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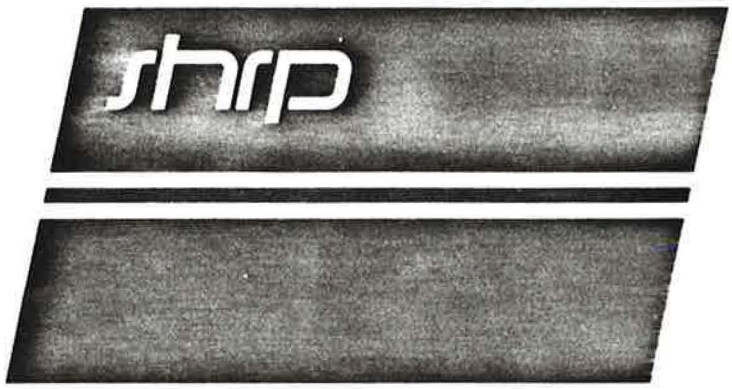

SHRP-LTPP GUIDE FOR FIELD MATERIALS SAMPLING, TESTING, AND HANDLING

STRATEGIC HIGHWAY RESEARCH PROGRAM
818 Connecticut Avenue NW
Washington, DC 20006

May, 1990

PREFACE

Version 2.0 of the SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling is to be used as the field operations guide for SHRP Regional Drilling and Sampling Contractors (and others such as Canadian Provinces) responsible for the field sampling, field testing, handling and shipment of material samples for SHRP Long Term Pavement Performance (LTPP) test sections. The field sampling, handling and testing activities will be conducted under the direct supervision of the SHRP Authorized Representative. This Guide provides basic information on LTPP sections, field sampling and testing plans, coordination, and scheduling requirements and field operations. The Guide is intended to be the basic document to provide quality and consistency to the field sampling and testing operations vital to the success of the SHRP-LTPP program.

Copies of the Guide should be available on-site during field sampling and testing operations and both the SHRP Authorized Representative and the Drilling and Sampling Contractor Crew Chief should be thoroughly familiar with its contents, particularly the types and numbers of samples to be obtained from the various test section experiment types. An adequate number of copies of such items such as data forms and sampling location plans should also be available at the test site.

The Guide is primarily based on Version 1.0, SHRP-LTPP Guide for Drilling and Sampling and the Technical Provisions prepared by SHRP for the drilling and sampling contracts. Other documents used in the preparation of this Guide are the LTPP Data Collection Guide, pertinent AASHTO material specifications and test methods, related ASTM standards, AASHTO Manual on Subsurface Investigations - 1988, and NCHRP Report 125, "Optimization of Density and Moisture Content Measurements by Nuclear Methods." Important contributions came from earlier work performed by the SHRP Technical Assistance Contractor and reviews of draft copies by the SHRP staff, members of the SHRP Materials Expert Task Group and Regional Coordination Office Contractor personnel. Version 1.0 of this Guide was used extensively during field sampling and testing operations in all four SHRP regions in 1989 during which a number of revisions were made by the issuance of SHRP Materials Directives. For Version 2.0, SHRP Regional Engineers, SHRP Authorized

Representatives, other field personnel as well as the SHRP Quality Assurance Consultant were interviewed and a review was conducted of appropriate correspondence concerning operations during 1989. This information along with the Directives issued in 1989 and the observations of the SHRP Quality Assurance Consultant were used to prepare Version 2.0 of this Guide. Consequently, this Guide (Version 2.0) shall be used for all SHRP field sampling and field testing operations.

REVISION DATES AND AFFECTED TEXT

Date of version 2.0: April 1990

(Note: Version 2.0 replaces Version 1.0 dated, January 20, 1989).

All revision and corrections should be reported here and in the Table of Contents.

Date of Revision	Extent of Revision

ABBREVIATIONS AND SPECIAL TERMINOLOGY

The following abbreviations are generally used in this guide.

SHRP	Strategic Highway Research Program
LTPP	Long-Term Pavement Performance
GPS	General Pavement Studies
SPS	Specific Pavement Studies
RCO	Regional Coordination Office
RCOC	Regional Coordination Office Contractor
NPPB	National Pavement Performance Data Base
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
AC	Asphaltic Concrete
PCC	Portland Cement Concrete
JCP	Jointed Concrete Pavement (plain and/or reinforced)
JPCP	Jointed Plain Concrete Pavement
JRCP	Jointed Reinforced Concrete Pavement
CRCP	Continuously Reinforced Concrete Pavement
Diam.	Diameter
DLR	Driving Length to Refusal
IOP	Inches of Penetration
BA..	Designation for Twelve Inch Auger Borings
A..	Designation for Six Inch Auger Borings
C..	Designation for Four and Six Inch Core Holes
S..	Designation for the Shoulder Auger Probe(s)
TP..	Designation for the Test Pit(s)

SHRP terminology for pavement materials and soils is described in Appendix C (Table C.2) of this Guide.

"SHRP Regional Engineer" is the SHRP staff person located in each RCO responsible for the overall management of all SHRP contracts in the region. With regard to the drilling and sampling, this SHRP staff person is the "SHRP Project Manager" responsible for coordination between the drilling and sampling contractor and the state highway agencies, for administrative actions, and for

decisions pertaining to the contract. The SHRP Regional Engineer is also the "SHRP Project Manager" for the regional laboratory material testing contract.

"SHRP Authorized Representative" is used extensively in this guide as the RCO's Drilling Supervisor or other RCO staff person authorized by the SHRP Regional Engineer to: (a) provide guidance, specific procedures, and instructions, (b) supervise and provide local field coordination with states and local agencies, (c) exercise on-site judgement as appropriate in response to questions or problems requiring immediate responses, and (d) approve the work completed by the Drilling and Sampling Contractor.

"Drilling and Sampling Contractor" refers to the SHRP contractor who has been selected and awarded a SHRP regional contract for field material sampling and field testing.

"Laboratory Materials Testing Contractor" is used for the SHRP Contractor who has been selected and awarded the SHRP regional contract for laboratory testing of pavement materials (asphalt, asphaltic concrete, aggregate, base and subbase material, and soils) collected from SHRP pavement sections. This work does not include PCC testing.

"Laboratory PCC Testing Contractor" is used for the SHRP Contractor who has been selected and awarded the SHRP national contract for laboratory testing of PCC samples collected from SHRP pavement sections.

"LTPP Field Material Sampling Guide" is used for this SHRP-LTPP Guide for Field Materials Sampling, Testing and Handling. "LTPP Laboratory Material Testing Guide" is used for the SHRP-LTPP Guide for Laboratory Material Handling and Testing.

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SECTION 1

INTRODUCTION

SECTION 1: INTRODUCTION

1.1 LONG TERM PAVEMENT PERFORMANCE STUDY

The overall goal for Long Term Pavement Performance (LTPP) studies established by the Strategic Transportation Research Study and adopted by the Advisory Committee for Pavement Performance is: "to increase pavement life by investigation of various designs of pavement structures and rehabilitated pavement structures, using different materials and under different loads, environments, subgrade soil, and maintenance practices." A major component of the LTPP research that will be used to develop tools for accomplishment of the overall objective is the establishment of a National Pavement Performance Data Base (NPPD) containing inventory information and performance histories of pavements with various design features, materials, traffic loads, environmental conditions, and maintenance practices. The primary source of the information to be included in the NPPD will be the inventory and monitoring data collected on a large number of pavement test sections located in existing or in-service pavements (Figure 1) forming the General Pavement Studies (GPS) portion of the Long Term Pavement Performance (LTPP) research and test sections built and instrumented for more intensive evaluation of selected factors forming the Specific Pavement Studies (SPS) portion of LTPP.

The LTPP study is being conducted under the central leadership of Strategic Highway Research Program (SHRP) staff with technical assistance provided under SHRP contract P-001. The inventory and field monitoring data are being collected through the efforts and supervision of four Regional Coordination Office (RCO) contractors in cooperation with the state/province highway agencies (SHAs). The activities of the field material sampling and field testing contractors will provide pavement material samples for laboratory testing, in situ density and moisture test data, and visual pavement layer information for each section. This information will be included in the NPPD.

