Voids Filled with Asphalt		AASHTO PP19		
Recovered Asphalt Cement Tests by Participating Highway Agency				
Abson Recovery	AE01	LTPP P21	8	A02tXX,CA06tXX CA11tXX,CA15tXX,CA19tXX CA24tXX,CA28tXX,CA33tXX
Penetration @ 5° C		AASHTO T49	1[d]	
Penetration @ 25° & 46° C	AE02	LTPP P22	1[d]	
Viscosity @ 60° & 135° C	AE05	LTPP P25	2	
Specific Gravity @ 16°C	AE03	LTPP P23	2	
Dynamic Shear @ 3 temperatures		AASHTO TP5	2	
Creep Stiffness @ 2 temperatures		AASHTO TP1	2	
Direct Tension @ 2 temperatures		AASHTO TP3	2	
Replacement Cores to replace damaged cores				CA05tXX, CA25tXX
LTPP Performance Tests by LTPP Contract Laboratory				
Creep Compliance	AC06	LTPP P06	4[c]	CA03tXX, CA14tXX, CA23tXX, CA32tXX
Indirect Tensile Strength	AC07	LTPP P07	1[c]	CA16tXX
Resilient Modulus	AC07	LTPP P07	1[b c]	CA07tXX, CA21tXX CA31tXX
SUPERPAVE™ Shear Tester Performance Tests by SUPERPAVE™ Regional Test Center				
Frequency Sweep at Constant Height & Simple Shear at Constant Height	SST-1	AASHTO M003 P005 AASHTO M003, P005	2	CA04tXX, CA30tXX
Volumetric Test & Uniaxial Strain	SST-2	AASHTO M003 P005 AASHTO M003 P005	2	CA12tXX CA22tXX
Repeated Shear at Constant Stress Ratio	SST-3	AASHTO M003, P005	2	CA09tXX, CA26tXX
SUPERPAVE™ Indirect Tensile Tests by SUPERPAVE™ Regional Test Center				
Indirect Tensile Creep Compliance & Indirect Tensile Strength	SP-IT	AASHTO M05 AASHTO M005	10	CA01tXX, CA08tXX, CA10tXX, CA13tXX, CA17tXX, CA18tXX CA20tXX, CA27tXX CA29tXX, CA34tXX

Notes
a These cores are from each test section at time intervals t = A (0 months), t = C (12 months), t = E (24 months) and t = F (48 months) after construction
b Three specimens are needed for one test
c. Specimens of 100-mm diameter will be cored from 150-mm field cores
d Three penetration readings must be taken from each test can

3. Field Materials Sampling

3.1 General

This section describes procedures and guidelines 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.

3.2 Personnel Requirements

The scope, intensity and time constraints imposed on the field drilling and sampling for this SPS experiment are such that it is recommended that additional field personnel, above and beyond those needed for routine construction/acceptance testing, be present on the site. These personnel should have sole responsibility for obtaining the necessary material samples, completing the necessary data sheets and forms, and performing the necessary testing. It is recommended that the field crew include a qualified and experienced on-site project supervisor who is experienced with LTPP sampling procedures and data collection and reporting requirements. This supervisor should be a senior technician, geologist, or engineer with experience in subsurface explorations and pavement field sampling and testing. This person must be familiar with all aspects of the LTPP drilling and sampling program, field drilling and sampling techniques and the timing of all field activities.

3.3 Field Operations

Field operations at each SPS-9A project site will include the following activities.

1 Prior to construction, the LTPP RCOC should establish a joint field team with the participating highway agency to coordinate the conduct of the activities involved in the drilling and sampling operations. An LTPP representative should be assigned to assist the participating highway agency and contractors to assure that field operations are performed in accordance with the proper procedures and the field sampling and testing plan

2 The LTPP field team shall lay out the project site, mark initial sample locations and perform the sampling and testing operations. It is important to follow the sequence of boring as specified in the sampling plan to reduce the risk of mixing of samples at the site. Core or auger locations that are considered unacceptable should be replaced with alternate locations and marked on an as-sampled layout plan after obtaining a written approval from FHWA-LTPP staff

3. The LTPP field representative shall record, report, and resolve problems encountered during the field operations Correspondence with the requisite FHWA-LTPP staff

should be performed as necessary to maintain uniformity across all experiment projects.

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

3.4 Collection of Samples, Marking, Packaging, and Shipping

Because of the research nature of this project and because samples will be shipped over long distances, it is extremely important that the sample be packaged carefully. 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 eliminate damage to the samples or influence their properties.

General requirements for marking and packaging individual samples are as follows:

- Sample numbering systems (as provided later in this section).
- Indelible ink pens of black or other suitable color shall be used for marking labels.
- Labels and tags shall be of high quality moisture resistant material.
- Bags for small portions of auger and bulk samples of materials to be used for laboratory moisture content determination shall be plastic lined cloth or heavy plastic and sealable against moisture loss or gain by wire-ties. Liter-size jars adequately sealed against moisture loss or gain may also be used for this purpose
- Bags for large bulk samples shall be heavy cloth, plastic lined with wire-tie for closing.
- Cores shall be placed in "zip-lock" storage bags or other suitable material (e.g. heavy-duty plastic or "bubble-wrap" wrap) to ensure that they are sealed from moisture, then wrapped for their entire length with tape (e.g., plastic transparent mailing tape 50 mm wide)

3.4.1 Sampling Location Designations

Sampling locations are designated on the LTPP forms and material sampling plans with the following six digit code format:

L ## t X X

where

L = Location type:

- B - bulk sample location
- A - 150 mm diameter core and/or auger locations
- S - Shoulder auger probe 6 m below the pavement surface
- C - 150 mm diameter core locations
- T - nuclear density/moisture gage
- F - field bulk HMA sample
- H - Samples obtained from the Hot Mix Plant.

= Location number. Up to a two digit location number is assigned sequentially to each location type on each test section. For the SUPERPAVE™ mixtures, when obtaining bulk samples of plant mix materials use sample location numbers of 01-09 for the topmost layer (wearing course) and 11-19 for the binder course. (This explicitly limits sampling and testing to a maximum of two SUPERPAVE™ materials, layers, in a test section)

t = Sampling time interval. This time interval is used for samples taken at specified time intervals referenced to the construction date. The single letter designating the time from paving is as follows.

- A - prior, during or immediately after construction
- B - 6 months
- C - 12 months
- D - 18 months
- E - 24 months
- F - 48 months

X X = Section. Use the 2 digit test section number, e.g , 01, 02, 03 This makes the sample location unique to that test section

Examples of valid sample location numbers include·

B01A01 Bulk sample 01 from test section 01.

A02A03 Auger location 02 from test section 03.

C04B03 Core location 4 at sampling time interval B (six months after paving) from test section 03.

The samples from each sample location are assigned a sample number as described in the next section.

3.4.2 Sample Code Number

Each sample (core, bulk, moisture, compacted) shall be assigned a seven digit designation that must be recorded on the appropriate data forms. The sample number will consist of the following format:

	S	***M***	***##***	***t***	***XX***
Digit	1	2	34	5	6 7

where

S = Sample type:
C - core sample
D - compacted specimen from plant mixed material
B - bulk sample
M - moisture sample
L - compacted specimen from laboratory mixed material
N - uncompacted laboratory mixed material sample

M = Material Type:
A - asphalt concrete
C - asphalt cement
P - portland cement concrete
T - treated, bound, or stabilized base/subbase
U - combined aggregate used in asphalt concrete mixes
G - untreated, unbound granular base/subbase
S - subgrade soil or fill material

= Sample number Up to a two digit sample number assigned sequentially to each sample with the same sample type and material type designation For specimens made in the SUPERPAVE™ Gyratory Compactor from bulk samples (DA***** and LA***** codes), use sample numbers from 01-49 for the topmost SUPERPAVE™ layer and 50-99 for a binder course material/layer (if it is a SUPERPAVE™ mixture). Similarly for cores (CA***** codes), the top layer is marked with a sample number of 01-49 while the bottom of the core

(binder layer) is incremented by 49 to be in the range of 50-99.

t = Sampling time interval. This time interval is used for samples taken at specified time intervals referenced to the construction date. The single letter designating the time from paving is as follows:

A	-	prior, during or immediately after construction
B	-	6 months
C	-	12 months
D	-	18 months
E	-	24 months
F	-	48 months

X X = Section number. Use the 2 digit test section number, e.g., 01, 02, 03. This makes the sample location unique to that test section.

The following are examples of valid samples code numbers.

CA24A02 Asphalt concrete cores obtained at time interval A, immediately following paving, from section 02.

CA01D01 An example of HMA core sample numbering taken from section 01 during interval "D" (18 months after construction).

CT02A03 Treated base core 2 from test section 03.

BG01A01 Bulk sample 1 of granular base from test section 1. Assign numbers consecutively as samples are obtained from each test section, BG01A01, BG02A01, etc

BA01A02 Bulk sample 1 of uncompacted HMA from test section 2. Assign numbers consecutively as samples are obtained from each test section, BA01A02, BA02A02, etc

DA01A01 Compacted specimen number 01 of plant mixed HMA from section 01 interval A (during construction)

NA01A02 Uncompacted sample of laboratory mixed HMA made from constituent materials obtained from the plant used in section 02

LA01A01 Compacted specimen 1 of laboratory mixed HMA made from constituent materials obtained from the plant destined for mixture placed in section 01.

BS01A02 Bulk subgrade sample of material from test section 02 obtain prior to construction. Assign sample numbers consecutively for multiple samples from the same test section.

MS01A02 Subgrade moisture content sample 1 obtained from bulk sampling location on test section 02.

3.4.3 Labels and Tags

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

STATE CODE
SPS PROJECT CODE
TEST SECTION NO
LOCATION DESIGNATION (as marked on sample layout plans)
SAMPLE NUMBER
DATE (mm-dd-yy, sampling date)
FIELD SET (one digit number which will be 1 for the first round of sampling)

3.4.4 Packaging

Suggestions for labelling and combining the samples for shipment are as follows:

1. All samples of like material (e.g., asphaltic concrete surface and binder) shall be placed in separate boxes or separate compartments of one box.

2 Each sample shall have a label or tag attached that clearly identifies the material.

3 Each core shall be surrounded with "bubble-wrap" or other acceptable cushioning material on all sides within the shipping box.

4. All bulk samples shall be marked with 2 labels or tags. One shall be placed inside the bag and one attached to the outside. A small bag or jar sample for moisture testing of each bulk sample shall be placed inside the bulk sample bag

5. All shipping boxes should be wood of suitable grade and construction to withstand shipping and subsequent moving without breakage of the box or damaging of samples

6. All boxes should be adequately secured by nails or screws prior to shipping.

Field Operations Information Sheets 1 and 2-1 shall be sent with each shipment of materials samples

3.4.5 Shipping

All samples should be shipped within 5 days to the laboratory designated by the participating highway agency. Each box shall be labeled 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.

It is recommended that each shipment be insured for an amount to cover at least twice the cost of the field work performed at the site to obtain the samples.

A copy of the bill of lading clearly showing the boxes being shipped and a receipt signed by the shipping organization shall be sent to the appropriate FHWA LTPP Regional Coordination Office.

All of the above guidelines are designed to protect the integrity of the material samples to the highest degree possible within economic limits. These materials are very important to the success of the LTPP program and should be treated with as much care as possible. Cooperation from all participants is needed to ensure that these specimens are shipped to the laboratory with a minimum of damage.

3.4.6 Patching and Clean-up

Following the completion of the sampling and testing of each layer, the sampling personnel shall be especially careful to remove all debris created by the operations. Field sampling and testing personnel shall also repair and restore all bulk sampling, auger probe, or coring locations, etc. by replacing all material and compacting the layer as per the participating agency practice. The method of repair of each type of sampling area shall be outlined in the materials sampling plan

3.5 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 concerning 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 must 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 LTPP representative, the data sheets must be reviewed by the LTPP representative prior to forwarding the sheets to the appropriate personnel.

3.5.1 Field Set Number

The field set number is a sequentially assigned number used to indicate the different time periods in which material sampling and field testing were conducted on the project. A field set number can apply to more than one day since sampling of SPS-9A test sections may require more than one day.

As a general rule for new construction, all sampling that occurs up to the opening of the pavement test section to traffic shall be assigned field set number 1. For cores, this is the same as sampling time interval A. All subsequent sampling shall be assigned a field set number incrementally. For example, the next sampling conducted would be given a field set number of 2, etc.

For overlay projects, all sampling that occurs prior to construction of the overlay should be designated field set number 1. All sampling performed during construction should be designated field set number 2, etc.

3.5.2 Cores

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 2 mm. Data sheets for these logs are included in Appendix B of this document. 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 B of the **SHRP-LTPP Guide for Field Materials Sampling, Handling and Testing**. The general code 700 shall be used to identify HMA. Code 321 shall be used in the field to classify other asphalt treated mixes such as base and subbase materials. 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.

3.5.3 A-type Sampling

Data for each A-type sampling hole shall be recorded on Sampling Data Sheet 4-1. This includes auguring used to obtain subgrade bulk samples and to perform material classification and layer thickness measurements on base and subbase layers This data should include descriptions of the subgrade layers, samples depths, and other related data. Data to be recorded on this form should include the following:

1. Material type and description for 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 encountered in the hole to the nearest 2 mm.

3 Presence and levels of any water encountered.

4. Sample numbers.

3.5.4 Shoulder Auger Probes

Data for shoulder auger probes shall be reported using Sampling Data Sheet 9. A description and material code must be recorded as a function of depth. If bedrock or other very stiff layer of material occurs at less than 6 m, auguring operations must be terminated and reported. Refusal caused by the presence of cobbles, boulders, etc. should not be reported as bedrock or a stiff layer. For all the sampling operations the data recorded should follow the following guidelines.

1. Material type and description for 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 2-mm.

3. Presence and levels of any water encountered.

4. Sample numbers.

3.5.5 Bulk Sampling of Subgrade

Observations and measurements performed during subgrade sampling shall be logged as the excavation progresses and reported on Sampling Data Sheet 12. The record shall include description of the exposed subgrade and thickness of any layers to the nearest 2 mm, sample numbers and number of bags per sample, test numbers, any water seepage, sloughing, voids and other pertinent items.

3.6 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-9A test site The forms will appear in the final assembled data packet in the order provided in Appendix A. The title page will always be the first (top) sheet of the data packet and it will include the following information.

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. The pages should then be numbered 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 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, an appropriate number of duplicates should be made. The original and one copy should be forwarded to the FHWA LTPP RCOC. Also, copies should forwarded to the participating highway agency and those laboratories designated by the agency to perform the laboratory tests on the samples.