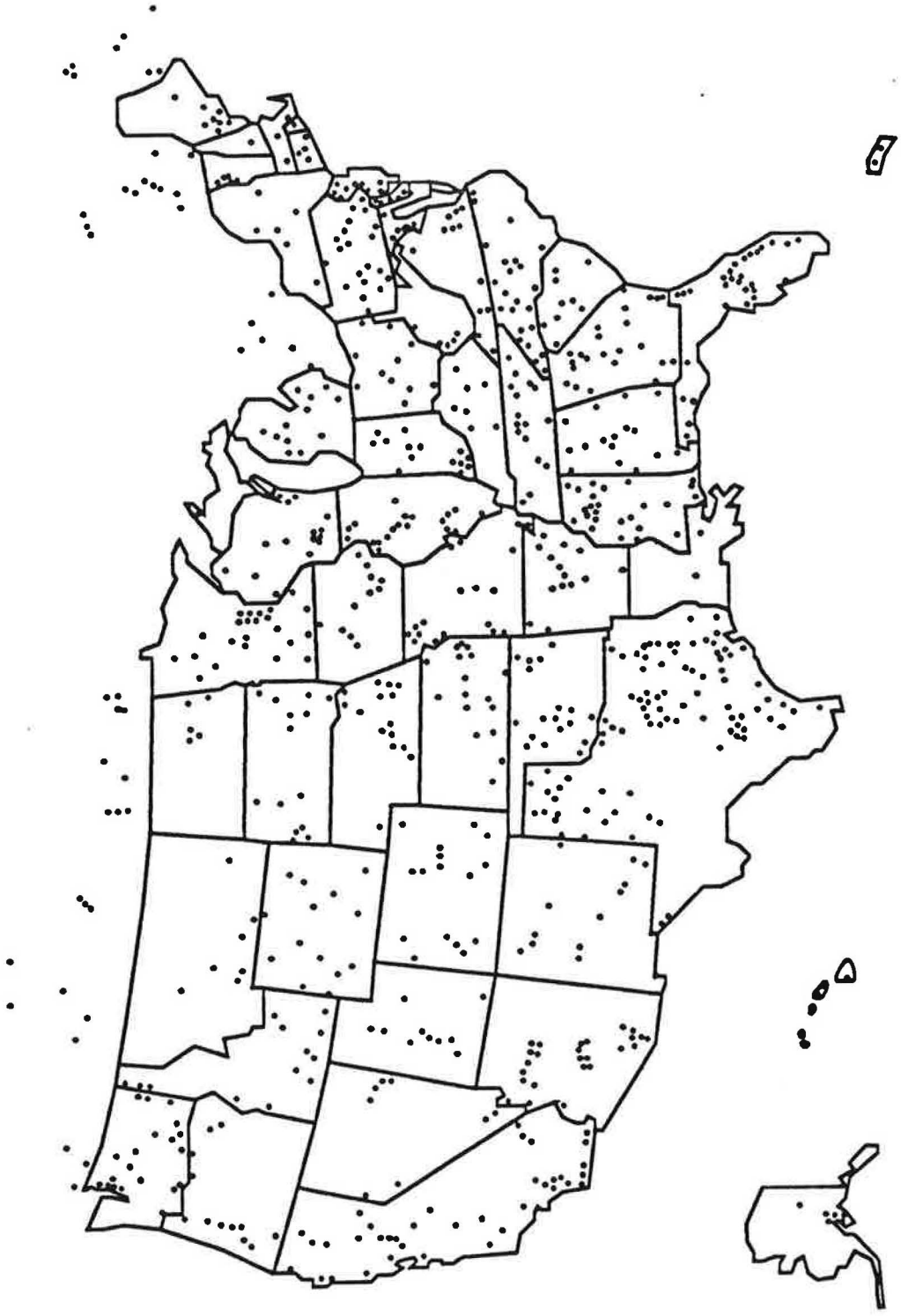


Figure 1. Locations of Approved GPS Sites, April 1990.

1.2 FIELD SAMPLING AND TESTING

Field material sampling and field testing of designated pavement test sections are important parts of the pavement data collection efforts for the LTPP studies.

The scope of the GPS work and numbers of experiments by type are described in Section 3.2 of the Contract Technical Provisions and Appendix B of this Guide. Any minor modifications to the scope and layout for each location will be given to the drilling and sampling contractor in advance of the actual work. Additional or reduced sampling and testing at specific locations may be required due to the conditions encountered.

The work scopes for other types of experiments such as for SPS, asphalt, and maintenance may be added in the future by supplemental agreement. Any changes in the scope or nature of any of the work will be accomplished in accordance with applicable contract provisions.

The primary objective of the LTPP Field Material Sampling Guide is to achieve consistency and high quality in the field activities of the regional drilling and sampling contractors. The work will be accomplished by core drilling, augering, test pit opening, sampling, and nuclear testing of the designated pavement test sections using the plans and guidelines provided in this Guide and site specific instructions given by the SHRP Authorized Representatives.

The regional drilling and sampling contractors will be under the operational control of the SHRP Authorized Representative from the SHRP Regional Coordination Office (RCO). The work on the designated pavement test sections will include, but not necessarily be limited to the following:

1. Cooperation and coordination with state highway agencies, which will provide traffic control, patching, and test pit restoration. In some areas and under some circumstances, the drilling and sampling contractors may be required to provide all or any of the traffic control, patching, and test pit restoration services.

2. Coordination with the SHRP Authorized Representative regarding schedule, scope of work, and other technical details.

3. Lay out of sampling and testing locations based on drawings and instructions provided in this Guide.

4. Diamond bit core-drilling of asphaltic concrete, portland cement concrete, cement treated layers, bituminous treated layers, and other treated or stabilized pavement layers.

5. Auger sampling of untreated bases, subbases, and subgrades.

6. Shelby (thinwall) tube sampling and splitspoon sampling of subgrade soils.

7 Sawing and other methods of removal of asphaltic concrete and portland cement concrete pavement layers at test pit locations.

8. Sawing, drilling, and other methods of removal of treated layers at test pit locations.

9. In-place nuclear density and moisture tests of untreated base, subbase, and subgrade soils at test pit locations.

10. Removal of bulk and moisture samples of untreated pavement layer materials and subgrade soils at test pit and other locations.

11. Detailed logging of each exploration.

12. Preparation of a summary report for each site.

13. Careful marking, packaging, and shipping of all materials designated for laboratory testing and storage.

14. Clean up and disposal of excess material and debris from test pits, augering and bulk sampling.

The product of the LTPP field material sampling and field testing will be the obtaining of and the careful packaging and shipping of samples of pavement materials and soils collected from the selected pavement test sections in each SHRP region. The laboratory testing of these samples will produce an important component of the NPPD. Field nuclear testing for in-place density and moisture content of various pavement layers will also produce information for the NPPD. Conditions encountered in the field during the sampling and testing will be recorded. A thorough understanding of pavement construction techniques, extensive pavement materials sampling capability, and experience will be critical to the quality of the final product. The samples will be shipped to the designated selected laboratory testing contractors. Portland cement concrete samples will be shipped to the laboratory PCC testing contractor. All other pavement materials such as asphalt concrete cores, treated and untreated base and subbase, and subgrade soils will be shipped to the designated regional laboratory material testing contractor.

It is the intent of the regional field material sampling and field testing contract that the contractor is to provide services when required. However, SHRP intends to schedule at least the initial GPS inventory work so that it is continuous over periods of several months at a time or by other means to minimize travel and standby time. The actual geographic locations of the pavement test sections will be defined by the appropriate RCO personnel. The scope of work at each test section will be as specified by the SHRP Authorized Representative. The scope of GPS work at each test section and number of GPS sections by experiment type are subject to change. Additional or reduced field material sampling and field testing at specific locations may be required due to the conditions encountered. Any necessary minor modifications to the scope and layout for each location will be given to the drilling and sampling contractor in advance of the actual work.

The specific work scopes for other types of experiments, such as Specific Pavement Study (SPS), asphalt, and maintenance may be added in the future by supplemental agreements. Major changes in the scope or nature of any of the work may be necessary and will be accomplished in accordance with applicable contract provisions.

The verified and marked GPS sections generally consist of an area 500 feet in length and one lane wide in which nondestructive deflection testing will be performed with SHRP owned falling weight deflectometers by the RCO staff on a periodic basis. Distress data such as cracks, ruts, roughness and others will be obtained by other SHRP contractors. The SHRP Technical Assistance Contractor (P-001) staff provide the overall guidance and necessary checks for acceptable data quality and inter-region data consistency during all data collection efforts including the field material sampling and field testing and laboratory material testing work. These quality control activities for the field drilling, sampling and handling are described in Section 4 of this guide.

The quantities and locations of SPS test sections and other work sites will be defined as they are selected. Some of the SPS and other work is expected to be on or near GPS test sections. "Other Work" pertains to experiments for the SHRP maintenance and asphalt programs, post-inventory phase evaluations of GPS or other experimental pavements, and other special studies. The actual numbers and locations will be provided as the work progresses and in time for the drilling and sampling contractor to schedule the work.

SECTION 2

COORDINATION, SCHEDULING, AND SUPERVISION

SECTION 2: COORDINATION, SCHEDULING, AND SUPERVISION

2.1 GENERAL SHRP ORGANIZATION AND SUPERVISION

As indicated in Figure 2, a number of agencies and people are involved in the LTPP operations. Efficient and timely conduct of the field material sampling and field testing activities will require a clear understanding of the administrative, supervisory, and operational responsibilities of the various agency personnel to provide the necessary close coordination between agencies and the scheduling of the activities.