4. Laboratory Materials Testing

4.1 General

This chapter contains general guidelines to be used by laboratories participating in the SPS-9A laboratory materials testing program. Most of the protocols, test data reporting sheets, definitions, etc. referenced in this document can be found in the document **SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing** Revised and Amended July, 1993. The purpose of the protocols and the materials testing guide is to minimize the variability of materials test data attributable to laboratory material testing and handling techniques by standardizing these techniques as much as possible. They also provide a common format for reporting test results so they can be stored in the LTPP Information Management System for dissemination. The general instructions included in this SPS-9A materials sampling and testing document are to be used as general guidelines by the laboratories. However, the laboratory chief/manager must exercise judgement when using these guidelines. If problems or discrepancies are found, the LTPP Regional Coordination Office (RCO) should be contacted.

It should be noted that **all** laboratories wishing to participate in the laboratory material testing program for the SPS projects must maintain either a current AASHTO certification or satisfactory current participation in AMRL/CCRL certification programs **combined** with the direct supervision of the laboratory by a registered professional engineer

This laboratory materials testing plan assumes that multiple laboratories will be involved with testing the materials from each SPS-9A test section. Because more than one laboratory is involved with the testing of these materials, close coordination is essential between the LTPP Regional Coordination Office, the state/provincial field sampling forces, the state/provincial laboratory and the FHWA-LTPP Laboratory Materials Testing Contractor. The LTPP RCO is responsible for this coordination which includes.

- Detailing the material test assignments for each laboratory
- Verifying that layer numbers, sample codes and specimen codes assigned to the various samples are correct and consistent.
- Tracking materials shipments, sample test status and disposal of all samples.
- Compiling and quality review of all laboratory test results.

4.2 Laboratory Testing of Subgrade Materials

The participating highway agency laboratory, or their designee, is responsible for performing the sieve analysis, atterberg limits, material classification, and natural moisture content tests on the subgrade materials obtained from the SPS-9A test sections The LTPP

protocols containing the test procedure, reporting requirements and data forms for these tests are:

Natural Moisture Content	Protocol P49
Sieve Analysis	Protocol P51
Atterberg Limits	Protocol P43
Classification	Protocol P52

The following general procedures shall be used to perform the testing on the subgrade soils:

- Perform moisture content testing (Protocol P49) on all jar samples provided with the bulk samples.
- Combine the bulk samples with the same sample number if contained in more than one bag or container. Do not combine bulk samples of materials obtained from different locations in the SPS-9A project.
- Thoroughly mix the combined bulk sample and then dry the sample in accordance with the procedure described in Section 4.1 of AASHTO T87-86, "Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test."
- The mixed and dried sample is to be reduced to the appropriate test size using the procedures described in AASHTO T248. The test samples shall be representative of the total bulk sample.
- Perform all other tests in accordance with the appropriate protocols. The table below contains approximate test sample sizes for each test procedure.

Protocol Name	Protocol No.	Approximate Sample Size (kg)		
		Maximum Aggregate Size		
		25 mm	51 mm	76 mm
Particle Size Analysis	P51	5	18	60
Atterberg Limits	P43	2	4	5
Classification	P47	Based on P51 and P43 Results		
TOTAL		7	22	65

It is likely that a substantial amount of material may be left over after testing of the subgrade soil. This extra material ensures that an adequate amount of sample is available to

run all of the required characterization tests. This extra material shall not be disposed of until all testing has been completed and reviewed by the supervising engineer.

4.3 Laboratory Testing of Embankment Materials

Materials from embankment layers greater than or equal to 1.2-m thick shall be treated as subgrade materials and tested in accordance with section 4.2, Laboratory Testing of Subgrade Soils. Materials from embankment layers less than 1.2 m thick shall be considered as a subbase but tested as a subgrade material.

4.4 Laboratory Testing of Unbound Granular Base/Subbase Material

The participating highway agency laboratory, or their designee, is responsible for conducting all laboratory testing on unbound base and subbase materials.

These tests shall be conducted in the following order:

1.	Particle Size Analysis	Protocol P41
2.	Sieve Analysis (washed)	Protocol P41
3.	Atterberg Limits	Protocol P43
4.	Classification	Protocol P47

The following general procedures shall be used to perform the testing on the unbound granular base/subbase.

- Combine the bulk samples with the same sample number if contained in more than one bag or container. Do not combine bulk samples of materials obtained from different locations in the SPS-9A project.

- Thoroughly mix the combined bulk sample and then dry the sample in accordance with the procedure described in Section 4.1 of AASHTO T87-86, "Dry Preparation of Disturbed Soil and Soil Aggregate Samples for Test "

- The mixed and dried sample is to be reduced to the appropriate test size using the procedures described in AASHTO T248. The test samples shall be representative of the total bulk sample

- Perform all other tests in accordance with the appropriate protocols.

Extra material shall not be disposed of until all testing has been completed and reviewed by the supervising engineer.

4.5 Laboratory Testing of HMA Materials

The following sections are to be used as a guide for the completion of the laboratory material testing program for Hot Mixed Asphalt (HMA) materials, including asphalt cement, aggregates, gyratory compacted HMA mix, and HMA cores.

4.5.1 Bulk Samples of HMA Mix and Constituent Materials

Tests on bulk samples of HMA mix constituent materials include tests on samples of aggregate and asphalt cement binder.

4.5.1.1 Testing of Bulk HMA Aggregate Samples

The following tests, as presented in Table 4, should be performed on the aggregates sent to the Participating Agency designated laboratory:

Aggregate Gradation
Specific Gravity of Coarse Aggregate
Specific Gravity of Fine Aggregate
Specific Gravity of -200 Material
Coarse Aggregate Angularity
Fine Aggregate Angularity
Toughness
Soundness
Deleterious materials
Clay Content
Thin, Elongated particles

4 5.1 2 Testing of Bulk Asphalt Cement Samples

The following tests, as presented in Table 4, should be performed on each asphalt cement used in the SPS-9A experiment HMA mixtures·

Penetration @ 5°, 25° and 46° C
Viscosity @ 60° and 135° C
Specific Gravity @ 16° C
Dynamic Shear @ 3 temperatures
Brookfield Viscosity @ 135° & 165° C
Rolling Thin Film Oven conditioning (RTFO)
Dynamic Shear on RTFO residue @ 3 temperatures
Pressure Aging Vessel (PAV) conditioning on RTFO residue
Dynamic Shear on RTFO-PAV residue @ 3 temperatures
Creep Stiffness of RTFO-PAV residue @ 2 temperatures
Creep Stiffness of RTFO-PAV residue @ 2 temperatures (24 hours conditioning)
Direct Tension on RTFO-PAV residue @ 2 temperatures

Determining Test Temperatures for Binder Testing - Original (Tank) Material. High temperature Dynamic Shear Rheometer (DSR) testing is used to characterize the original properties of asphalt cement. This test is performed to determine the ratio between the complex shear modulus G^* and the sine of the phase angle δ at a minimum of three temperatures. The selection of the three temperatures is dependent upon the PG grade of the asphalt cement. The first temperature at which the asphalt must be tested is the high temperature value of the performance grade. (see Table 1 in AASHTO Designation MP1). The selection of the other two temperatures is done with the intent to bracket the specification threshold value ($G^*/\text{Sin}\ \delta = 1.0$ kPa) for high temperature DSR testing over a temperature range of 12°C. In order to achieve this objective, the second test temperature depends on the value of $G^*/\text{Sin}\ \delta$ obtained for the first temperature. If the value of $G^*/\text{Sin}\ \delta$ is less than 1.0 kPa at the first test temperature, the next temperature should be 6°C less than the first temperature (Figure 7(a)). However, if the value of $G^*/\text{Sin}\ \delta$ is greater than 1.0 kPa at the first test temperature, a temperature 6°C greater than the first temperature should be used. The third temperature is selected based upon the value of $G^*/\text{Sin}\ \delta$ at the first and second test temperatures, with the objective to bracket the threshold value of 1.0 kPa to the maximum possible extent. The selection approach for the third temperature is shown schematically in Figure 7. In this figure, "X" and "Y" define the difference between $G^*/\text{Sin}\ \delta$ at the first and second temperatures and threshold value, respectively. In Figure 7(a), "X" is less than "Y", which results in a third test temperature of 64°C (closer to the first temperature). In the situation illustrated in Figure 7(b), "X" is greater than "Y", thus a third test temperature of 52°C is used (closer to the second temperature). If the test results at the first two temperatures are both greater than 1, then the third temperature should be higher than the second temperature. If the test results at the first two temperatures are less than 1, then the third temperature should be lower than the second temperature. **In summary, the three temperatures are selected based upon the balancing temperature range around the value of $G^*/\text{Sin}\ \delta = 1$ kPa to the maximum possible extent.**

Asphalt Binder Test Temperature after RTFO and at Times t = 0 and t = 6 Months The test temperatures at these sampling times will be the same as those established for the case of original asphalt binder in the previous section. Tests at these temperatures will provide a comparison between the original properties of asphalt cements, after RTFO conditioning, and after aging effects at t=0 and t=6 months.

Asphalt Binder Test Temperatures After PAV Conditioning. Three type of tests are needed to characterize asphalt after PAV conditioning These include low temperature DSR, bending beam (BB) and direct tension (DT) In developing the test temperatures for these tests, a similar approach as in the case of original asphalt cement is used. That is, the objective is to establish test temperatures that will closely bracket the threshold value of the test results.

In case of low temperature DSR testing, measurement of the loss shear modulus, $G = G^*\text{Sin}\ \delta$, at three test temperatures is required. The first temperature is defined as the low test temperature specified in AASHTO MP1 for the PG grade. For example, if the asphalt cement PG grade is **PG 58-28**, the first testing temperature for the asphalt is 19°C.

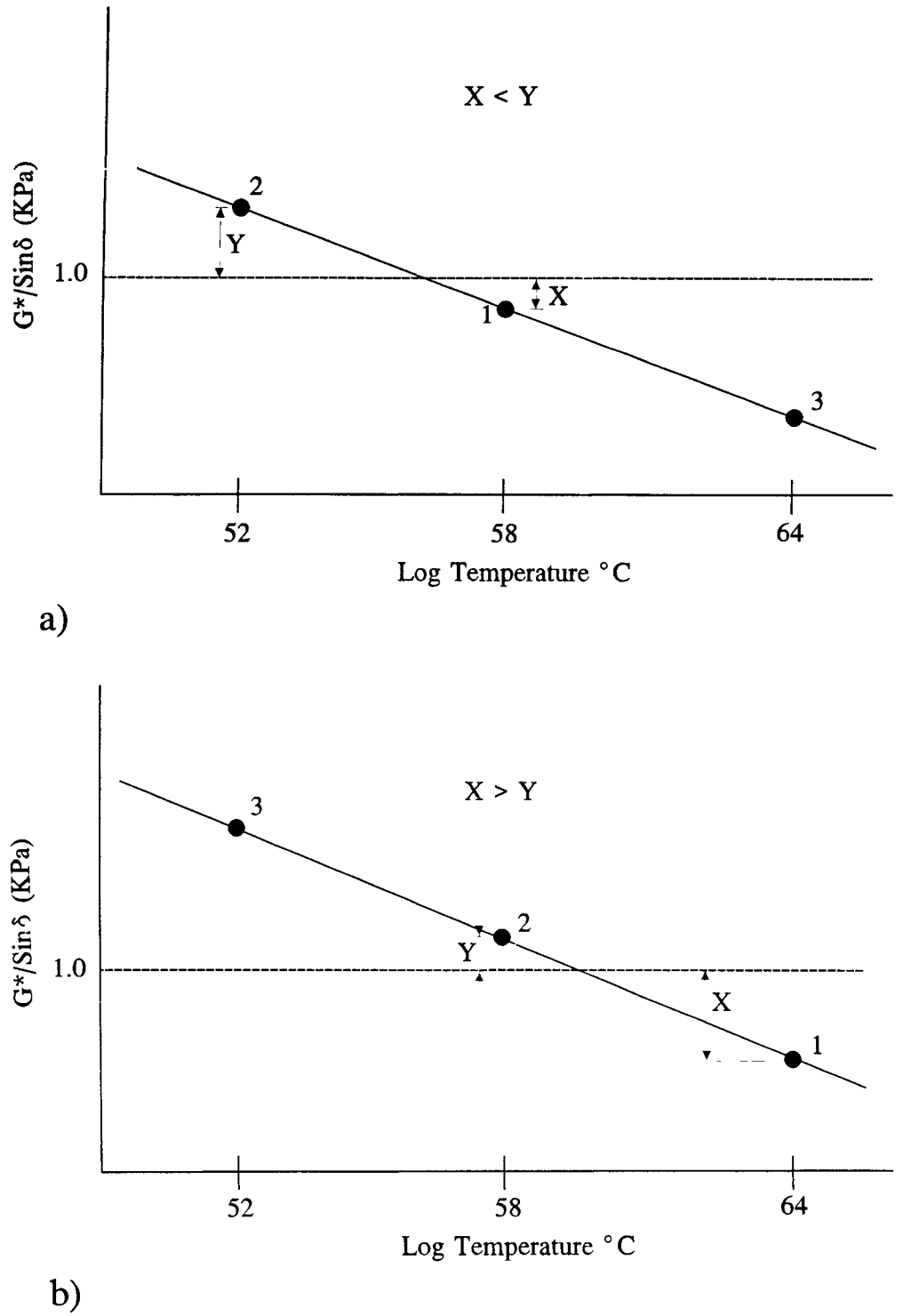


Figure 7. Test temperature determination for original asphalt cement for DSR testing

which corresponds to the **low** temperature for this PG grade from Table 1 of AASHTO MP1. The intent of the other two temperatures is to bracket the specification threshold value of $G^*Sin\ \delta$ = 5000 kPa over a temperature range of 6°C. The second test temperature depends upon the value of $G^*Sin\ \delta$ obtained at the first temperature. If the value of $G^*Sin\ \delta$ at the first temperature is less than 5000 kPa, the second test temperature should be 3°C less than the first temperature (Figure 8(a)), i.e. 16°C. However, if $G^*Sin\ \delta$ is greater than 5000 kPa at the first test temperature, the second test temperature should be 3°C greater than the first temperature, i.e. 22°C. The third temperature is selected to bracket the threshold value of $G^*Sin\ \delta$ of 5000 kPa to the maximum possible extent. The selection approach for the third temperature is shown schematically in Figure 8. In Figure 8(a), with "X" is less than "Y", a third test temperature of 22°C is selected. In Figure 8(b), since "X" is greater than "Y", a third test temperature of 16°C is selected. If the test results at the first two temperatures are both greater than 5,000, then the third temperature should be higher than the second temperature. If the test results at the first two temperatures are less than 1, then the third temperature should be lower than the second temperature. **In summary, the selection of three temperatures is based upon balancing the three temperatures across a value of $G^*Sin\ \delta$ = 5000 kPa to the maximum possible extent.**

Two test temperatures are required for creep stiffness and direct tension measurements. For both of these tests, the first test temperature is the temperature specified in MP1 as a function of the asphalt PG grade. For example, if the asphalt grade is **PG 58-28**, the asphalt should be tested at -18°C for both the tests. The second temperature will be selected based upon how the test results compare with the criteria established in AASHTO MP1. If the creep stiffness is less than 300 MPa, a temperature 6°C lower is selected for the second test and vice versa. Similarly, if the value of strain in direct tension is greater than 1%, a 6°C lower temperature is selected for the second temperature and vise versa

Asphalt Binder Test Temperatures for Times, t > 6 Months. The test temperatures at these sampling times will be the same as those for the tests on the PAV conditioned material for all test types (DSR, BB and DT) as described in the previous section These temperatures are used for developing relationships of age hardening behavior as a function of time. In addition, the relationships developed from this testing can be used for validating the results from PAV conditioning.

4.5 1 3 Testing of Gyratory Compacted HMA Mix Samples

Characterization, quality control tests and performance related tests are performed on HMA specimens prepared with the gyratory compactor.

Plant Obtained Material Characterization. Bulk samples of aggregate and binder obtained from the plant will be mixed in accordance with the Job Mix Formula for each test section These samples will be evaluated for volumetric and moisture susceptability properties as indicated in Table 5 for all test sections. To maintain a consistent basis for comparison, three specimens for each of the sections shall be compacted to N_{Max} established

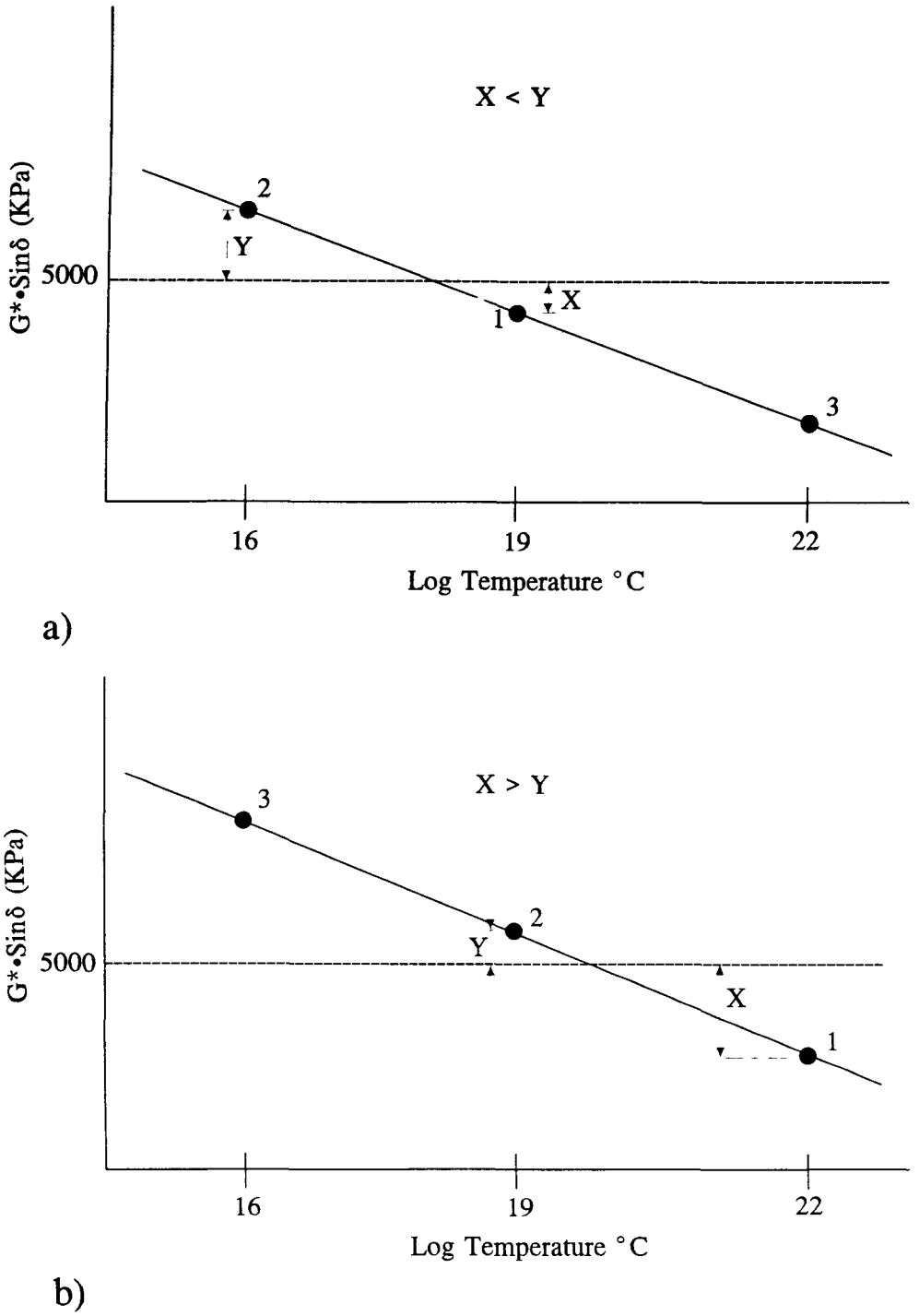


Figure 8. Test temperature determination for PAV conditioned asphalt cement for DSR testing

by the traffic and environmental loadings. Upon obtaining the corrected gyratory compaction curves, the bulk specific gravity at N_{Design} and the number of gyrations to obtain 7 % air voids may be determined. The moisture susceptability specimens shall be compacted to the number of gyrations required to achieve 7 % air voids and six samples are to be prepared at this compaction level for determining the moisture susceptability. The bulk specific gravity, estimated from the gyratory compaction curves at N_{Design} along with maximum specific gravity; the aggregate properties previously determined under 4.5.1.1; and the binder specific gravity determined under 4.5.1.2 shall be used to calculate the volumetric properties in accordance with AASHTO PP-19.

The above procedure may be accomplished from the following steps:

1. Prepare and mix 3 samples in accordance with the Job Mix Formula being careful to use the proper mixing temperature and the guidelines set forth in the Asphalt Institute Manual MS-2.

2. Compact these specimens at the appropriate compaction temperature in the Gyratory Compactor to N_{Max} as required for the specific temperature and traffic loadings. While compacting the specimens, produce the Gryatory Compaction versus gyrations curves.

3. Determine the bulk specific gravity of the compacted specimens and determine the correction factor for the compaction curves.

4. Estimate the bulk density (G_{mb} AASHTO T166) at N_{Design} of each of the specimens by reading the associated corrected density corresponding to N_{Design} (also based upon temperature and traffic loadings).

5. Prepare and mix another sample in accordance with the Job Mix Formula, and determine the maximum theoretical density (G_{mm}, AASHTO T209) of the sample.

6. Look up the specific gravities of the coarse, fine and -#200 aggregates from the testing performed as stated in Table 4, and compute the combined bulk specific gravity (G_{sb}). Also obtain the binder specific gravity (G_b) from the same source.

7 Calculate Voids in Mineral Aggregate (VMA), Air Voids (AV) and Voids Filled with Asphalt (VFA) from the above components following the instructions in AASHTO PP-19.

For test section 02, the preconstruction testing is further expanded as presented in Table 6. The number of sample compacted at N_{Max} for this section increases to 6. These six compaction curves serve as a basis to prepare the additional 32 samples at 7 % air voids and 2 at 3 % air voids. The basis for compaction levels (3 or 7% air voids) was based upon the entry levels for the SUPERPAVE™ Level III mix design procedures Calculate the

Volumetric properties for the compacted specimens as presented above for the other test sections.

Quality Control Related Tests. Samples of plant produced HMA will be compacted using a gyratory compactor to N_{Max} to assess either conformance with the mixture design or document possible changes in the plant produced mixture for non SUPERPAVE™ test sections. The results of these tests will be recorded for reference purposes. The use of these measurements for control quality control purposes will depend on the total production quantity for a given mixture. Quality control related tests on the aggregate, binder and the asphalt mixture are to be performed by the participating highway agency or their designee.

Similar to the Plant Material Characterization, at time of production, a comparison data is collected on the volumetric properties of the mixtures compacted to N_{Design}. This procedure is slightly different from above due to possible plant variations in gradations and asphalt content. Thus, the following procedure is presented:

1. Group the samples into two subsets of three samples; one from the beginning of production and one from end of production.

2. Sample and Compact three specimens at the appropriate compaction temperature in the Gyratory Compactor to N_{Max} as required for the specific temperature and traffic loadings. While compacting the specimens, produce the Gryatory Compaction versus gyrations curves.

3. Determine the bulk specific gravity of the compacted specimens and determine the correction factor for the compaction curves.

4. Estimate the bulk density (G_{mb} AASHTO T166) at N_{Design} of each of the specimens by reading the associated corrected density corresponding to N_{Design} (also based upon temperature and traffic loadings).

5. Sample and test another sample to determine the maximum theoretical density (G_{mm}, AASHTO T209) of the sample

6 Extract asphalt (LTPP P04/AC04) from a sufficient quantity of mix to run the aggregate gradation and measure asphalt content. Compare extracted asphalt content to the job mix formula (JMF) tolerance range.

7. Run an aggregate gradation on the extracted aggregate (P14) and compare against JMF design composite gradation

8. Look up the specific gravities of the coarse, fine and -#200 aggregates from the testing performed as stated in Table 4, and compute the combined bulk specific gravity (G_{sb}) based upon the weight fractions determined by the aggregate gradation. Also obtain the binder specific gravity (G_b) from the same source.

9. Calculate Voids in Mineral Aggregate (VMA), Air Voids (AV) and Voids Filled with Asphalt (VFA) from the above components following the instructions in AASHTO PP-19.

Similar to the Plant Material Characterization and Quality Control samples above, the number of samples for test section 02 is also 6. These samples are similarly grouped into two subsets; one at the start of the test section and another at the end of the section. Each subset is to be tested as noted above to provide information concerning possible material variation occurring during production. These two subsets are to be completed prior to initiation of preparation of the Performance Testing samples.

Performance Testing. Samples of plant production for SUPERPAVE™ mixtures intended for the SUPERPAVE™ performance test methods are compacted at two levels of compaction. The majority of the test samples are to be compacted to 7 % air voids, with limited samples compacted to 3 % air voids for the Repeated Shear at Constant Stress Ratio. These results will be used in the evaluation of the SUPERPAVE™ performance prediction models. The following samples of 150 mm diameter and 140 mm height shall be prepared in the Gryatory Compactor for the following tests.

Test Method	Protocal	Air Voids
Samples for the LTPP Contract Laboratory		
Creep Compliance (LTPP method)	P 06	7 %
Resilient Modulus (LTPP method)	P 07	7 %
Indirect tensile strength (LTPP method)	P 07	7 %
Samples for the SUPERPAVE™ Regional Test Center		
Frequency Sweep at Constant Height	SST-1	7 %
Simple Shear at Constant Height	SST-1	7 %
Volumetric Test	SST-2	7 %
Uniaxial Strain	SST-2	7 %
Repeated Shear at Constant Stress	SST-3	3 %
Indirect Tensile Creep Compliance (SUPERPAVE™ method)	SP-IT	7 %
Indirect Tensile Strength (SUPERPAVE™ method)	SP-IT	7 %

It is assumed that the performance samples will be split immediately upon receipt and processing in the laboratory to the appropriate sample size for compaction. Once split, these samples should be set aside until the Quality Control (N_{Max}) samples are completed. Once the required machine settings, as described below, are determined, compaction of these samples may begin. These samples were also grouped into two subsets; one associated with

the beginning and end of production. The Gyratory Compaction curves for the beginning set shall be associated with the beginning samples and likewise for the end portion. To determine the compaction level (Number of gyrations required to produce the desired air voids), overlay the three corrected Compaction - Gyration curves and determine the average number of gyration necessary to obtain this compaction level. Once the required number of gyrations is determined, compact each set of samples to this number of gyrations.

4.5.2 Laboratory Procedures for HMA Core Preparation and Testing

4.5.2.1 HMA Core Preparation, Orientation, Handling and Thickness Measurement

The AC Core Examination and Thickness Test (LTPP Test Designation AC01) will be the first test performed on **all** AC cores prior to sawing. LTPP Protocol P01 will be used for the performance of this test. Protocol P01 covers the visual examination of the entire asphaltic concrete core and the measurement of the length of the entire asphalt concrete core. It also covers the identification and determination of thickness of the individual layers within the core. On cores which contain one or more bonded layers the laboratory is required to identify the different layers, assign layer numbers and measure the thickness of each layer **prior** to sawing. The procedure described in Section 3.3 of Attachment "B" to Protocol P01, contained in Appendix E.2 of the **SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing**, shall be used to measure the thickness of the bonded layers. It should be noted and emphasized that multiple **lifts** within an asphalt concrete layer shall not be separated by sawing. All of the lifts will be treated as a single homogeneous layer and tested as such. Also, in **no case** shall two or more layers within an HMA core sample be combined for any test.

AC cores that are received by the laboratory from the field should be marked with an arrow to show the direction of traffic. It is important that this orientation mark be transferred to all layers to be tested within an AC core when these layers are separated by sawing. After sawing, the laboratory technician must paint an arrow in the same orientation on the sawed surface of the lower asphalt layer(s). This arrow shall be placed along the same axis to designate the direction of traffic on the pavement surface. The face to be marked shall be the one closest to the pavement surface The marking of the direction of traffic is required for all cores

Different layers within an AC core shall be separated by carefully sawing the sample Special care shall be taken for sawing AC cores so as to provide minimum disturbance. The sawing operation on the interface of the layer to be separated shall be performed so that the asphaltic concrete will not be weakened by shock or by heating. The sawed surfaces of cores shall be smooth, plane, parallel and free from steps, ridges, and grooves. Care should be taken to avoid chipping or cracking. Always saw and separate the bottom layer first, followed by the next layer in ascending order until reaching the top layer. After sawing, proper identification, etc. shall be attached to the core to facilitate identification.

4.5.2.2 Volumetric and Binder Tests on Cores from Main Study Test Sections

Cores from all test sections will be tested for volumetric and both conventional and SUPERPAVE™ binder stiffness properties. Tests and computations include:

Volume percent air voids
Percent voids filled with asphalt
Bulk Specific Gravity

Asphalt extraction, Abson recovery
Penetration @ 5° C
Penetration @ 25° and 46° C
Viscosity @ 60° and 135° C
Specific Gravity @ 16° C
Dynamic Shear @ 3 temperatures
Creep Stiffness @ 2 temp
Direct Tension @ 2 temp

Properties of field (aged) asphalt binder will be determined from asphalt extracted from the cores The top 50-mm of each core sample should be used to obtain these recovered asphalt samples. It is estimated that a total of approximately 650-g of asphalt is required to run a complete set of binder tests, although these tests can be performed on as little as 475 grams. It is estimated that a total of 8 cores are required to produce the desired 650-g of material assuming a 3% recovery of asphalt (total mass) from the top 50 mm of the core. All asphalt reclaimed from the 8 cores must be blended together prior to testing. The tests and the amount of binder required for each test is summarized as follows.