The SHRP Regional Engineer is responsible for administration and management of all SHRP contracts in the Region including the contract for drilling and sampling. Consequently, he will be responsible for all contractual matters such as processing of invoices and approval of standby and overtime. He will also provide for coordination between the various regional contractors and state highway departments plus resolve questions and concerns that may arise during the day-to-day operations. A map showing the SHRP regions is illustrated in Figure 3.

The RCO contractor will designate the drilling supervisor or another staff engineer as the SHRP Authorized Representative to provide primary on-site supervision during the drilling and sampling operations, subject to the technical direction and surveillance of the SHRP Regional Engineer. Thus the SHRP Authorized Representative will be responsible for the direction of field operations and will work with the drilling and sampling contractor to assure effective, efficient, and safe operations at the work site at all times. Specific responsibilities include: arranging for coordination of scheduling of the work with the state highway agencies including provisions for traffic control at the test section, exercising necessary judgment in authorizing minor on-site changes in work based on conditions encountered, implementing quality control and quality assurance procedures, obtaining photo documentation of exposed pavement layers in test pits, and providing initial approval of work completion forms.

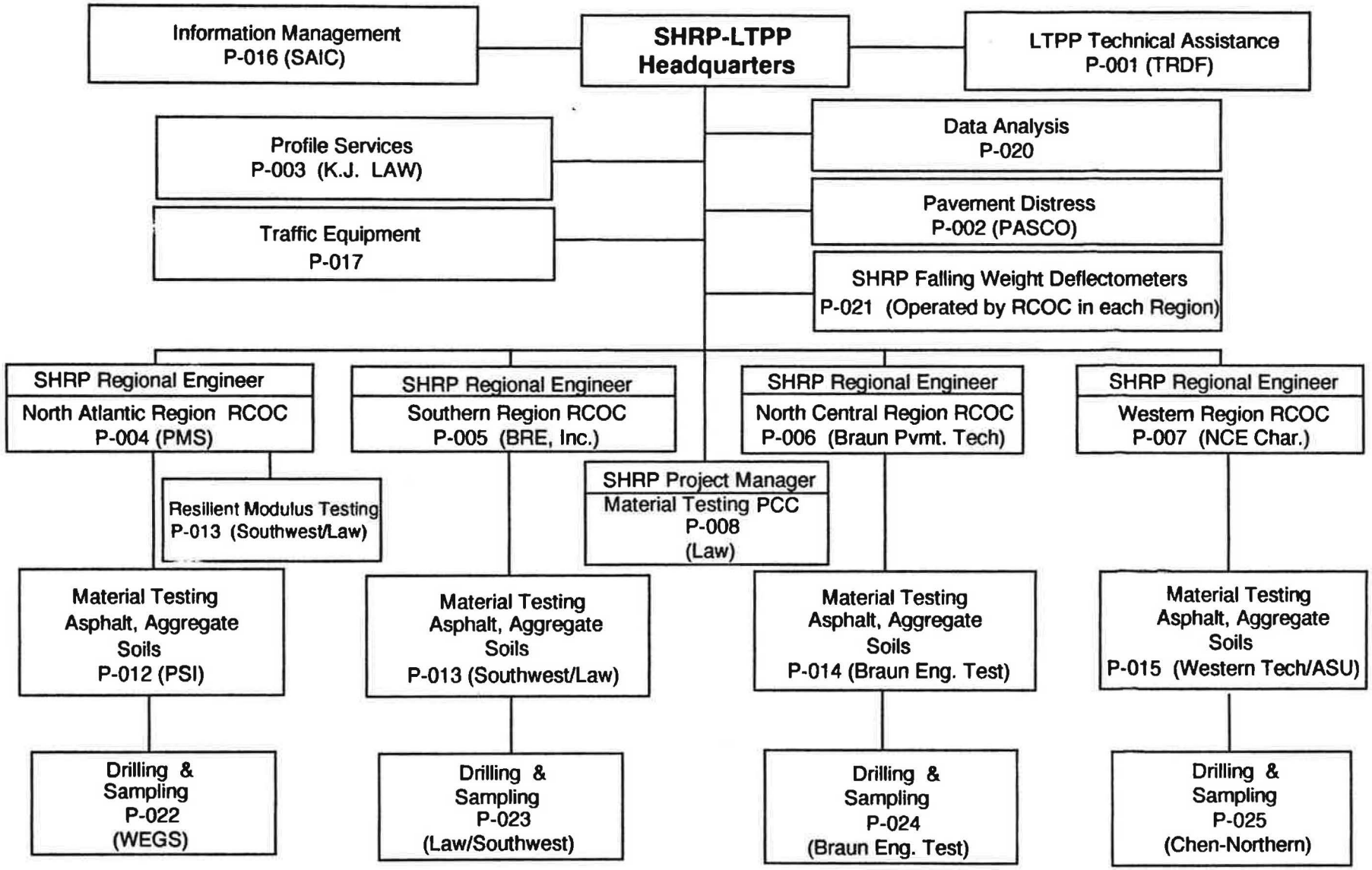


Figure 2. Agencies Involved in LTPP Operations.

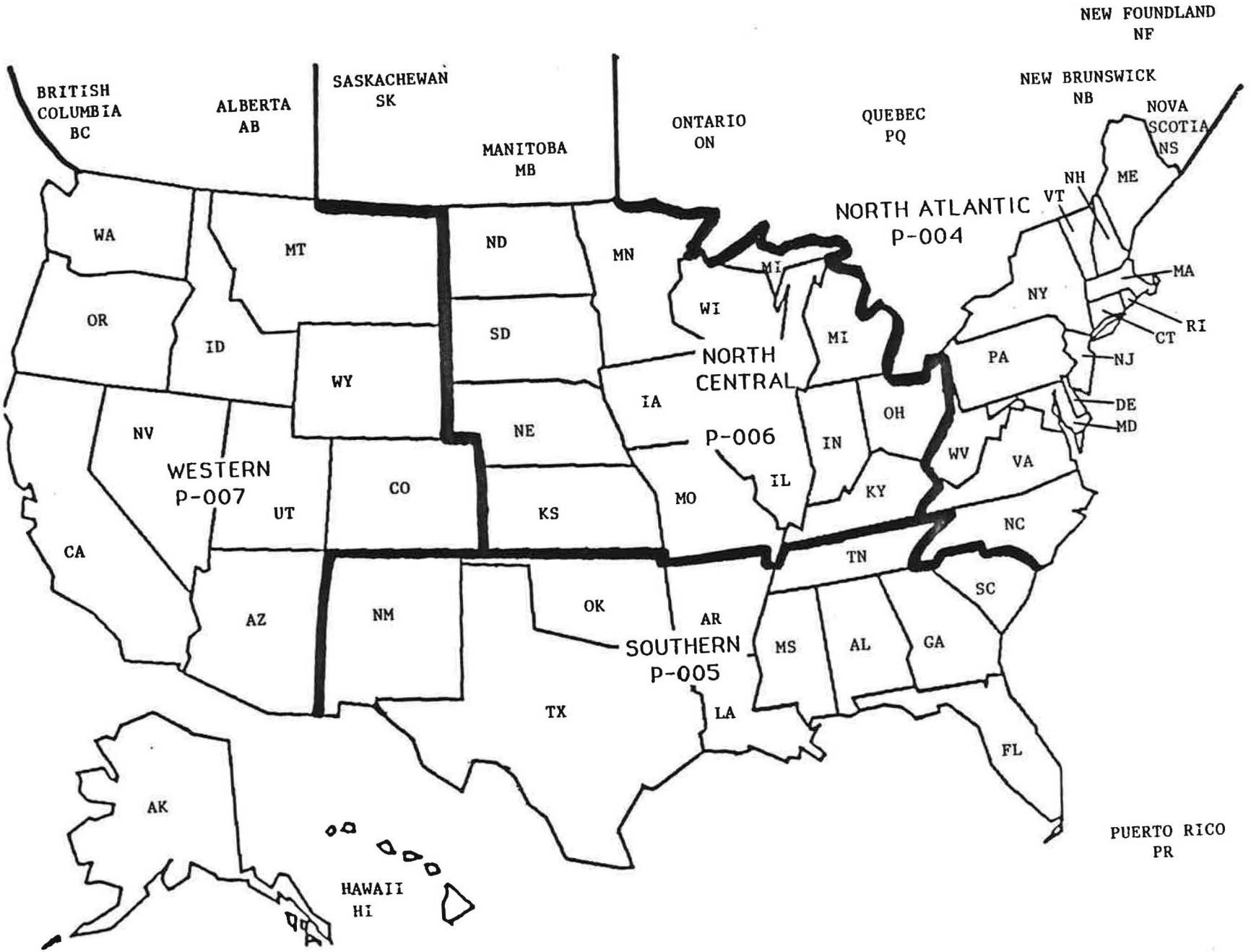


Figure 3. SHRP Regions

2.2 COORDINATION BETWEEN SHRP, STATE AGENCY, AND RCO PERSONNEL

The initial coordination activity will be a meeting in the RCO involving SHRP staff, RCO staff including the designated SHRP Authorized Representative, and the drilling and sampling contractor representatives. The names, addresses, and phone numbers of appropriate personnel will be exchanged. The scope of work, general locations of pavement test sections, schedules, state agency participation, duties and responsibilities of supervisory personnel, permits, reports, legal requirements, and other concerns will be discussed.