Test Name	Number of Tests	Amount of Mat'l Per Test (gms)	Total Amount (gms)
Penetration @ 5°C	3 Points	75	75
Penetration @ 25°C	3 Points	75	75
Penetration @ 46°C	3 Points	150	150
Viscosity @ 60°C	2	30	60
Viscosity @ 135°C	2	30	60
Specific Gravity @ 16° C	2	30	60
Dynamic Shear at three temperatures	2(3 temp)	3	18
Creep Stiffness at two Temperatures	2(2 temp)	15	60
Direct Tension at two Temperatures	2(2 temp)	10	80
Total Amount of Asphalt Required			**638**

The above table shows a requirement of approximately 638 grams of asphalt to run the all tests on separate samples. If at least 475-g of material are available, all of the

above tests results can be obtained by performing more than one test on the samples using the following procedure:

Penetrations	Prepare one 6 oz container for penetration testing that contains 150 grams of asphalt. Run the test at 5°C and take three penetration readings. Use the same asphalt in the same container to run penetration at 25°C for three points. Finally, bring the same container to 46°C and perform the penetration test at three points. Thus, using this approach only 150 grams of asphalt is needed to run all of the penetration tests.
Viscosity @ 60°C	A total of 60 grams of asphalt is sufficient to run the viscosity test at 60°C.
Viscosity @ 135°C	A total of 60 grams of asphalt is sufficient to run the viscosity test at 135°C.
Dynamic Shear Rheometer	Use a total of 18 grams of asphalt to run the test at three temperatures. Use the same specimen at each of the three temperatures. However, a new sample must be used for the replicate test.
Creep Stiffness	Run this test at two temperatures for two replicates. This requires a total of 60 grams of asphalt.
Direct Tension	Run this test at two temperatures for two replicates. This requires a total of 80 grams of asphalt.
Specific Gravity	A total of 60 grams of asphalt is required for the two replicate samples. If sufficient asphalt is not available, use asphalt from the penetration tests to run the specific gravities.

Using this methodology, the anticipated least amount of extracted binder can be used to perform all the required binder tests

The following procedure should be used to determine the volumetric parameters from the cores obtained at various time intervals.

1 A total of eight (8) cores should be available for testing from each time period.

2 Perform Core Examination and Thickness AC01 on all eight (8) cores prior to any other testing.

3. Measure the Bulk Specific Gravity G_{mb} (AC02) on all cores.

4. Perform an asphalt extraction on these cores to determine the asphalt content, P_b, and to perform a gradation analysis on the extracted aggregate on all cores. The extracted AC should be reclaimed by using Abson Recovery (AE01) technique and used for binder tests.

5. Determine Aggregate Gradation (AG04) and record the values of percent weight of dry aggregate passing each sieve to the appropriate number of significant figures and decimal places on laboratory data sheet T14.

6. Estimate the maximum theoretical specific gravity G_{mm} based upon the extracted asphalt percentage and effective aggregate specific gravity determined during the mix design process.

7. Calculate the VMA, Air voids and VFA using the results listed above, the specific gravity of aggregate portions and the asphalt cement specific gravity previously determined,

4.5.2.3 Volumetric, Binder, and Performance tests on Cores from Level III Study Test Sections

Cores from test sections having mixtures designed using SUPERPAVE™ will be tested for both volumetric and conventional and SUPERPAVE™ binder properties, as detailed in 4.5.2.2, as well as the SUPERPAVE™ performance measurements. The results from these tests are intended to be used in the SUPERPAVE™ models to predict performance of the as-placed mixture. The tests and computation to be performed on these cores include:

Volume percent air voids
Percent voids filled with asphalt
Bulk specific gravity
Theoretical maximum specific gravity

Asphalt extraction, Abson recovery
Penetration @ 5° C
Penetration @ 25° and 46° C
Viscosity @ 60° and 135° C
Specific gravity @ 16° C
Dynamic Shear @ 3 temperatures
Creep Stiffness @ 2 temp
Direct Tension @ 2 temp

Creep Compliance (LTPP method)
Resilient Modulus (LTPP method)
Indirect Tensile Strength (LTPP method)

Frequency Sweep at Constant Height
Simple Shear at Constant Height
Uniaxial Strain
Volumetric Test
Repeated Shear at Constant Stress

Indirect Tensile Creep Compliance (SUPERPAVE™ method)
Indirect Tensile Strength (SUPERPAVE™ method)

4.6 Sample Identification and Marking

It is imperative to maintain strict adherence to the sample identification and marking procedures used initially in the field. The sample numbers, core/sample location numbers, etc. shall follow each sample throughout the laboratory materials testing process and it is extremely important to keep sample tags and labels on samples during storage.

4.7 Sample Record Keeping

The laboratories conducting the testing for the SPS-9A projects are required to keep in close coordination with the FHWA-LTPP Regional Coordination Office from the time of receiving the samples from the field to the disposal of the material samples Timely transmission of information between the laboratory and the RCO should be maintained using the standard guidelines and forms discussed in this section. The forms discussed herein may be found in Appendix C.2 of the **SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing**.

4.7.1 Sample Receipt Procedures

The field material samples will be shipped to the participating laboratory by the drilling and sampling crew. The drilling and sampling crew or others, as designated by the state/provincial agency, will also mail a complete packet of field data sheets for the corresponding SPS project. Field Operations Information Form 1 provides an inventory of material samples shipped to the laboratory Field Operations Information Form 2-1 also provides pavement layer numbers assigned in the field

Upon receipt of the samples, the samples shall be inspected by the laboratory manager (or their designee) for completeness of the shipment (as compared to the data shown on Field Operation Forms 1 and 2-1), damage, contamination, sufficient quantity, proper identification and properly completed field forms. Regardless of the condition and size of the samples, they must be logged in by using the information from Field Operation Forms 1 and 2-1 as well as individual sample tags and markings.

The laboratory shall then use Forms L01, L02, and L03 to prepare the sample receipt report for each project. It is imperative that the sample identification and any unique laboratory control number (assigned by the participating laboratory) remain attached to the sample/sample container **at all times**. In the event that it becomes necessary to remove the

identification label or tag during sample processing or testing, steps shall be taken to ensure that the relationship between the sample and its identification is not lost but the identification is restored to the sample at the end of each step of processing or testing.

After completing the sample receipt process, these forms should be transmitted to the appropriate personnel. As a minimum, this should include the state/provincial agency contact person and the FHWA-LTPP RCOC.

After preparing the sample receipt report, the laboratory manager shall make laboratory test assignments using Form L04 (Appendix C.2 of the Laboratory Testing Guide). On this form, the first three columns from the left provide the following information about the pavement layers:

a. **Column 1 - Layer Number**. Layer number is assigned on Column 1 of Form L04 starting with layer number 1. Layer number 1 is always assigned for the subgrade and the last layer number is always assigned to the pavement surface layer. An example of layer numbers for a five-layer pavement structure is:

Subgrade	1
Subbase	2
Base	3
AC Binder Course	4
AC Surface Course	5

b. **Column 2 - Layer Description.** Layer description is provided on Column 2 of this form, using the following codes:

Overlay	01	Subgrade	07
Seal Coat	02	Interlayer	08
Surface Layer	03	Friction Course	09
AC Layer below Surface	04	Surface Treatment	10
Base Layer	05	Embankment (Fill)	11
Subbase Layer	06		

c **Column 3 - Layer Type**. Layer type code is assigned in Column 3 from the left on Form L04 using:

AC - for asphaltic concrete (bituminous concrete) layer,
TB - for bound (treated) base,
TS - for bound (treated) subbase,
GB - for unbound (granular) base,
GS - for unbound (granular) subbase,
SS - for subgrade (untreated), and
ST - for subgrade (treated)

Multiple sheets can be used for the laboratory designated test assignments on the samples from a SPS project. Appendix C.2 of the Laboratory Materials Testing Guide contains further instructions on the use of Forms L01-L04. The FHWA-LTPP RCOC, shall approve all test data reporting forms

4.7.2 Test Data Reporting

The participating laboratory is required to use the LTPP standard data reporting forms for recording test results. These data reporting forms are contained in Appendix C.2 of the **SHRP-LTPP Interim Guide for Laboratory Material Handling and Testing**. All of these forms provide space to record sample identification information and test data as well as comments and notes relevant to each test. These forms are also contained at the end of each LTPP Protocol contained in Appendix E.2 of the Laboratory Material Testing Guide. All data entry sheets should be forwarded to the FHWA-LTPP RCOC for processing and approval.

4.7.3 Sample Disposition Reporting

At the completion of all testing for a SPS project, Form L06 (Appendix C.2 of the Laboratory Materials Testing Guide) is used by the participating laboratory to provide the LTPP RCO with a record status of **all** material samples. This form includes entries for recording whether a particular sample/specimen was stored, disposed of, etc. After completion of this form, it should be transmitted to the appropriate personnel. As a minimum, this should include the state/province agency contact personnel and the RCOC

4.8 Sample Storage

Due to the volume of work and the likelihood of delays in testing, proper storage conditions must be maintained for all specimens obtained from the Long Term Pavement Performance (LTPP) program Specific Pavement Studies experiments This includes samples and specimens that will be tested by the state highway agency laboratories or their agents and the materials which will subsequently tested by the FHWA contracted laboratories. The storage requirements presented herein are critical to ensuring the integrity of the sample/specimen for future testing and materials characterization. Specifically, requirements for adequate storage and temperature conditions have been detailed for the specimens to ensure that the samples are not compromised while intending not to make the storage requirements burdensome on the participating laboratory. Identification assigned to the materials shall be retained on tested samples, untested samples and extra samples at all times.

The term "Environmentally Protected Storage" as used in this document means that the storage area shall be fully enclosed and not subjected to the natural elements. This type of area shall provide protection against contact with water (rain or wet floor) and exposure to direct sunlight. Also, the storage area shall be capable of maintaining each sample in the required temperature range as specified below. Samples shall be marked to indicate their status; such as "hold material - do not use "

The following guidelines shall be followed for storage of materials from the LTPP experiments:

4.8.1 Asphaltic Concrete Cores

Asphaltic concrete cores should be stored flat side down, fully supported and between 5°C (40°F) and 21°C (70°F) in an environmentally protected storeroom.

4.8.2 Asphalt Treated Materials

Asphalt Treated Base/Subbase and Treated Subgrade cores and materials should be stored flat side down, fully supported and at a temperature between 5°C (40°F) and 21°C (70°F) in an environmentally protected storeroom.

4.8.3 Other Than Asphalt Treated Materials

Other than asphalt treated base/subbase and subbase cores and materials should be stored in a fully supported condition and at a temperature between 5°C (40°F) and 38°C (100°F) in an environmentally protected storeroom.

4.8.4 Bulk/Moisture Samples

Bulk and moisture samples of base, subbase and subgrade material should be kept in an environmentally protected storage area at temperatures between 5°C (40°F) and 38°C (100°F).

4.9 Sample Handling and Shipping

All samples sent to other laboratories for testing shall, as a minimum, be prepared and shipped using the following guidelines.

4.9.1 Packaging

1. Each sample shall have a label or tag attached that clearly identifies the material, the project number/test section from which it was recovered, and the sample number.

2 Each core shall be surrounded by "bubble-wrap" or other acceptable cushioning material on all sides within the shipping box.

3 Bulk samples shall be marked with the two samples or tags. One shall be placed inside the bag and one attached to the outside Pieces from treated layers not suitable for testing as cores shall be packaged and shipped as bulk samples.

4. Thin-walled tube samples and jar samples shall be packaged in boxes with cushioning such as "bubble-wrap" or other similar material.

5. Shipping boxes shall be made of wood of suitable grade and construction to withstand shipping and subsequent moving without breakage of the box or damaging of the samples.

6. All boxes shall be adequately secured by nails or screws prior to shipping.

7. All necessary documentation related to the samples being shipped shall also be included in the shipment. A duplicate set of all necessary documentation shall be sent in a separate package to the laboratory to confirm the box inventory.

4.9.2 Shipping

Each box shall be labeled to include the project identification number, type(s) of samples, box number (for each series of boxes). The boxes shall be labeled "Handle with Care" or similar wording as specified by the transporting organization to reasonably insure careful handling and protection from freezing and overheating.

It is recommended that each shipment be insured for an amount to cover at least twice the cost of the field work performed at the site to obtain the samples.

A copy of the bill of lading clearly showing the boxes being shipped and a receipt signed by the shipping organization shall be sent to the appropriate FHWA LTPP Regional Coordination Office.

4.9.3 Summary

The sample preparation and shipping guidelines provided herein are designed to protect the integrity of the materials samples to the highest degree possible within economic limits. These materials are very important to the success of the LTPP program and should be treated with as much care as possible. Cooperation from all participants is needed to insure that these specimens are shipped between laboratories with a minimum of damage

4.10 Laboratory Tracking of Samples

This section contains Laboratory Sample Tracking Tables which contain instructions for sample handling and tracking throughout the laboratory testing process. Tables 12 to 24 detail the sample handling and testing for the material samples through the progression of testing. Tables 12 to 16 present the pre-HMA placement samples for test sections exclusive of 02 Tables 17a & 17b detail the state/ provincial agency laboratory (or their designee), sampling and testing activities immediately before and during construction. Tables 18a, 18b and 19 detail the SUPERPAVE™ Regional Test Center and LTTP Contract Laboratory activities at the start of the project Finally Tables 20 to 24 details core sample handling and testing done by the various agencies with Table 23 presenting SUPERPAVE™ Regional Test Center and Table 24 detailing the sample handling and testing for the FHWA-LTPP Laboratory Materials Testing Contractor

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

- tracking of samples as they are taken from the field and tested in the laboratory
- laboratory test sequences for each pavement material type
- dedicated sample(s) for each test
- designation of extra samples for future use
- instructions for sample storage
- special instructions and other remarks

As mentioned previously, these tables are based on the idealized sampling plan presented in Section 3 of this document. Using these tracking tables, each laboratory shall be able to plan and track each sample through the laboratory materials testing program for the SPS-9A experiment in a step-by-step manner.

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

Sample Location Number - as described previously in Section 3 and as shown on sample tags and labels.

Sample Number - as described previously in Section 3 and as shown on sample tags and labels.