The names, addresses, phone numbers, and FAX numbers of the various agencies and personnel involved in the drilling and sampling activities are provided in Appendix A. A list of the state highway agency LTPP contact engineers and addresses and phone numbers is also included in Appendix A.

Other information to be provided to the drilling and sampling contractor by the RCO include:

- Maps showing specific locations of test section.
- Expected conditions at each test section such as type of pavement, layer thicknesses, and location of utilities.
- Possible changes in scope of work including the need for contractor provided traffic control and test pit excavation.
- Standard SHRP forms for scheduling, data collection, and reporting of work accomplished as shown in Appendix C; a reproducible set of the forms printed single sided; and an example set of completed forms as shown in Appendix E.
- List of SHRP terminology and abbreviations to be used in boring logs and other reports as shown in Appendix C.

Arrangements for traffic control, test pit excavation, test pit restoration, and pavement patching will be on a state-by-state basis.

An essential activity of the field sampling and testing activity is the establishment and continuous communication with the local state highway agency with regard to such items as planning, scheduling, responsibilities, and safety. A planning meeting to initiate this communication and coordination should be held in each state in advance of any field operations with participation by SHRP staff (the SHRP project manager), RCO personnel including the SHRP Authorized Representative, drilling and sampling contractor personnel (the crew chief will be the authorized contractor representative during sampling operations), and the local state highway agency personnel (including the person or persons designated by the state as responsible for any state conducted activities such as traffic control, test pit excavation, and test pit restoration). This is a very important activity. All questions and concerns about such items as scheduling, permits, responsibilities, and safety must be resolved prior to the beginning of field operations. The SHRP Authorized Representative will be responsible for coordination of all field operations between the state highway and the drilling and sampling contractor personnel. Activities such as traffic control, identification of utilities (underground and overhead), drilling and sampling procedures, safety regulations and requirements, and emergency actions will be reviewed and approved.

External coordination and communication of regional activities will be those activities related to other regions, LTPP technical assistance contract staff, and SHRP headquarters. These should be handled by the SHRP Regional Engineer. Such communication will assure timely execution of the work and the transmission of results. Communications after normal working hours should be sent by facsimile machines (FAX) to assure that timely information is transmitted. The internal coordination and communications will involve quality control and quality assurance reviews where the SHRP Authorized Representative will meet with the drilling and sampling contractor staff and the SHRP Regional Engineer on the progress and any technical difficulties that may have risen. These reviews should be performed periodically during the contract.

Daily coordination will occur in the field between the drilling and sampling contractor's crew chief and the SHRP Authorized Representative in cooperation with the SHRP Regional Engineer, other RCO staff, and SHA personnel. The crew chief must have the authority to respond to short notice requests and direction

by the SHRP Authorized Representative for overtime, standby time, nights or weekend work. The crew chief should have full knowledge along with the SHRP Authorized Representative of the status and any possible changes in the schedule.

2.3 SCHEDULING

The drilling and sampling contractor shall submit to the SHRP Authorized Representative, at least monthly, a detailed schedule showing the proposed locations of the crew(s) for each calendar day of the next four weeks. The schedule should be prepared using the format shown in Appendix C, Form S10. Any proposed changes to the schedule will be approved by and coordinated with the SHRP Authorized Representative prior to implementing the change. Unanticipated changes such as due to weather or delays on a site will be coordinated with the SHRP Authorized Representative and SHA personnel as soon as the incident occurs. The contractor must submit an update of this monthly schedule every week to the SHRP Authorized Representative and the appropriate SHA personnel. Each update will include a schedule for the next four weeks. By early afternoon of the day before the scheduled activities, the crew chief should recontact the appropriate personnel to confirm the schedule.

2.4 PERMITS AND INSURANCE

All work will be performed on SHA Right-of-Ways. However, it will be the responsibility of the drilling and sampling contractor to be acquainted with all applicable regulations and secure all necessary permits to perform the work including interstate shipping of samples and transportation of nuclear gauges. The drilling and sampling contractor shall exercise due precaution to avoid underground and overhead utilities in the prosecution of its work and shall be responsible for all injury to persons, damage to property, either directly or indirectly, that may result from its operation. SHRP and SHA will provide any information on underground utilities that is in their records.

All coordination for traffic control, permits, any "extra" insurance (over the insurance required by NAS/NRC), and other legal requirements related to field work will be made on a state-by-state basis. Adequate advance notice is required by SHA's for traffic control arrangements. Traffic control and lane closure may

have to be furnished by the drilling and sampling contractor in some sections. In these cases, traffic control costs will be based on a mutual agreement between SHRP and the drilling and sampling contractor. The traffic control method must as a minimum meet the standards included in the Manual of Uniform Traffic Control Devices (MUTCD).

2.5 VEHICLES, EQUIPMENT AND MATERIALS

The drilling and sampling contractor shall at all times provide at the field site all vehicles, equipment, and materials required by the contract. These items shall be in proper working order and meet Federal, state, and local regulations such as configurations, load restrictions, and safety requirements. Drivers of the vehicles must meet state and local requirements with respect to the number of hours driven/worked within a seven day period. Also, expendable items such as bits, packaging materials, rope, etc. shall be available in quantities that will preclude any operational delays. Non-conformance will be cause for shut down of operations without compensation of any kind.

2.6 SAFETY

At any time drilling, sampling, and testing activities are being performed on highway pavements, the safety of the operating crews as well as the traveling public is of the utmost importance. A comprehensive safety plan shall be developed and implemented throughout the drilling and sampling contract. The safety plan shall identify SHA's and the drilling and sampling contractor and conform to local and MUTCD requirements with regard to reflectorized vests, hard hats, safety glasses, adequate clothing, (including foot gear), and first aid equipment. Standard operating procedures for drilling and sampling should be prepared and field crews provided training using these procedures. Where traffic control activities are provided by the SHA, the contractor field crews will be made aware of SHA safety requirements. Where traffic control is provided by the drilling and sampling contractor, procedures will be as required by the SHA or other traffic control agency. Work shall be stopped and corrective actions taken when the SHRP Authorized Representative, the crew chief, or the designated SHA official have any concerns about the safety of operations.

Visitors to the site will not be permitted within 25 feet of drilling equipment. Vehicles in the work site shall be facing in the direction of traffic to avoid any possibility of confusion. When a drill rig is facing the oncoming traffic, another vehicle should be located between the drill rig and the oncoming traffic and facing in the direction of traffic. Care should be exercised to minimize encroachment of water from the drilling activities onto pavement surfaces open to traffic. In case of freezing conditions, de-icing chemicals must be used to prevent the formation of ice on the traveled pavements and around the drilling operations.

SECTION 3

FIELD OPERATIONS

SECTION 3: FIELD OPERATIONS

This section describes procedures for material sampling, field testing, and handling of cores and other material samples at test sections and during transfer to the laboratory for testing. The major objective is to minimize the variability of material properties attributable to sampling and handling techniques by standardizing these techniques as much as possible.

3.1 GENERAL PROCEDURES

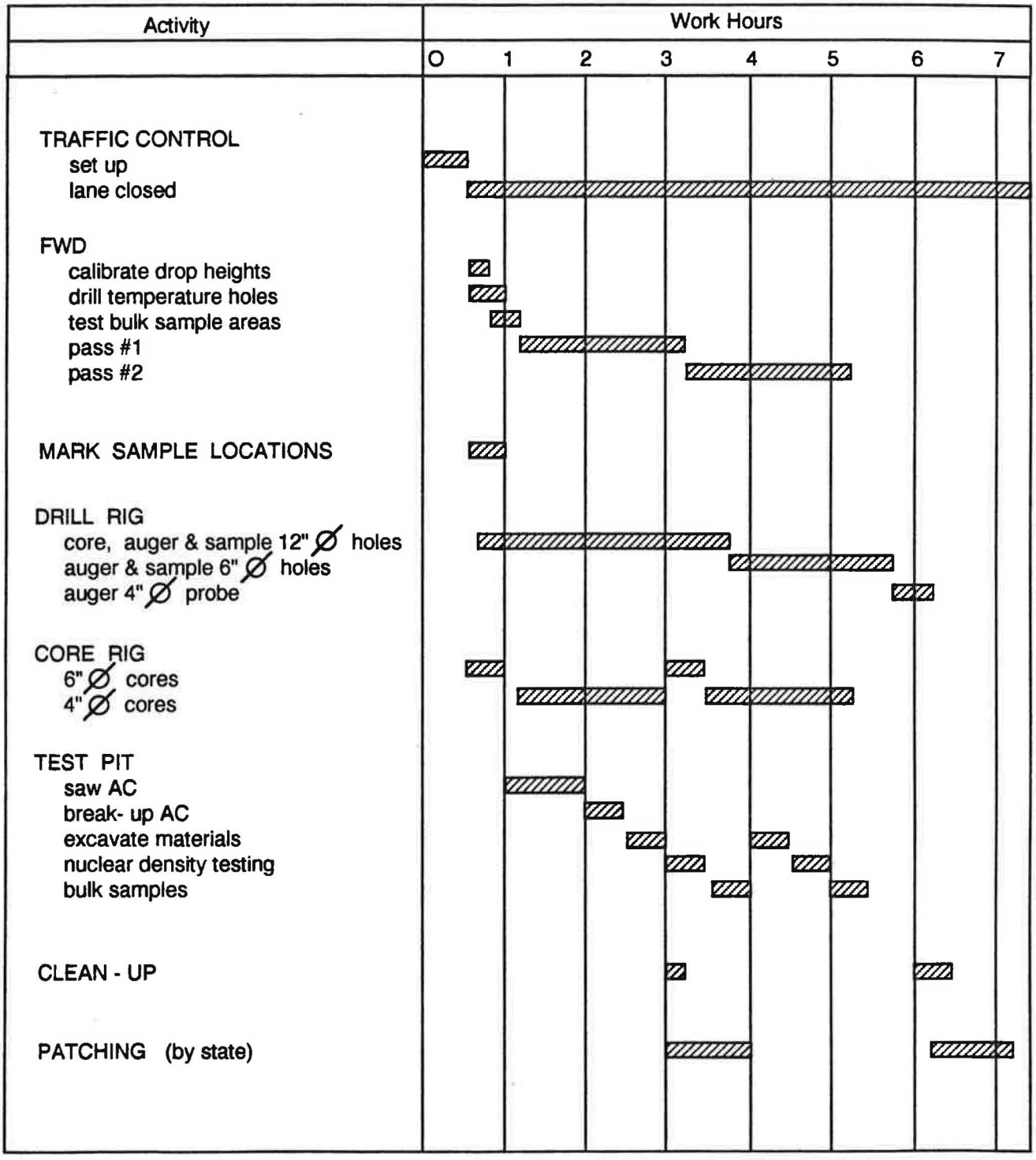
The general procedures expected to be followed for each site are outlined below:

1. By 3:00 p.m. local time on the day preceding work at a new site the drilling contractor's crew chief shall notify the SHRP Authorized Representative of the proposed location and time of arrival at the next site, obtain approval to proceed along with any special instructions for the site, and confirmation of starting time. (See Figure 4 and Figure 5 for an example of a daily work plan).

2. Upon arrival at the site, the crew chief shall check in with the SHRP Authorized Representative to verify site limits and traffic control availability.

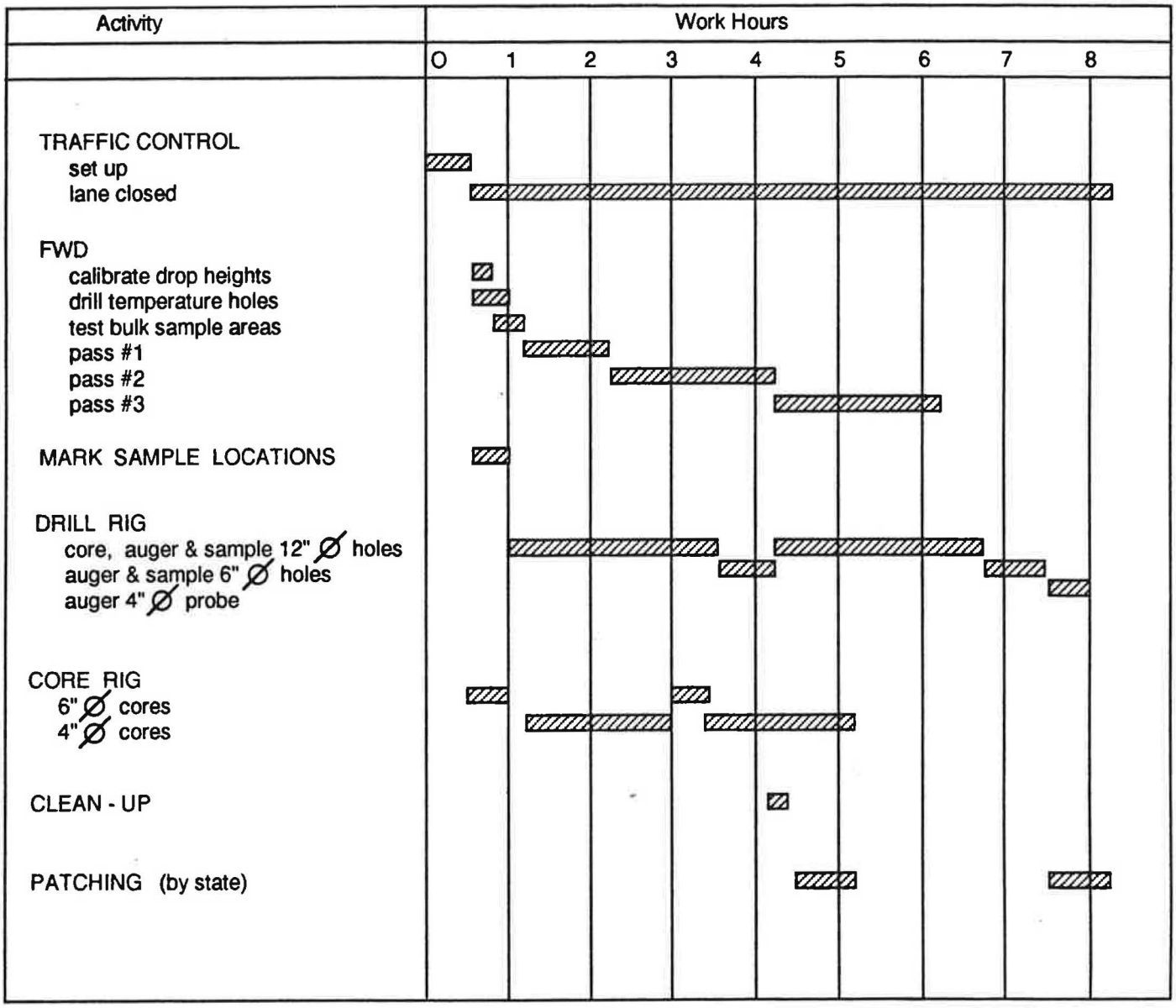
3. Lay out the initial sample locations and commence the coring. Lay out the remaining locations and continue sampling and testing. The basic GPS sampling and testing sequence of operations will be:

   (a) Sawing and removal of pavement at the test pit location.
   (b) Coring and augering near the test pit location.
   (c) Coring and augering at opposite end of test site.



NOTE: Actual times will vary depending on pavement type, thickness, number of layers and down time.

Figure 4. Example of a typical day of drilling and sampling an AC pavement.



NOTE: Actual times will vary depending on pavement type, thickness, number of layers and down time.

Figure 5. Example of a typical day of drilling and sampling a PCC pavement.

(d) Bulk sampling and moisture/density testing in the test pit as layers are removed.

(e) Shelby tube undisturbed sampling of subgrade material. (If unable to obtain Shelby tube samples, SHRP Authorized Representative may direct the use of splitspoon sampling to obtain subgrade material samples.)

(f) Auger probes in the shoulder if required.

Variations of this sequence of operations may be made by the Contractor to optimize the efficiency of the operations. If any core or auger location is unacceptable for any reason, an alternate location should be selected and marked on the as-sampled layout plan.

4. Complete any authorized extra GPS work as applicable to the specific test section and any other authorized work. This work may be performed on subsequent days, after the approval by the SHRP Authorized Representative, if the basic GPS work requires a full day.

5. Report any problems not covered by previous instructions to the SHRP Authorized Representative and obtain further instructions.

6. Prepare samples for shipping, complete logs and other records, and clean up work sites.

7. Advise the SHRP Authorized Representative of completion and obtain approval to leave the site.

8. Notify, at once, all concerned personnel (i.e., the SHRP Authorized Representative, SHRP Regional Engineer, State Highway Agency contact person, Traffic Control Supervisor, etc.) if, for any reason, drilling contractor is delayed, or anticipates delay and cannot appear at the designated date, time, and place for the next site to be investigated. A revised schedule shall be determined as soon as possible.