Lab Test Number - shall be assigned as per the following:

a. Beginning of the Section (Station 0-): samples of each layer that are retrieved from areas in the approach end of the test section (stations preceding 0+) shall be assigned Laboratory Test Number '1'

b. End of the Section (Stations 150+): samples of each layer that are retrieved from areas in the leave end of the test section (stations after 150+) shall be assigned Laboratory Test Number '2'.

c. Middle of the Section (Stations 0+ to 150+). samples of each layer that are retrieved from areas in the middle of the test section (from the paver) shall be assigned Laboratory Test Number '3'.

Required Laboratory Tests Per Layer - order in which testing shall proceed.
Extra Sample - is the sample to be saved as a backup for other tests? A "yes" in this column implies that this is a dedicated extra sample saved for future use. A "no" indicates that a sample can be discarded after use.

Sample Storage - the following codes are used to specify the sample storage conditions for samples.

a. environmentally protected and controlled storeroom at 5-21°C (40-70°F).
b. environmentally protected and controlled storeroom at 5-38°C (40-100°F).

Sample Disposal? - indicates whether or not a sample can be disposed of after testing. Generally all samples, or portions of samples that are not tested are saved until further notice.

Table 12. Tracking table of subgrade/embankment testing in the state/province laboratory (or their designee)

a) For New/Reconstruction Only

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
			Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed
			First	Second	Third	Fourth			
B01A01	BS01A01	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes
B01A02	BS01A02	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes
B01A03	BS01A03	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes

Note: above table represents three sections on a project

b) For Existing Pavement - Overlay Construction

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
			Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed
			First	Second	Third	Fourth			
A01A01	BS01A01	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes
A01A02	BS01A02	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes
A01A03	BS01A03	1	SS01/P51	SS03/P43	SS04/P52	SS09/P49	No	(b)	Yes

Note above table represents three sections on a project

Table 13(a). Tracking table of base/subbase testing in the state/province laboratory (or their designee) (new/reconstruction only)

Unbound Layer

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence						
			Required Laboratory Tests Per Layer				Extra Sample	Sample Storage	Sample Disposed
			First	Second	Third	Fourth			
B02A01	BG01A01	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	No	(b)	Yes
B02A02	BG01A02	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	No	(b)	Yes
B02A03	BG01A03	2	UG01/P41	UG02/P41	UG04/P43	UG08/P47	No	(b)	Yes

Note: above table represents three sections on a project

Bound Layer

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence			
			Required Laboratory Tests Per Layer	Extra Sample	Sample Storage	Sample Disposed
C01A01	CT01A01	1	AC01/P01 or TB01/P31	No	(a)	Yes
C02A01	CT02A01	2	AC01/P01 or TB01/P31	No	(a)	Yes
C01A02	CT01A02	1	AC01/P01 or TB01/P31	No	(a)	Yes
C02A02	CT02A02	2	AC01/P01 or TB01/P31	No	(a)	Yes
C01A03	CT01A03	1	AC01/P01 or TB01/P31	No	(a)	Yes
C02A03	CT02A03	2	AC01/P01 or TB01/P31	No	(a)	Yes

Note above table represents three sections on a project

Table 13(b). Tracking table of base/subbase testing in the state/province laboratory (or their designee) (existing pavement - overlay construction)

Unbound Layer (table represents three sections on a project)

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence			
			Required Laboratory Tests Per Layer	Extra Sample	Sample Storage	Sample Disposed
A02A01	BG01A01	2	Note 1	No	(b)	Yes
A02A02	BG01A02	2	Note 1	No	(b)	Yes
A02A03	BG01A03	2	Note 1	No	(b)	Yes

Note 1 Visually classify material in accordance with Appendix C of the SHRP-LTPP Guide for Material Sampling Testing and Handling

Bound Layer (table represents three sections on a project)

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence			
			Required Laboratory Tests Per Layer	Extra Sample	Sample Storage	Sample Disposed
A01A01	CT01A01	1	AC01/P01 or TB01/P31	No	(a)	Yes
A02A01	CT02A01	2	AC01/P01 or TB01/P31	No	(a)	Yes
A01A02	CT01A02	1	AC01/P01 or TB01/P31	No	(a)	Yes
A02A02	CT02A02	2	AC01/P01 or TB01/P31	No	(a)	Yes
A01A03	CT01A03	1	AC01/P01 or TB01/P31	No	(a)	Yes
A02A03	CT02A03	2	AC01/P01 or TB01/P31	No	(a)	Yes

Table 14. Tracking table of asphalt concrete or PCC surface layer testing in the state/province laboratory (or their designee) (existing pavement - overlay construction)

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence			
			Required Laboratory Tests Per Layer	Extra Sample	Sample Storage	Sample Disposed
A01A01	CA01A01 or CP01A01	1	AC01/P01 or PC06/P66	No	(a)	Yes
A02A01	CA02A01 or CP02A01	2	AC01/P01 or PC06/P66	No	(a)	Yes
A01A02	CA01A02 or CP01A02	1	AC01/P01 or PC06/P66	No	(a)	Yes
A02A02	CA02A02 or CP02A02	2	AC01/P01 or PC06/P66	No	(a)	Yes
A01A03	CA01A03 or CP01A03	1	AC01/P01 or PC06/P66	No	(a)	Yes
A02A03	CA02A03 or CP02A03	2	AC01/P01 or PC06/P66	No	(a)	Yes

Note table based upon three sections in a project

Table 15. Tracking table of aggregate and binder testing to be performed by participating state/province (or their designee) on all test sections (pre-construction)

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence							
			Required Laboratory Tests Per Layer					Extra Sample	Sample Storage	Sample Disposed
			First	Second	Third	Fourth	Fifth			
H01AXX	BU10AXX	3	AG04/P14	AG01/P11 AG02/P12 AASHTO T100	Penn DOT TM 621 ASTM C1252	AASHTO T96 AASHTO T104	AASHTO T112 AASHTO T176 ASTM D4791	Yes	(b)	No
H01AXX	BC01AXX	3	AASHTO T49[c] AE02/P22[c] AE05/P25 AE03/P23	ASTM D4402 AASHTO TP5[d,f]	ASTM T240 AASHTO TP5[d,g]	AASHTO PP1 AASHTO TP5[d,h] AASHTO TP1[d] AASHTO TP1[d,e]	AASHTO TP3[d]	Yes	(a)	No

c three penetration readings are taken for each test
d temperature selection, see section 4
e conditioning time extended to 24 hrs ± 10 minutes at 10°C above the minimum performance temperature.
f original (tank) binder
g after RTFOT conditioning
h after RTFOT and PAV conditioning

Table 16. Tracking table of asphalt mixture testing to be performed by participating state/province (or their designee) on section 01 and section 03 (pre-construction)

Sample Location Number	Sample Number	Lab Test Number	Steps Involved in Laboratory Handling and Testing Sequence					
			Required Laboratory Tests Per Layer			Extra Sample	Sample Storage	Sample Disposed
			First	Second	Third			
H01AXX	NA01AXX	3	AC03/P03			No	(a)	Yes
H01AXX	LA01AXX	3	AASHTO M-002[c]	AC02/P02	AASHTO PP19[e]	No	(a)	Yes
H01AXX	LA02AXX	3	AASHTO M-002[c]	AC02/P02	AASHTO PP19[e]	No	(a)	Yes
H01AXX	LA03AXX	3	AASHTO M-002[c]	AC02/P02	AASHTO PP19[e]	No	(a)	Yes
H01AXX	LA04AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes
H01AXX	LA05AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes
H01AXX	LA06AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes
H01AXX	LA07AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes
H01AXX	LA08AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes
H01AXX	LA09AXX	3	AASHTO M-002[d]	AC05/P05		No	(a)	Yes

c Gyratory compaction at N_{Max}

d Gyratory compaction at 7 percent air voids (Number of gyrations estimated from the gyratory compaction curve).

e Estimate the corrected bulk density at N_{Design} for use in volumetric calculations

Table 17a. Tracking table of compacted laboratory prepared asphalt concrete samples from test section 02 on all projects by state/province laboratory or their designee

	Compact bulk Samples to Conditions and label compacted specimens								
Sample Loc Number	Initial Sample Num	Air Voids	Ht (mm)	Final Sample Num	1st[c,d]	2nd[c,d]	Extra Sample	Store Sample	Dispose Sample
H01A02	NA01A02	N/A	115	LA01A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA02A02	N/A	115	LA02A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA03A02	N/A	115	LA03A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA04A02	N/A	115	LA04A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA05A02	N/A	115	LA05A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA06A02	N/A	115	LA06A02	P02	PP19[f]	No	(a)	Yes
H01A02	NA07A02	3	140	LA07A02	P02	SRTC	No	(a)	No
H01A02	NA08A02	3	140	LA08A02	SRTC		No	(a)	No
H01A02	NA09A02	7	140	LA09A02	P05[e]		No	(a)	Yes
H01A02	NA10A02	7	140	LA10A02	P05[e]		No	(a)	Yes
H01A02	NA11A02	7	140	LA11A02	P05[e]		No	(a)	Yes
H01A02	NA12A02	7	140	LA12A02	P05[e]		No	(a)	Yes
H01A02	NA13A02	7	140	LA13A02	P05[e]		No	(a)	Yes
H01A02	NA14A02	7	140	LA14A02	P05[e]		No	(a)	Yes
H01A02	NA15A02	7	140	LA15A02	P02	LCL	No	(a)	No
H01A02	NA15A02				P03		No	(a)	Yes
H01A02	NA16A02	7	140	LA16A02	LCL		No	(a)	No
H01A02	NA17A02	7	140	LA17A02	LCL		No	(a)	No
H01A02	NA18A02	7	140	LA18A02	LCL		No	(a)	No
H01A02	NA19A02	7	140	LA19A02	LCL		No	(a)	No
H01A02	NA20A02	7	140	LA20A02	LCL		No	(a)	No
H01A02	NA21A02	7	140	LA21A02	LCL		No	(a)	No
H01A02	NA22A02	7	140	LA22A02	LCL		No	(a)	No
H01A02	NA23A02	7	140	LA23A02	SRTC		No	(a)	No
H01A02	NA24A02	7	140	LA24A02	SRTC		No	(a)	No
H01A02	NA25A02	7	140	LA25A02	SRTC		No	(a)	No
H01A02	NA26A02	7	140	LA26A02	SRTC		No	(a)	No
H01A02	NA27A02	7	140	LA27A02	SRTC		No	(a)	No
H01A02	NA28A02	7	140	LA28A02	SRTC		No	(a)	No
H01A02	NA29A02	7	140	LA29A02	SRTC		No	(a)	No
H01A02	NA30A02	7	140	LA30A02	SRTC		No	(a)	No
H01A02	NA31A02	7	140	LA31A02	SRTC		No	(a)	No
H01A02	NA32A02	7	140	LA32A02	SRTC		No	(a)	No
H01A02	NA33A02	7	140	LA33A02	SRTC		No	(a)	No
H01A02	NA34A02	7	140	LA34A02	SRTC		No	(a)	No
H01A02	NA35A02	7	140	LA35A02	SRTC		No	(a)	No
H01A02	NA36A02	7	140	LA36A02	SRTC		No	(a)	No
H01A02	NA37A02	7	140	LA37A02	SRTC		No	(a)	No
H01A02	NA38A02	7	140	LA38A02	P02	SRTC	No	(a)	No
H01A02	NA39A02	7	140	LA39A02	SRTC		No	(a)	No
H01A02	NA40A02	7	140	LA40A02	SRTC		No	(a)	No

Notes

c In the above table, LCL and SRTC indicates that the core is to be packaged and shipped to the LTPP Contract Laboratory and the Superpave Regional Test Center, respectively

d The specimens are to be labeled and marked with the direction of compaction The top of the specimen shall be marked with a "T" Upon arrival at the labs, appropriate sample preparations for testing shall be performed by the testing Lab

e Trim 140mm Sample to the proper height

f Determine the corrected bulk density from the gyratory compaction curves at N_{Design} for use in volumetric calculations

Table 17(b). Tracking table of compacted field asphalt concrete bulk samples from test section 02 on all projects by state/province laboratory or their designee (cont'd)

Compact Bulk Sample to Conditions and label compacted Specimens									
Sample Loc Number	Initial Sample Num.	Air (%)	Ht. (mm)	Final Sample Num	1st[cd]	2nd[cd]	Extra Sample	Store Sample	Disp Samp
F01A02	BA01A02	3	140	DA01A02	SRTC		No	(a)	No
F01A02	BA01A02				P04		No	(b)	Yes
F02A02	BA02A02	N_{max}	115	DA02A02	P02		No	(a)	Yes
F03A02	BA03A02	N_{max}	115	DA03A02	P02		No	(a)	Yes
F04A02	BA04A02	N_{max}	115	DA04A02	P02		No	(a)	Yes
F05A02	BA05A02	7	140	DA05A02	LCL		No	(a)	No
F06A02	BA06A02	7	140	DA06A02	P02	SRTC	No	(a)	No
F06A02	BA06A02				P03	P04 & P14	No	(b)	Yes
F07A02	BA07A02	7	140	DA07A02	SRTC		No	(a)	No
F08A02	BA08A02	7	140	DA08A02	SRTC		No	(a)	No
F09A02	BA09A02	7	140	DA09A02	LCL		No	(a)	No
F10A02	BA10A02	7	140	DA10A02	SRTC		No	(a)	No
F11A02	BA11A02	7	140	DA11A02	SRTC		No	(a)	No
F11A02	BA11A02				P04		No	(b)	Yes
F12A02	BA12A02	7	140	DA12A02	SRTC		No	(a)	No
F13A02	BA13A02	7	140	DA13A02	SRTC		No	(a)	No
F14A02	BA14A02	7	140	DA14A02	SRTC		No	(a)	No
F15A02	BA15A02	7	140	DA15A02	LCL		No	(a)	No
F16A02	BA16A02	7	140	DA16A02	P02	LCL	No	(a)	No
F16A02	BA16A02				P04		No	(b)	Yes
F17A02	BA17A02	7	140	DA17A02	LCL		No	(a)	No
F18A02	BA18A02	7	140	DA18A02	LCL		No	(a)	No
F19A02	BA19A02	7	140	DA19A02	SRTC		No	(a)	No
F20A02	BA20A02	7	140	DA20A02	SRTC		No	(a)	No
F21A02	BA21A02	7	140	DA21A02	SRTC		No	(a)	No
F22A02	BA22A02	7	140	DA22A02	P02	SRTC	No	(a)	No
F22A02	BA22A02				P03	P04 & P14	No	(b)	YES
F23A02	BA23A02	7	140	DA23A02	SRTC		No	(a)	No
F24A02	BA24A02	7	140	DA24A02	SRTC		No	(a)	No
F25A02	BA25A02	7	140	DA25A02	SRTC		No	(a)	No
F26A02	BA26A02	7	140	DA26A02	SRTC		No	(a)	No
F27A02	BA27A02	7	140	DA27A02	SRTC		No	(a)	No
F28A02	BA28A02	7	140	DA28A02	SRTC		No	(a)	No
F29A02	BA29A02	7	140	DA29A02	LCL		No	(a)	No
F30A02	BA30A02	7	140	DA30A02	LCL		No	(a)	No
F31A02	BA31A02	N_{max}	115	DA31A02	P02		No	(a)	Yes
F32A02	BA32A02	N_{max}	115	DA32A02	P02		No	(a)	Yes
F33A02	BA33A02	N_{max}	115	DA33A02	P02		No	(a)	No
F34A02	BA34A02	3	140	DA34A02	SRTC		No	(a)	No
F34A02	BA34A02				P04		No	(b)	Yes

Notes Apply notes from Table 17 (a) with the exception of (e).

Table 18 (a) Tracking table of compacted laboratory asphalt specimens from test section 02 to be performed by the SUPERPAVE™ Regional Test Center.

Sample Loc. Number	Final Sample Num.	1st	2nd[cde]	Extra Sample	Sample Storage	Sample Disposed
H01A02	LA07A02	P02	SST-3		(a)	Yes
H01A02	LA08A02	P02	SST-3		(a)	Yes
H01A02	LA23A02	P02	SST-1		(a)	Yes
H01A02	LA24A02	P02	SST-1		(a)	Yes
H01A02	LA25A02	P02	SST-1		(a)	Yes
H01A02	LA26A02	P02	SST-1	Yes[f]	(a)	No
H01A02	LA27A02	P02	SST-2		(a)	Yes
H01A02	LA28A02	P02	SST-2		(a)	Yes
H01A02	LA29A02	P02	SST-2		(a)	Yes
H01A02	LA30A02	P02	SST-2	Yes[f]	(a)	No
H01A02	LA31A02	P02	SP-IT		(a)	Yes
H01A02	LA32A02	P02	SP-IT		(a)	Yes
H01A02	LA33A02	P02	SP-IT		(a)	Yes
H01A02	LA34A02	P02	SP-IT		(a)	Yes
H01A02	LA35A02	P02	SP-IT		(a)	Yes
H01A02	LA36A02	P02	SP-IT		(a)	Yes
H01A02	LA37A02	P02	SP-IT		(a)	Yes
H01A02	LA38A02	P02	SP-IT		(a)	Yes
H01A02	LA39A02	P02	SP-IT		(a)	Yes
H01A02	LA40A02	P02	SP-IT	Yes[f]	(a)	No

Notes:

c: The test designations in the table are keyed as follows:
SST-1 - SUPERPAVE Shear Tester Frequency Sweep and Simple Shear
SST-2 - SUPERPAVE Shear Tester Volumetric and Uniaxial Strain
SST-3 - SUPERPAVE Shear Tester Repeated Stress
SP-IT - Indirect Tensile Strength and Creep Compliance

d The 140 mm cylinders are to be cut into two replicate samples and labeled "A" for the top and "B" for the base of the specimen

e For the "A" specimen, the base of the sample is to be mounted to the movable top platten while the top of "B" specimen shall be mounted to the movable platten.

f Specimens are to be used to replace possible damaged or suspect specimens

Table 18 (b). Tracking table of compacted field asphalt concrete testing to be performed by SUPERPAVE™ Regional Test Center

Sample Loc. Number	Final Sample Num.	1st	2nd[cd]	Extra[f] Sample	Sample Storage	Sample Disposed
F01A02	DA01A02	P02	SST-3			Yes
F06A02	DA06A02	P02	SST-1			Yes
F07A02	DA07A02	P02	SST-2			Yes
F08A02	DA08A02	P02	SP-IT			Yes
F10A02	DA10A02	P02	SST 1	Yes		No
F11A02	DA11A02	P02	SST-2			Yes
F12A02	DA12A02	P02	SP-IT			Yes
F13A02	DA13A02	P02	SP-IT			Yes
F14A02	DA14A02	P02	SP-IT	Yes		No
F19A02	DA19A02	P02	SP-IT			Yes
F20A02	DA20A02	P02	SP-IT			Yes
F21A02	DA21A02	P02	SP-IT			Yes
F22A02	DA22A02	P02	SP-IT			Yes
F23A02	DA23A02	P02	SST-2	Yes		No
F24A02	DA24A02	P02	SST-1			Yes
F25A02	DA25A02	P02	SP-IT			Yes
F26A02	DA26A02	P02	SP-IT			Yes
F27A02	DA27A02	P02	SST-2			Yes
F28A02	DA28A02	P02	SST-1			Yes
F34A02	DA34A02	P02	SST-3			Yes

Notes

c The test designations in the table are keyed as follows
SST-1 - SUPERPAVE Shear Tester Frequency Sweep and Simple Shear
SST-2 - SUPERPAVE Shear Tester Volumetric and Uniaxial Strain
SST-2 - SUPERPAVE Shear Tester Repeated Stress
SP-IT - Indirect Tensile Strength and Creep Compliance

d The 140 mm cylinders are to be cut into two replicate samples and labeled "A" for the top and "B" for the base of the specimen

e For the "A" specimen, the base of the sample is to be mounted to the movable top platten while the top of "B" specimen shall be mounted to the movable platten

f Specimens are to be used to replace possible damaged or suspect specimens

Table 19. Tracking table of compacted asphalt concrete testing to be performed by LTPP contract laboratory

Sample Loc. Number	Final Sample Num.	1st	2nd	Extra Sample	Sample Storage	Sample Disposed
Compacted HMA samples from laboratory prepared samples						
H01A02	LA15A02	P02	P07		(a)	Yes
H01A02	LA16A02	P02	P07		(a)	Yes
H01A02	LA17A02	P02	P07		(a)	Yes
H01A02	LA18A02	P02	P07		(a)	Yes
H01A02	LA19A02	P02	P06		(a)	Yes
H01A02	LA20A02	P02	P06		(a)	Yes
H01A02	LA21A02	P02	P06		(a)	Yes
H01A02	LA22A02	P02	P06		(a)	Yes
Compacted HMA samples from field samples						
F05A02	DA05A02	P02	P07		(a)	Yes
F09A02	DA09A02	P02	P07		(a)	Yes
F15A02	DA15A02	P02	P06		(a)	Yes
F16A02	DA16A02	P02	P06		(a)	Yes
F17A02	DA17A02	P02	P07		(a)	Yes
F18A02	DA18A02	P02	P06		(a)	Yes
F29A02	DA29A02	P02	P07		(a)	Yes
F30A02	DA30A02	P02	P06		(a)	Yes

Notes: c: Trim the 150 mm diameter, 140 mm height specimens to 100 mm and 65 mm height.

Table 20. Tracking table for quality control of compacted asphalt concrete for 01, 03 and other Non-Level III test sections (state/province laboratory or their designee)

Sample Loc. Num.	Sample Num.	Lab. Test Num.	First	Second	Third	Fourth	Fifth	Extra Sample	Sample Storage	Sample Disposed
F02AXX	BA01AXX	3				M-002[c]	AC02/P02	No	(a)	Yes
F02AXX	BA02AXX	3	AC03/P03	AC04/P04	AG04/P14	M-002[c]	AC02/P02	No	(a)	Yes
F02AXX	BA03AXX	3				M-002[c]	AC02/P02	No	(a)	Yes
F02AXX	BA04AXX	3	AC03/P03	AC04/P04	AG04/P14	M-002[c]	AC02/P02	No	(a)	Yes
F02AXX	BA05AXX	3				M-002[c]	AC02/P02	No	(a)	Yes
F02AXX	BA06AXX	3				M-002[c]	AC02/P02	No	(a)	Yes

c AASHTO provisional Specification, Compacted at N_{max} Samples are to be prepared to obtain a height of approximately 115 mm with a diameter of 150 mm

d AASHTO PP19 Volumetric Computations are to be performed on the corrected bulk density as determined by the gyratory compaction curves at N_{Design}

Table 21. Tracking table of asphalt concrete cores from Main Study test sections 01, 03 and supplemental sections at time interval A and on section 02 at all intervals after A

(State/Province Laboratory or their designee)

Sample Loc. Num.	Sample Num.	Lab. Test Num.	Steps Involved in Laboratory Handling and Testing Sequence								Extra Sample	Sample Storage	Sample Disposed
			Required Laboratory Tests Per Layer										
			1st	2nd	3rd	4th	5th	6th	7th	8th			
C01tXX	CA01tXX	1	P01	P02	P04	P21	P14	PP19[a]	Blend Recovered Asphalt For Binder Testing	T49[a,b]	No	(a)	Yes
C02tXX	CA02tXX	1	P01	P02	P04	P21				P22[b]			
C03tXX	CA03tXX	1	P01	P02	P04	P21				P25			
C04tXX	CA04tXX	1	P01	P02	P04	P21				TP5[c]			
C05tXX	CA05tXX	2	P01	P02	P04	P21				TP1[c]			
C06tXX	CA06tXX	2	P01	P02	P04	P21				TP3[c]			
C07tXX	CA07tXX	2	P01	P02	P04	P21				P23[d]			
C08tXX	CA08tXX	2	P01	P02	P04	P21	P14	PP19[a]					

a: AASHTO Specification
b: three penetration readings required from each test can.
c: see section 4.5.1.2 for test temperature selection.
d: if enough asphalt not available, use asphalt from penetration cans.

Table 22 (a). Tracking Table of AC Cores from Main Study section 02 - Interval A and all test sections of Level III Study - all intervals

Sample Loc. Number	Initial Sample Num.	Ship To	Extra Sample	Sample Storage	Sample Disposed
C01tXX	CA01tXX	SRTC	No	(a)	Yes
C02tXX	CA02tXX	SL	No	(a)	Yes
C03tXX	CA03tXX	LTPP	No	(a)	Yes
C04tXX	CA04tXX	SRTC	No	(a)	Yes
C05tXX	CA05tXX	SL	No	(a)	No
C06tXX	CA06tXX	SL	No	(a)	No
C07tXX	CA07tXX	LTPP	No	(a)	No
C08tXX	CA08tXX	SRTC	No	(a)	No
C09tXX	CA09tXX	SRTC	No	(a)	No
C10tXX	CA10tXX	SRTC	No	(a)	No
C11tXX	CA11tXX	SL	No	(a)	No
C12tXX	CA12tXX	SRTC	No	(a)	No
C13tXX	CA13tXX	SRTC	No	(a)	No
C14tXX	CA14tXX	LTPP	No	(a)	No
C15tXX	CA15tXX	SL	No	(a)	No
C16tXX	CA16tXX	LTPP	No	(a)	No
C17tXX	CA17tXX	SRTC	No	(a)	No
C18tXX	CA18tXX	SRTC	No	(a)	No
C19tXX	CA19tXX	SL	No	(a)	No
C20tXX	CA20tXX	SRTC	No	(a)	No
C21tXX	CA21tXX	LTPP	No	(a)	No
C22tXX	CA22tXX	SRTC	No	(a)	No
C23tXX	CA23tXX	LTPP	No	(a)	No
C24tXX	CA24tXX	SL	No	(a)	No
C25tXX	CA25tXX	SL	No	(a)	No
C26tXX	CA26tXX	SRTC	No	(a)	No
C27tXX	CA27tXX	SRTC	No	(a)	No
C28tXX	CA28tXX	SL	No	(a)	No
C29tXX	CA29tXX	SRTC	No	(a)	No
C30tXX	CA30tXX	SRTC	No	(a)	No
C31tXX	CA31tXX	LTPP	No	(a)	Yes
C32tXX	CA32tXX	LTPP	No	(a)	Yes
C33tXX	CA33tXX	SL	No	(a)	No
C34tXX	CA34tXX	SRTC	No	(a)	No

Notes: In the above table, the cores are to be labeled; marked for direction and top and sent to the following labs for testing:

LTPP LTPP Contract Laboratory
SL State Laboratory
SRTC SUPERPAVE Regional Test Center.

Table 22 (b). Tracking table for AC cores from Main Study section 02 at interval A and on all intervals and sections for the Level III Study at the state/province laboratory or their designee

Sample Loc Number	Sample Number	Steps Involved in Laboratory Handling and Testing Sequence										
		Required Laboratory Tests										
		1st	2nd	3rd	4th	5th	6th	7th	8th	Extra Sample	Store Sample	Dispose Sample
C02tXX	CA02tXX	P01	P02	P04	P21		Blend Recovered Asphalt from cores	Run the following tests on the blended asphalt T49[cd] P22[d] P25 P23 TP5[f] TP1[f] TP3		No	(a)	Yes
C06tXX	CA06tXX	P01	P02	P04	P21					No	(a)	Yes
C11tXX	CA11tXX	P01	P02	P03	P04	P21			P14	No	(a)	Yes
C15tXX	CA15tXX	P01	P02	P04	P21					No	(a)	Yes
C19tXX	CA19tXX	P01	P02	P04	P21					No	(a)	Yes
C24tXX	CA24tXX	P01	P02	P03	P04	P21			P14	No	(a)	Yes
C28tXX	CA28tXX	P01	P02	P04	P21					No	(a)	Yes
C33tXX	CA33tXX	P01	P02	P04	P21					No	(a)	Yes
C05tXX	CA05tXX									Yes[c]	(a)	No
C25tXX	CA25tXX									Yes[c]	(a)	No

Notes

c Use the last two cores for possible replacement of damaged or suspect cores. Dispose of cores after all testing has been completed and reviewed.

d: AASHTO Specification

e Three penetrations readings required per test can

f See Section 4 5 1 2 for temperature selection.