3.2 TEST SECTION LOCATIONS

The LTPP test sections (sites) are located throughout the United States and Canada. However, the regional contractors for field material sampling and field testing will not be required to work in Puerto Rico, Hawaii, Alaska, and Canadian Provinces. A summary of currently approved GPS sections by state for each GPS experiment is included in Appendix B. The SHRP Authorized Representative will provide updates for this summary and site information as needed.

As the program progresses, additional GPS sections, SPS sites, and test sections for other SHRP studies may be identified in each of the regions. SHRP reserves the right to adjust the scope of work to equalize the work load and optimize efficiency of the data collection and testing effort.

The SHRP Authorized Representatives will provide location maps (Figure 6) to the drilling and sampling contractors in their regions during the initial meetings described in Section 2 and on an as-needed basis. They will show the SHRP ID number and the specific test section location including highway/road designation, direction of traffic, lane number, and a land marker for each section. Preliminary inventory data sheets (Figure 7) will also be provided for each section describing the expected conditions such as pavement type, layer materials, and layer thicknesses. The general layout of a test section is presented in Figure 8. The details of marking the beginning and end of the test section are illustrated in Figure 9. A GPS test section is 500 feet long. The field sampling and testing areas are located just prior to and beyond the GPS test section resulting in the occupancy of approximately 700 feet.

Figure 9 illustrates that the SHRP ID number, 100 foot markers, and start and end of each test section is clearly marked with white paint on the pavement surface in the lane selected for the test section. An erected sign (Figure 8) is located in advance of the start of the section.

Typical layouts for material sampling points and field testing points are shown in Figures 10 and 11 and more detailed sampling and testing plans for each type of test section are shown in Appendix B.

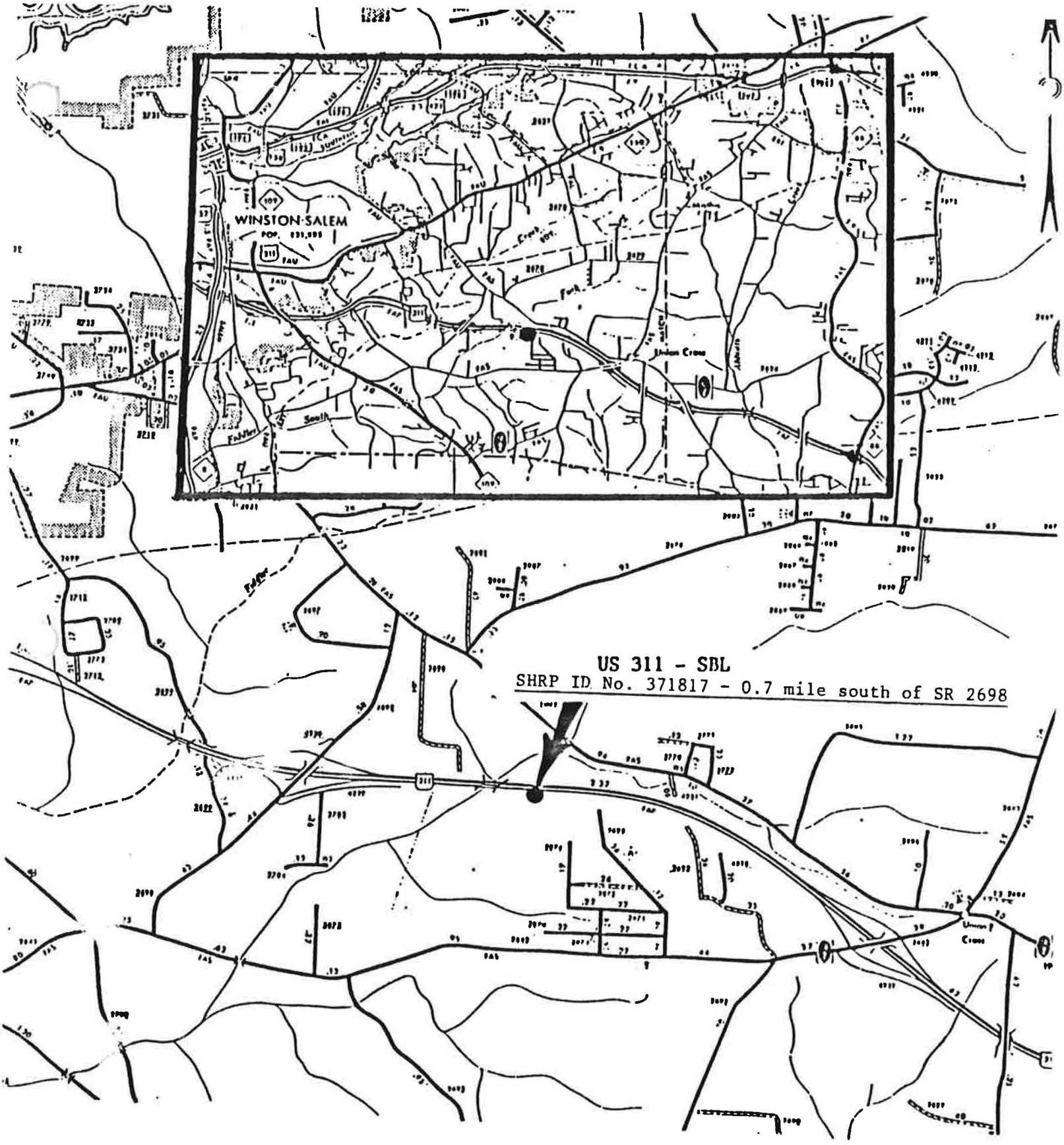


Figure 6. Example Location Map of Test Section.

STRATEGIC HIGHWAY RESEARCH PROGRAM
GENERAL PAVEMENT STUDIES
Long-Term Pavement Performance Monitoring
Project Information Sheet
March, 1988

REGION: North Atlantic
STATE: North Carolina
EXPERIMENT: AC on Granular Base

SHRP Assigned ID:	371817	District:	9	Year Open:	1983
State Assigned ID:	1330	Highway:	U.S.- 311	Year Traffic:	1985
Expmnt Design Cell:	1- 67	Length:	2.3 miles	AADT:	28000
Status:	Selected	Lanes:	2	Trucks:	10.0 %

DESIGN FACTORS:
- Moisture - Wet
- Temperature - No Freeze
- Subgrade - 53 = Silty Clay — Fine
- Traffic - 310 KESAL/Yr — High (85)
- AC Thickness - 4.5 in. — Med (3.0, 8.0)
- Base Thickness - 12.0 in. — High (10.0)
- AC Stiffness - 648 kpsi — Low (650)

MISCELLANEOUS:
- Base Type - Granular
- AC Voids - 8.9
- Structural No. - 2.5

LAYER CONFIGURATION

LAYER NO.	LAYER DESCRIPTION	LAYER THICKNESS	LAYER MATERIAL TYPE
4	3 = Orig Surface	2.0	1 = Asphalt Concrete
3	4 = HMAC Below Surf	2.5	28 = Hot Mix Asphalt Concrete
2	5 = Base Layer	12.0	23 = Crushed Stone or Gravel or Slag
1	7 = Subgrade	.0	53 = Silty Clay

PAVEMENT LAYER INFORMATION

	ASPHALT CONCRETE LAYERS											
LAY	-- GRADE ---		AC	AC		ACVIS	ACVIS	PEN	AC	AC	AGG	AC
NUM	VISC	PENETR	CONT	DENS	S	140	275	77	TRBF	VOID	SPGR	STIFF
4	20	0	5.9	147	3	0	0	0	.0	10.0	.000	594
3	20	0	5.2	150	3	0	0	0	.0	8.1	.000	691

Figure 7. Example Inventory Data of a GPS-1 Test Section.

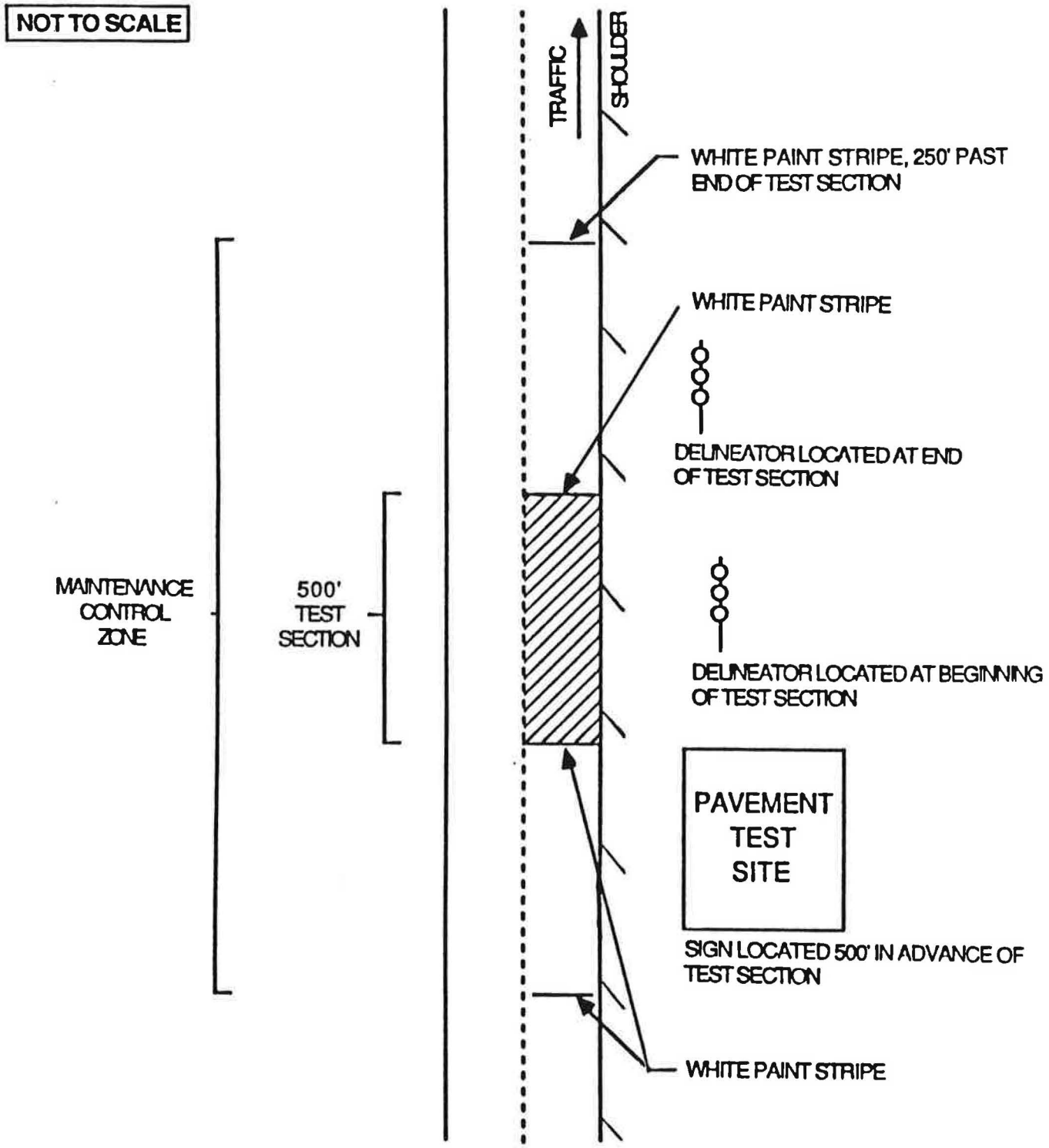


Figure 8. General Layout of Test Sections.

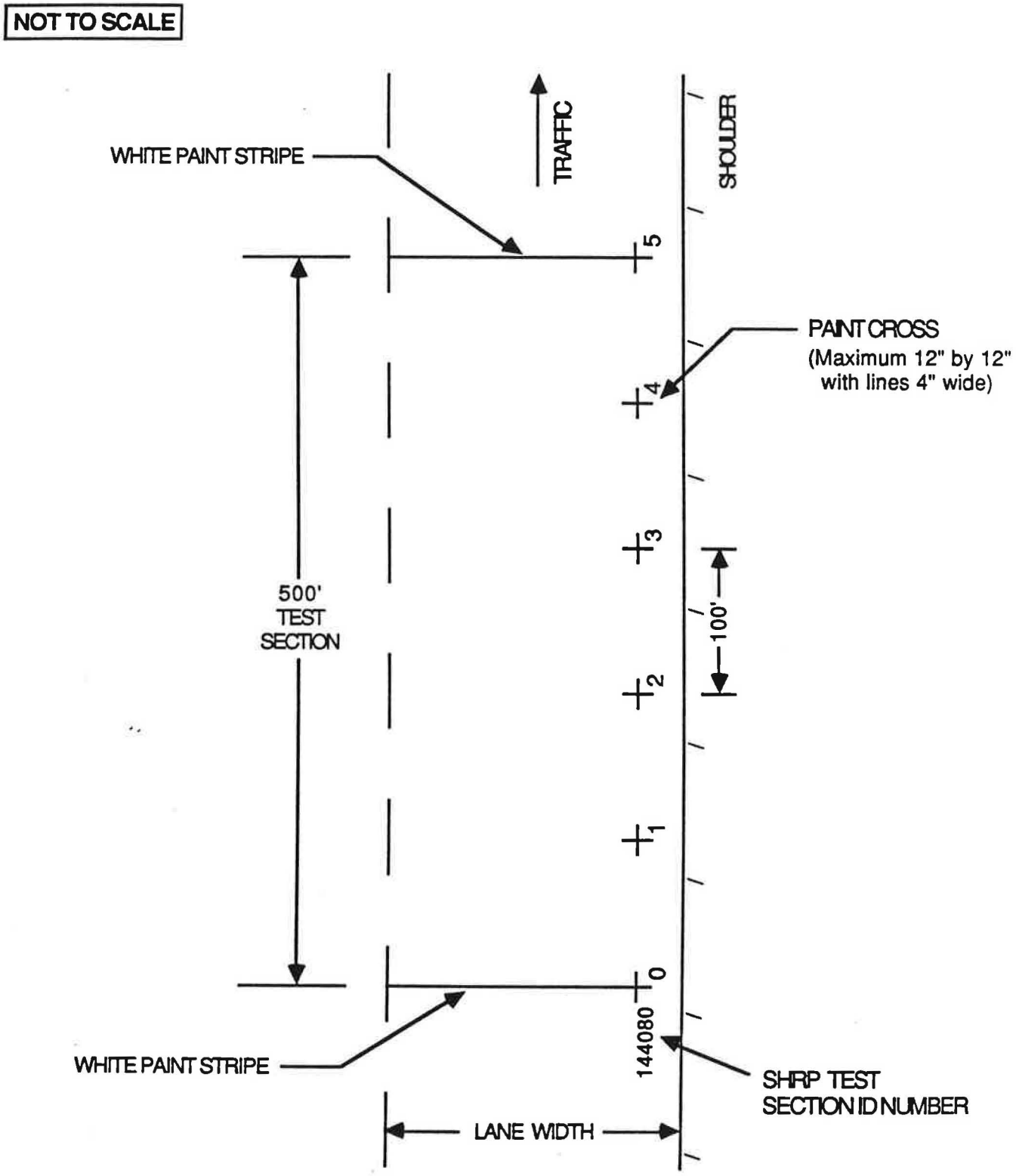


Figure 9. Details of GPS Test Section Markings.