Table 23. Tracking table of asphalt concrete cores testing to be performed by SUPERPAVE™ Regional Test Center

Sample Location Number	Sample Number	Laboratory Test Number	Steps Involved in Laboratory Handling and Testing Sequence					
			Required Laboratory Tests Per Layer			Extra Sample	Sample Storage	Sample Disposed
C01tXX	CA01tXX	2	P01	P02	SP-IT	No	(a)	No
C04tXX	CA04tXX	2	PO1	P02	SST-1	No	(a)	No
C08tXX	CA08tXX	2	P01	P02	SP-IT	No	(a)	No
C09tXX	CA09tXX	2	P01	P02	SST-3	No	(a)	No
C10tXX	CA10tXX	2	P01	P02	SP-IT	No	(a)	No
C12tXX	CA12tXX	2	P01	P02	SST-2	No	(a)	No
C13tXX	CA13tXX	2	P01	P02	SP-IT	No	(a)	No
C17tXX	CA17tXX	2	PO1	P02	SP-IT	No	(a)	No
C18tXX	CA18tXX	2	P01	P02	SP-IT	No	(a)	No
C20tXX	CA20tXX	2	P01	P02	SP-IT	No	(a)	No
C22tXX	CA22tXX	2	P01	P02	SST-2	No	(a)	No
C26tXX	CA26tXX	2	P01	P02	SST-3	No	(a)	No
C27tXX	CA27tXX	2	P01	P02	SP-IT	No	(a)	No
C29tXX	CA29tXX	2	P01	P02	SP-IT	No	(a)	No
C30tXX	CA30tXX	2	P01	P02	SST-1	No	(a)	No
C34tXX	CA34tXX	2	P01	P02	SP-IT	Yes	(a)	No

Notes : The specimens shall be tested in the following order: The core examination and thickness shall be performed on the untrimmed core. Next, trim the core to testing geometry and determine the bulk density. Lastly, prepare and mount the specimen for the noted testing

The following convention was used to define the tests:

SST-1 Frequency Sweep and Simple Shear
SST-2 Volumetric and Uniaxial Strain
SST-3 Repeated Shear Testing
SP-IT SUPERPAVE Indirect Tensile Strength and Creep

Table 24. Tracking table of asphalt concrete cores testing to be performed by LTPP contract laboratory

Sample Location Number	Sample Number	Laboratory Test Number	Steps Involved in Laboratory Handling and Testing Sequence			
			Required Laboratory Tests Per Layer	Extra Sample	Sample Storage	Sample Disposed
C03tXX	CA03tXX	1	AC06/P06	No	(a)	Yes
C07tXX	CA07tXX	1	AC07/P07[d]	No	(a)	Yes
C14tXX	CA14tXX	1	AC06/P06	No	(a)	Yes
C16tXX	CA16tXX	1	AC07/P07[c]	No	(a)	Yes
C21tXX	CA21tXX	1	AC07/P07[d]	No	(a)	Yes
C23tXX	CA23tXX	1	AC06/P06	No	(a)	Yes
C31tXX	CA31tXX	2	AC07/P07[d]	No	(a)	Yes
C32tXX	CA32tXX	2	AC06/P06	No	(a)	Yes

c Indirect tensile strength test
d Resilient modulus test

Appendix A - Mix and Binder Characterization Data Forms

This appendix contains data forms for mix and binder characterization. Two mix and three binder data forms are included. The mix characterization forms include:

1. Preparation of Compacted Specimens of Modified and Unmodified HMA by Means of SHRP Gyratory Compactor.

2. Volumetric Analysis of Compacted Hot Mix Asphalt.

The binder data forms include:

1. Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR).

2. Flexural Creep Stiffness of Asphalt Binder Using Bending Beam Rheometer (BBR).

3. Fracture Properties of Asphalt Binder Using Direct Tension Tester (DT).

********** SPS LABORATORY TESTING DATA SHEET **********

SHRP-LTPP LABORATORY MATERIAL HANDLING AND TESTING SHEET NO _____ OF _____
LABORATORY MATERIAL TEST DATA
DETERMINING THE RHEOLOGICAL PROPERTIES OF ASPHALT BINDER
USING A DYNAMIC SHEAR RHEOMETER (DSR)
TEST DATA SHEET T27

ASPHALT CONCRETE LAYER (ASPHALT CEMENT PROPERTIES)
SHRP TEST DESIGNATION: AE07/SHRP PROTOCOL P27

LABORATORY PERFORMING TEST _____ LAB. CODE __ __ __ __

SHRP REGION _____ STATE _____ STATE CODE __ __
SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __
TESTED BY: _____ TEST SECTION NO. __ __
DATE TESTED: __ __-__ __-19__ __ FIELD SET NO. __

1. Material Type (Original = 1, RTFO = 2, PAV = 3, Field Aged = 4) __
2. For Field Aged, Time Since Construction (months) __ __ __.__
3. Test Control (Stress = 1, Strain = 2) __ 4. Test Plate Diameter (mm) __ __ .__
5. Test Gap (mm) __ __.__ __ __ 6. Conditioning Cycles __ __
7. Conditioning Frequency (radian/sec) __ __.__ 8. Test Freq. (radian/sec) __ __.__
9. Strain Amplitude (%) __ __.__ __ 10. Torque Amplitude (mN.m) __ __ __ __
11 AC Performance Grade PG __ __-__ __

12. COMPLEX MODULUS AND PHASE ANGLE

Number __ __	Temperature (C)	Complex Modulus, G* (kPa)	Phase Angle, δ (deg)
1	__ __ __ __	__ __ __ __ __ __ __	__ __ __
2			
3			
4			
5			

13 COMMENT CODES __ __ __ __ __ __ __ __ __ __ __ __

14 NOTE . PLEASE ATTACH THE RAW DATA FROM DYNAMIC SHEAR RHEOMETER

GENERAL REMARKS _____

CERTIFIED _____ Laboratory Chief
Affiliation _____

VERIFIED AND APPROVED _____ SHRP Representative
Affiliation._____

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

********** SPS LABORATORY TESTING DATA SHEET **********

SHRP-LTPP LABORATORY MATERIAL HANDLING AND TESTING SHEET NO _____ OF _____
LABORATORY MATERIAL TEST DATA
DETERMINING THE FLEXURAL CREEP STIFFNESS OF ASPHALT BINDER
USING THE BENDING BEAM RHEOMETER (BBR)
TEST DATA SHEET T28

ASPHALT CONCRETE LAYER (ASPHALT CEMENT PROPERTIES)
SHRP TEST DESIGNATION: AE08/SHRP PROTOCOL P28

LABORATORY PERFORMING TEST _____ LAB. CODE __ __ __ __

SHRP REGION _____ STATE _____ STATE CODE __ __
SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __
TESTED BY: _____ TEST SECTION NO. __ __
DATE TESTED: __ __-__ __-19__ __ FIELD SET NO. __

1. Material Type (Original = 1, RTFO = 2, PAV = 3, Field Aged = 4) __
2. For Field Aged, Time Since Construction (months) __ __ __.__
3. Test Temperature °C __ __.__ 4. Soak Time (min) __ __.__
5. Beam Width (mm) __ __.__ 6. Beam Thickness (mm) __ __.__
7. Preload (mN) __ __ 8. Seating Load (mN) __ __ __ __
9. Seating Load Time (sec) __ __ 10. Recovery Time (sec) __ __
11. AC Performance Grade PG ___-___

12. SUMMARY OF RESULTS

Time (sec)	Force (N)	Deflection (mm)	Stiffness (MPa)			m-value
			Measured	Estimated	Percent Difference	
8	_ _ _ _ _ _ _	_._ _ _ _ _	_ _ _ _	_ _ _ _	_._ _ _ _	_._ _ _
15						
30						
60						
120						
240						

REGRESSION COEFFICIENTS

a = _ _. _ _ _ b = _ _._ _ _ c = _ _. _ _ _ _ R^2 = _._ _ _ _

14. COMMENT CODES __ __ __ __ __ __ __ __ __ __ __ __ __ __

15. **NOTE : PLEASE ATTACH THE RAW DATA FROM BENDING BEAM RHEOMETER DEVICE**

GENERAL REMARKS: _____

CERTIFIED _____
Laboratory Chief
Affiliation: _____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation: _____

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

********** SPS LABORATORY TESTING DATA SHEET **********

SHRP-LTPP LABORATORY MATERIAL HANDLING AND TESTING SHEET NO _____ OF _____
LABORATORY MATERIAL TEST DATA
DETERMINING THE FRACTURE PROPERTIES OF ASPHALT BINDER
USING DIRECT TENSION TESTER (DT)
TEST DATA SHEET T29

ASPHALT CONCRETE LAYER (ASPHALT CEMENT PROPERTIES)
SHRP TEST DESIGNATION: AE09/SHRP PROTOCOL P29

LABORATORY PERFORMING TEST _____ LAB. CODE __ __ __ __

SHRP REGION _____ STATE _____ STATE CODE __ __
SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __
TESTED BY: _____ TEST SECTION NO. __ __
DATE TESTED: __ __-__ __-19__ __ FIELD SET NO. __

1. Material Type (Original = 1, RTFO = 2, PAV = 3, Field Aged = 4) __
2. For Field Aged, Time Since Construction (months) __ __ __.__
3. Test Temperature (°C) __ __.__ 4. Rate of Elongation (mm/sec) __.__
5. Specimen Cross Sectional Area (mm²) __.__ 6. Gauge Length (mm) __ __.__
7. Conditioning Time (minutes) __ __ __ 8. PG Performance Grade PG ___-___
9. Type of Fracture (Brittle = 1, Brittle-Ductile = 2, Ductile = 3) __

10. Test Summary Table

Test Number	Peak Load (N)	Peak Stress (kPa)	Peak Elongation (mm)	Percent Peak Strain (mm/mm)x100
1	__ __ __.__ __	__ __ __ __.__	__.__ __ __	__.__ __
2				
3				
4				
Average				
Std. Dev.				

14. COMMENT CODES __ __ __ __ __ __ __ __ __ __ __ __

15. NOTE : PLEASE ATTACH THE RAW DATA FROM DIRECT TENSION TESTER

GENERAL REMARKS: _____

_____

CERTIFIED VERIFIED AND APPROVED DATE

_____ _____ _____-____-19___

Laboratory Chief SHRP Representative Month- Day- Year
Affiliation: _____ Affiliation: _____

********** SPS LABORATORY TESTING DATA SHEET **********

SHRP-LTPP LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
PREPARATION OF COMPACTED SPECIMENS OF MODIFIED AND UNMODIFIED HMA BY MEANS OF SHRP GYRATORY COMPACTOR
TEST DATA SHEET T71

SHEET NO _____ OF _____

ASPHALT CONCRETE LAYER (ASPHALT CONCRETE PROPERTIES)
SHRP TEST DESIGNATION: SP01/SHRP PROTOCOL P71

LABORATORY PERFORMING TEST _____ LAB. CODE __ __ __ __

SHRP REGION _____ STATE _____ STATE CODE __ __

SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __

TESTED BY: _____ TEST SECTION NO. __ __

DATE TESTED: __ __-__ __-19__ __ FIELD SET NO. __

1. **SHRP Sample Number**	__ __ __ __		
2. **Asphalt Performance Grade**	PG ___-__ _	3. **Nominal Agg. Size (mm)**	__ __
4. **Traffic Level (ESAL's)**	_____	5. **Design High Air Temp (°C)**	__ __
6. **Mixing Temperature (°C)**	__ __ __	7. **Compaction Temperature (°C)**	__ __ __
8. **Specific Gravity of Asphalt**	__.__ __ __	9. **AC(%) by Mass of Total Mix**	__.__ __
10. **Effective SG of Agg., G_{se}**	__.__ __ __	11. **Bulk SG of Agg., G_{sb}**	__.__ __ __
12. **Specimen Diameter (mm)**	__ __ __	13. **Gyration Angle (Deg.)**	__.__ __
14. **Vertical Pressure (kPa)**	__ __ __ __	15. **Rotation Speed (rpm)**	__ __

16. **DENSIFICATION TABLE**

G_{mm}(meas) = - - - - -

Gyrations (Number)	SPECIMEN 1			SPECIMEN 2			AVG.
	G_{mb} (uncorr)	G_{mb} (corr)	$\%G_{mm}$ (corr)	G_{mb} (uncorr)	G_{mb} (corr)	$\%G_{mm}$ (corr)	$\%G_{mm}$ (corr)
N_{Ini} ( )	- - - - -	- - - - -	- - -	- - - - -	- - - - -	- - -	- - -
N_{Des} ( )							
N_{Max} ( )							
G_{mb}(meas)	- - - - -			- - - - -			

17 Air Voids @ N_{Des} (%) __ __ __ 18. VMA @ N_{Des}(%) __ __.__ 19 VFA @ N_{Des}(%) __ __ __

20 COMMENT CODES __ __ __ __ __ __ __ __ __ __ __ __ __ __

21. NOTE . PLEASE ATTACH THE RAW DATA FROM SHRP GYRATORY DEVICE

GENERAL REMARKS _____

CERTIFIED VERIFIED AND APPROVED DATE

_____ _____ ____-____-19___

Laboratory Chief SHRP Representative Month- Day- Year

Affiliation: _____ Affiliation. _____

********** SPS LABORATORY TESTING DATA SHEET **********

SHRP-LTPP LABORATORY MATERIAL HANDLING AND TESTING
LABORATORY MATERIAL TEST DATA
VOLUMETRIC ANALYSIS OF COMPACTED HOT MIX ASPHALT
TEST DATA SHEET T72

SHEET NO _____ OF _____

ASPHALT CONCRETE LAYER (ASPHALT CEMENT/CONCRETE PROPERTIES)
SHRP TEST DESIGNATION: SP02/SHRP PROTOCOL P72

LABORATORY PERFORMING TEST _____ LAB. CODE __ __ __ __

SHRP REGION _____ STATE _____ STATE CODE __ __

SPS EXPERIMENT NO _____ SPS PROJECT CODE __ __

TESTED BY: _____ TEST SECTION NO. __ __

DATE TESTED: __ __-__ __-19__ __ FIELD SET NO. __

1. Asphalt Properties:

	Specific Gravity	Percentage
Binder (G_b, P_b)	__.__ __ __	__ __.__

2. Aggregate Properties:

	Specific Gravity	Percentage
Coarse (G_c, P_c)	__.__ __ __	__ __.__
Fine (G_f, P_f)	__ __ __ __	__ __ __
Mineral Filler (G_m, P_m)	__.__ __ __	__ __.__
Combined Agg. (G_{sb})	__.__ __ __	
Effective SG (G_{se})	__.__ __ __	

3. Mixture Properties

Maximum Specific Gravity (G_{mm})	__.__ __ __
Bulk Specific Gravity (G_{mb})	__ __ __ __
Absorbed Asphalt, % (P_{ba})	__ __ __
Effective Asphalt Content, % (P_e)	__ __ __
Voids in Mineral Aggregate, % (VMA)	__ __.__
Air Voids, % (V_a)	__ __ __
Void Filled with Asphalt, % (VFA)	__ __ __

4. COMMENT CODES __ __ __ __ __ __ __ __ __ __ __ __ __ __

GENERAL REMARKS _____

CERTIFIED _____
Laboratory Chief
Affiliation: _____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation: _____

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

Appendix B - Field Materials Sampling and Testing Data Forms

In general, the field materials sampling and testing 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 bulk sampling of subgrade, granular material, and asphalt concrete materials performed 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 form relate to test section number and sample location referencing.

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 in this document.

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING DATA SHEETS

Material sampling and field testing data sheets used in the SPS experiments include Sampling Data Sheets and Field Operations Information Forms. The SPS-9A experiment requires completion of the following sheets and forms:

Sampling Data Sheet No.	Description
2	Pavement Core Log at C-Type Core Locations
4-1	A-Type Bore Hole Log
8-1	In-Situ Density and Moisture Tests
9	Shoulder Probe Log
10-1	Sampling Uncompacted Bituminous Paving Mixtures
12	Bulk Sampling of Subgrade and Unbound Granular Materials

Field Operations Information Form No.	Description
1	Laboratory Shipment Samples Inventory
2-1	Summary of Material Samples Sent to Each Laboratory

Most of the LTPP-SPS Material Sampling and Field Testing data sheets (Sampling Data Sheets and Field Operations Information Forms) 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 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 and province, or a letter starting with A, B, etc. for the second, third, etc. projects of the same SPS experiment constructed in the same state and province. The second digit corresponds to the SPS experiment number i.e. "9" for SPS-9A 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 the 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 (i.e. "SPS-9A" for projects in the SPS-9A experiment, "SUPERPAVE™ Asphalt Binder Study"

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

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+). Check "Within Section" if the sampling is performed within the boundaries of the monitoring length.

FIELD SET NO. The field set number is a sequentially assigned number to indicate the different time periods in which material samples and field testing were conducted on the project. These time periods usually refer to different stages in the pavement construction or life, such as prior to overlay construction, after overlay construction, etc. A field set number can apply to more than one day since sampling of SPS test sections may require 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 conducted on the prepared subgrade and base during construction on the project. Enter 2, 3, etc. for the second. third and subsequent sampling and field testing on this project.

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

This form is similar to Form S01A used for GPS test sections and is used to log data from the 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. 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.

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.

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.

LOCATION: OFFSET. This is the distance from the interface of the pavement lane and the outside shoulder to the core location (generally measured from the outside edge of the white pavement edge stripe). 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 HMAC and bound base layers from the same core hole, even if the bound base adheres to the HMAC 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 Materials Sampling, Handling and Testing corresponding to the described type of material.

SAMPLING DATA SHEET 4-1. A-TYPE BORE HOLE LOG

This form is similar to Form S02A used for GPS test sections and is designed to record logs of A-Type Shelby tube and splitspoon sampling. The following data 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.

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.

LOCATION: OFFSET. This is the distance from the interface of the pavement lane and the outside shoulder to the bore location (generally measured from the outside edge of the white pavement edge stripe). 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)USAL. 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 8-1. IN SITU DENSITY AND MOISTURE TESTS

This sheet is similar to Form S04 used for GPS test sections and is designed to record data from the in situ density and moisture tests performed on all unbound layers and density tests performed on bound layers 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.

LOCATION: STATION. This is the station number of the sampling area, 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.

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 white pavement edge stripe). This distance should be indicated to the nearest tenth of a foot.

SAMPLING LOCATION NUMBER. Enter the sampling location number shown 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 4 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 NUMBER. Write in the project specified layer number for the layer being tested.

MATERIAL TYPE. Report a "G" if the material is unbound (granular); record "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 if possible. Record to one decimal place in pounds per cubic foot (pcf).

AVERAGE. Calculate and record the average in situ densities 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 almost always be used. However, there may be some extenuating circumstances necessitating the use of methods "A" or "C".

ROD DEPTH. Record the depth of the nuclear density gauge probe to the nearest 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 and 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.

AUGURING 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 probes located after the test section, less than 0+00 for probes located before the test section, and between 0+00 and 5+00 for probe locations within the monitoring length.

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the auger location (generally measured form the outside edge of the white pavement edge stripe. 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 numbers for subsequent auger probes.

TOP OF ROCK BASED ON. Enter "Auger Refusal" if auger is refused. If the top of rock is based on some other observation, indicate the type of observation.

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 "yes" or a "no" as appropriate to indicate if 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 10-1. SAMPLING UNCOMPACTED BITUMINOUS PAVING MIXTURES

This data sheet is used to record information concerning sampling of uncompacted bituminous paving mixtures (asphalt concrete and asphalt-treated materials) for LTPP material testing purposes. Sampling shall be performed according to AASHTO T-168, except that a 100-lb sample should be used.

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

PLANT NAME. Record the common name or operator of the mix plant facility which produced the sampled material.

PLANT LOCATION. Record the location of the mix plant, including street address, town, and state.

PLANT TYPE. Indicate the general type of mix plant used to produce the mix. If a plant other than a batch or drum plant was used, indicate other and provide a description of the plant on the next line.

DESCRIPTION OF MIX PLANT. Provide a brief description of the type of mix plant noting any special features of traditional types of batch or drum plants, or a description of other mix plant types.

MANUFACTURER OF MIX PLANT. Enter the name of the mix plant manufacturer.

MODEL NUMBER. Enter the model number or model designation of the mix plant.

BATCH SIZE. Record the size of the batch the sample from which the sample was obtained.

SAMPLING LOCATION. Enter the code number shown on the data form corresponding to the location from which the sample was taken. If the sample was taken from the roadway prior to compaction, indicate the station and offset of the sample and the respective test section number.

MIX TYPE. Enter the code number corresponding to the generic type of material (virgin asphalt concrete, recycled asphalt concrete, asphalt dense graded or permeable asphalt treated).

LAYER TYPE. Enter the code number, as shown on the form, which corresponds to the type of layer in which the material is used.

SAMPLE LOCATION DESIGNATOR. Enter the sample type designation for the sample. Sampling locations are designated on the LTPP forms and material sampling plans with the following six digit code format:

L ## t X X

where

L = Location type:
- B - bulk sample location
- A - 150 mm diameter core and/or auger locations
- S - Shoulder auger probe 6 m below the pavement surface
- C - 150 mm diameter core locations
- G - Nuclear density/moisture gauge

= Location number. Up to a two digit location number is assigned sequentially to each location type on each test section.

t = Sampling time interval. This time interval is used for samples taken at specified time intervals referenced to the construction date. The single letter designating the time from paving is as follows:

A - prior, during or immediately after construction
B - 6 months
C - 12 months
D - 18 months
E - 24 months
F - 48 months

X X = Section. Use the 2 digit test section number, e.g., 01, 02, 03. This makes the sample location unique to that test section.

SAMPLE NUMBER Each sample (core, bulk, moisture, compacted) shall be assigned a seven digit designation that must be recorded on the appropriate data forms. The sample number will consist of the following format:

	S	***M***	***##***	***t***	***X X***
Digit	1	2	34	5	6 7

where

S = Sample type:
C - core sample
D - compacted specimen from plant mixed material
B - bulk sample
M - moisture sample
L - compacted specimen from laboratory mixed material
N - uncompacted laboratory mixed material sample

M = Material Type:
A - asphalt concrete
C - asphalt cement
P - portland cement concrete
T - treated, bound, or stabilized base/subbase
U - combined aggregate used in asphalt concrete mixes

G - untreated, unbound granular base/subbase
S - subgrade soil or fill material

= Sample number. Up to a two digit sample number assigned sequentially to each sample with the same sample type and material type designation.

t = Sampling time interval. This time interval is used for samples taken at specified time intervals referenced to the construction date. The single letter designating the time from paving is as follows:

A	-	prior, during or immediately after construction
B	-	6 months
C	-	12 months
D	-	18 months
E	-	24 months
F	-	48 months

X X = Section number. Use the 2 digit test section number, e.g., 01, 02, 03. This makes the sample location unique to that test section.

APPROXIMATE SAMPLE SIZE. Enter the approximate weight of the sample obtained, to the nearest pound.

DATE SAMPLED. Enter the date the material sample was obtained.

LOCATION SAMPLE SHIPPED TO. Record the location the sample was shipped to from the field. In many cases this should be the laboratory which will perform the testing.

DATE SHIPPED. Enter the date the material was shipped to the location 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.

SAMPLING DATA SHEET 12. BULK SAMPLING OF SUBGRADE AND UNBOUND GRANULAR MATERIALS

This form is similar to Form S03 used for GPS test sections and is designed to record data from the field sampling of materials from shallow excavations made in prepared subgrade and uncompacted graded layers during construction. 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 excavate the material.

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

LOCATION: STATION. This is the station number of the sampling area, 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.

LOCATION: OFFSET. This is the distance from the edge of the pavement lane and the outside shoulder to the outside edge of the sampling area (generally measured from the outside edge of the white pavement edge stripe). This distance should be indicated to the nearest tenth of a foot.

SAMPLING LOCATION NUMBER. Enter the sampling location number shown in the material sampling plan developed for the project.

EXCAVATION SIZE. Record the length and width of the excavation 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.

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 S06 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. 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 shallow excavations.

Sample location numbers and sample 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. Enter the laboratory number, as noted at the bottom of the form, each sample is sent to under the LAB column.

Typically, samples will include:

- All AC cores 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 2-1. 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 the samples to be aggregated into layers designated with a layer number. The layer number assigned to each layer (1 for subgrade, 2 for subbase, 3 for unbound base, etc.) is shown in the left hand column. 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.

OTHER GPS DATA FORMS

Other Field Materials Sampling and Testing data forms used for GPS test sections not referenced in this report 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 C-TYPE CORE LOCATIONS
SAMPLING DATA SHEET 2

SHEET NUMBER _____ OF _____

HRP 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.*** __

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

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 test section. "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.)	*6*	*6*	*6*	*6*	*6*	*6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam)	*6*	*6*	*6*	*6*	*6*	*6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*6*	*6*	*6*	*6*	*6*	*6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*6*	*6*	*6*	*6*	*6*	*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*** __ __
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***___-___-___
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__										

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:_____

IFIED _____
d 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.*** __
☐ Within Section
OPERATOR_____ ***NUCLEAR DENSITY GAUGE I.D.***_____ ***TEST DATE***___-___-____
TEST PIT NO:_____ DATE OF LAST MAJOR CALIBRATION___-___-___
Note: Use additional sheets if necessary

LOCATION: a) STATION						
b) OFFSET (Feet from O/S)						
DEPTH FROM SURFACE TO THE TOP OF THE LAYER, INCHES (From plans)						
LAYER DESCRIPTION						
MATERIAL TYPE: (Unbound=G Other=T)						
1						
IN SITU DENSITY, pcf 2						
3						
(AASHTO T238-86) 4						
AVERAGE						
Method (A,B,or C)						
Rod Depth, inches						
1						
IN SITU MOISTURE CONTENT, % 2						
3						
(AASHTO T239-86) 4						
AVERAGE						

GENERAL REMARKS:_____

ERTIFIED _____ Field Crew Chief
Affiliation:_____

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*** __ __
; EXPERIMENT NO _____ ***SPS PROJECT CODE*** __ __
ITE/HIGHWAY_____ Lane_____ Direction_____ ***TEST SECTION NO.*** __ __
SAMPLE/TEST LOCATION: ☐ Before Section ☐ After Section ***FIELD SET NO.*** __
☐ Within Section
OPERATOR_____ EQUIPMENT USED_____ ***AUGURING 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
SAMPLING UNCOMPACTED BITUMINOUS PAVING MIXTURES
SAMPLING DATA SHEET 10

SHEET NUMBER _____ OF _____

[RP REGION _____ STATE _____ ***STATE CODE*** __ __
'S EXPERIMENT NUMBER _____ ***SPS PROJECT CODE*** __ __
ROUTE/HIGHWAY_____ Lane_____ Direction_____ ***TEST SECTION NO.*** __ __
FIELD SET NO. __

PERSON PERFORMING SAMPLING

NAME _____ EMPLOYER _____

TITLE _____

MIX PLANT

PLANT NAME _____

PLANT LOCATION _____

PLANT TYPE Batch..... **1** Drum..... **2** Other (Specify)..... **3** [__]

DESCRIPTION OF MIX PLANT _____

MANUFACTURER OF ASPHALT PLANT _____

MODEL NUMBER _____

BATCH SIZE _____

SAMPLING LOCATION [___]

Conveyor Belt..... **1** Stockpile..... **2** Haul Truck..... **3** Funnel Device..... **4**
Roadway Prior to Compaction . .... **5** Station __ + __ __ Offset ____ (feet from O/S)
Other..... 6 (specify) _____

MIX TYPE "Virgin" Asphalt Concrete ..... **1** Recycled Asphalt Concrete..... **2** [___]

LAYER TYPE [___]

Rut Level-Up..... **1** Mill Replacement..... **2** Binder Course..... **3**
Surface Course..... **4** Surface Friction Layer. **5**

SAMPLE LOCATION DESIGNATION [___ ___ ___ ___ ___ ___]

SAMPLE NUMBER [___ ___ ___ ___ ___ ___ ___]

APPROXIMATE SAMPLE SIZE (lbs) ___ ___ ___

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

LOCATION SAMPLE SHIPPED TO _____

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

GENERAL REMARKS: _____

_____

_____

CERTIFIED _____
eld Crew Chief
__filiation: _____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation: _____

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

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING SHEET NUMBER _____ OF _____
BULK SAMPLING OF SUBGRADE AND UNBOUND GRANULAR MATERIALS
SAMPLING DATA SHEET 12

[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.*** 1

TECHNICIAN_____ EQUIPMENT _____ ***EXPLORATION DATE***___-___-___

LOCATION: STATION_____ ***OFFSET***_____***feet from °/s***

SAMPLING LOCATION NUMBER_____

PIT SIZE: (a) ***Length***_____**feet** (b) ***Width***_____**feet**

LAYER NUMBER:_____ **(SUBGRADE _____ GRADED AGGREGATE BASE _____)**

Scale (Inches)	***Strata Change*** *(Inches)*	***Moisture Sample No.***	***Bulk Sample No.***	***Material Description***	***Material Code***
4					
8					
12					
16					

GENERAL REMARKS:_____

CERTIFIED _____
eld Crew Chief
filiation:_____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation:_____

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

LTPP-SPS MATERIAL SAMPLING AND FIELD TESTING
LABORATORY SHIPMENT SAMPLES INVENTORY
FIELD OPERATIONS INFORMATION FORM 1
FOR EXPERIMENT SPS-9A

SHEET NUMBER _____ OF _____

HRP 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.*** __
☐ Within Section

FIELD WORK COMPLETED ON ____-____-____

Note: 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 SHEET NUMBER _____ OF _____
SUMMARY OF MATERIAL SAMPLES SENT TO EACH LABORATORY
FIELD OPERATIONS INFORMATION FORM 2
FOR EXPERIMENT SPS-9A

IRP 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 (surface)	4" Diameter	_____
_____	AC MIX BULK SAMPLES:	200 pound bulk samples	_____
		5 gallon pail asphalt cement	_____
_____	AC CORES (binder)	4" Diameter	_____
_____	AC MIX BULK SAMPLES:	200 pound bulk samples	_____
		5 gallon pail asphalt cement	_____
_____	UNBOUND BASE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
_____	UNBOUND SUBBASE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
1	SUBGRADE SAMPLES:	(a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
		(c) THIN-WALLED TUBES_____	

GENERAL REMARKS:_____

CERTIFIED _____
Field Crew Chief
Affiliation:_____

VERIFIED AND APPROVED _____
SHRP Representative
Affiliation:_____

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