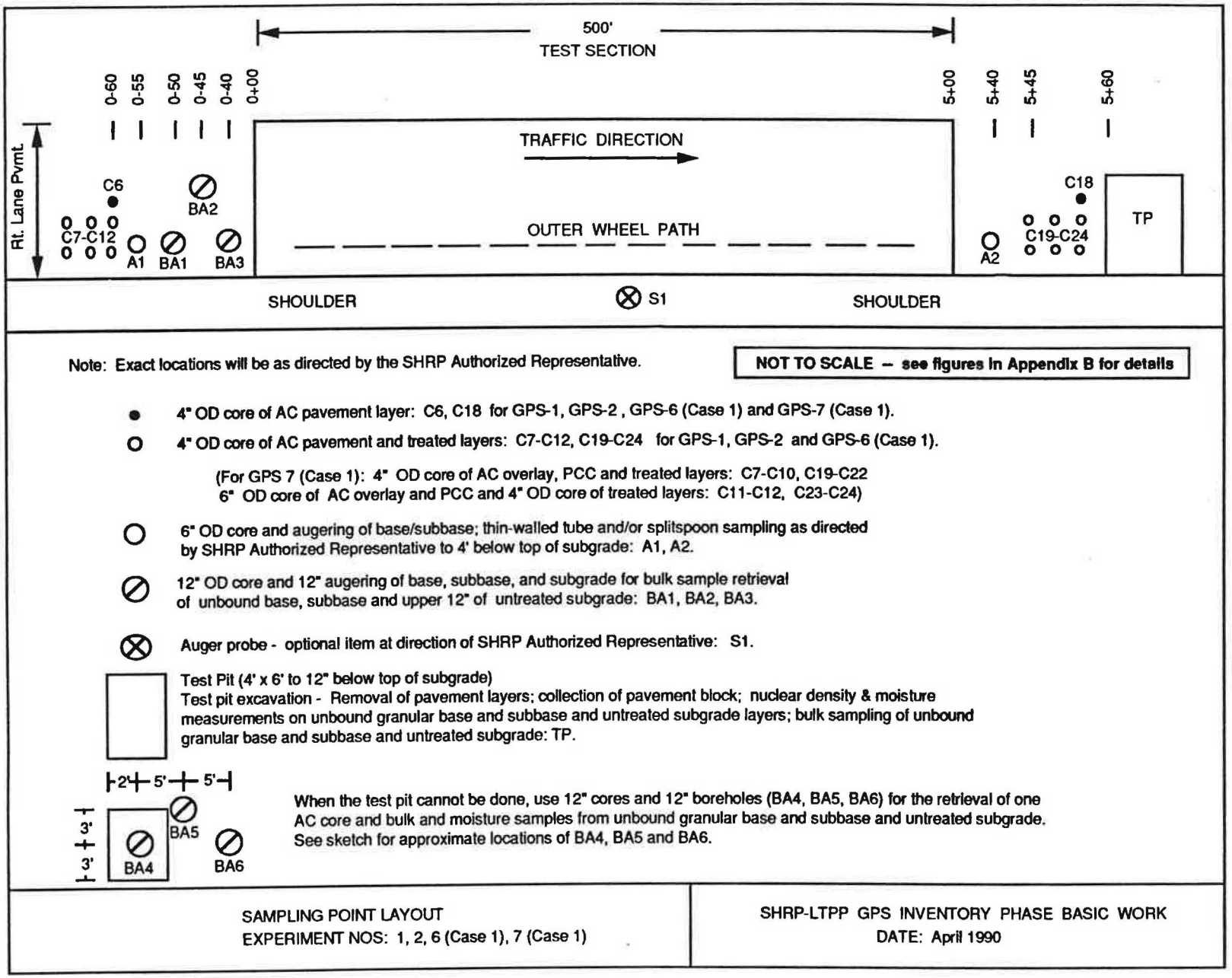


Figure 10. Typical sampling point locations for GPS-1, GPS-2, GPS-6 (Case 1), and GPS-7 (Case 1) pavements. (for GPS-6 (Case 2) and GPS-7 (Case 2) sampling points, see Appendix B)

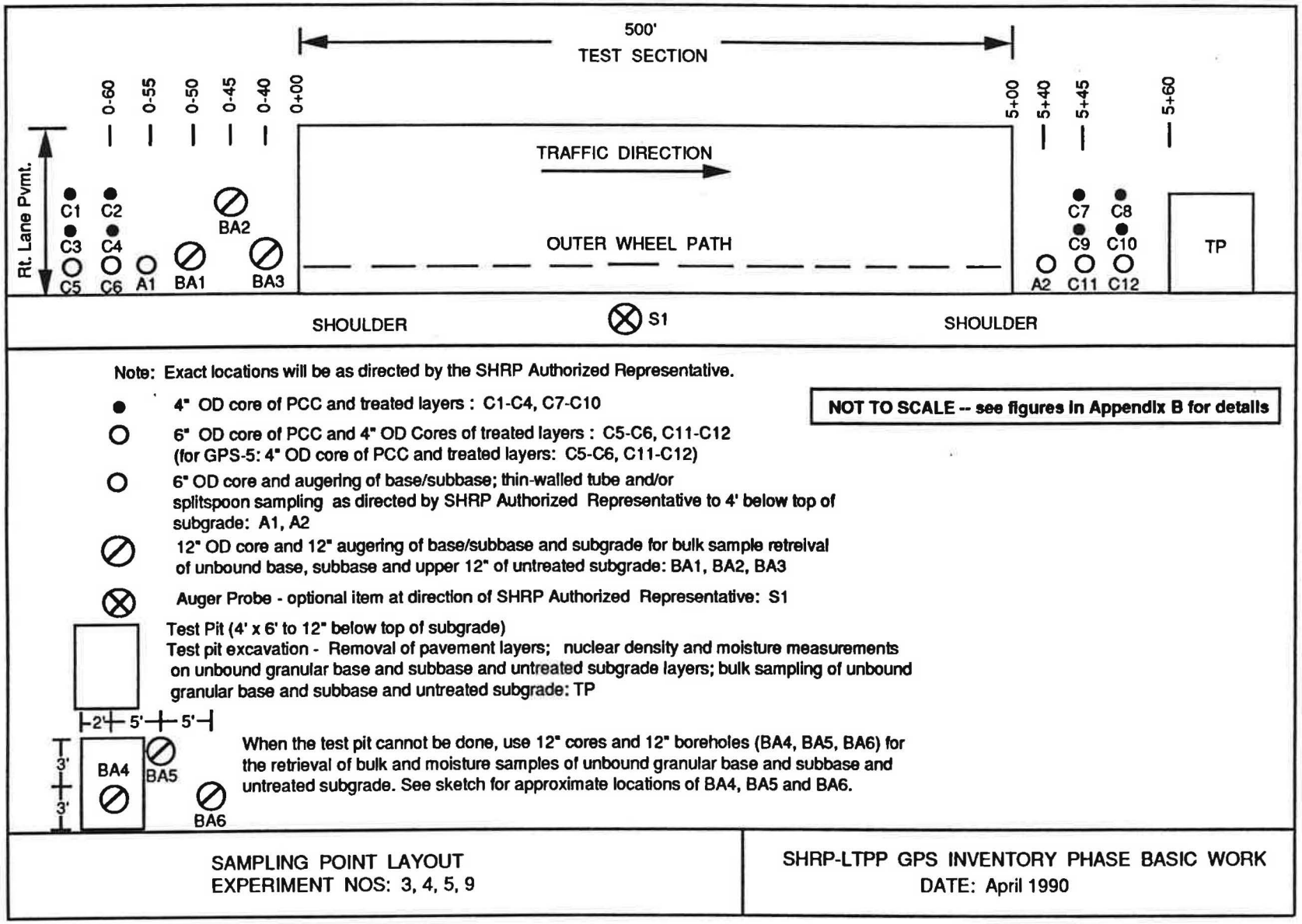


Figure 11. Typical sampling point locations for GPS-3, GPS-4, GPS-5 and GPS-9 pavements.

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

3.3 CORING OF PAVEMENT SURFACE AND BOUND (TREATED) LAYERS

This activity involves the coring of asphaltic concrete and portland cement concrete (both plain and reinforced) pavement surfaces; and portland cement, asphalt, and other treated base and subbase layers of pavements at locations as shown in Appendix B or as directed by the SHRP Authorized Representative. Exploration logs must be prepared using the forms in Appendix C. Examples of completed forms are included in Appendix E.

The coring and sampling operations for experiments GPS-6 and GPS-7 (asphalt concrete overlay over asphalt concrete and asphalt concrete overlay over jointed portland cement concrete, respectively) may occur at two different times; once before the overlay and once after the overlay. Consequently, the GPS-6 and GPS-7 pavement sections will be sampled and tested as either a case 1 or a case 2.

(a) Case 1 - If the complete field material sampling and field testing program for a GPS-6 and GPS-7 test section is conducted after the AC overlay has been placed, this section shall be sampled and tested as a "Case 1". A case 1 section will have no field material sampling and testing conducted before the overlay. This is the simplest and most economical case and it is the preferred plan for GPS-6 and GPS-7 pavements.

(b) Case 2 - If the field material sampling and field testing program for a GPS-6 and GPS-7 test section is conducted in two stages, once before the AC overlay and once after the AC overlay has been placed, then this section shall be sampled and tested as a "Case 2". A case

2 section will have the majority of the field material sampling and field testing conducted before placement of the AC overlay and then a second round of field sampling conducted after placement of the AC overlay to retrieve core samples of the AC overlay for laboratory materials testing. This is not the preferred case because it requires that two rounds of field testing be conducted.

See detailed figures B.11 through B.22 in Appendix B.

3.3.1 Reference Standard

AASHTO T24-86 - "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete".

3.3.2 Special Provisions

Apparatus - Diamond bit drilling is preferred. Mist or air cooled drilling is preferred as the best method of minimizing water contamination of sampled materials. All water remaining in core holes must be removed immediately by vacuum extraction or some other method approved by the SHRP Authorized Representative. The bit sizes will be 4.0 inches, 6.0 inches, and 12.0 inches, inside diameter (I.D.). Coring may be performed by a truck mounted drill rig or coring equipment fully capable of doing the required work and approved by the SHRP Authorized Representative. The cores shall be retained and packaged as specified in Section 3.6.5.

It is important for laboratory material testing that cores be oriented in the direction of traffic. All cores of pavement surfaces shall be marked on the top with an arrow to show the direction of traffic prior to removal of the cores from the pavement. The marking material shall be waterproof so as to remain clearly visible after coring operations.

Care should be exercised during extraction and handling of cores to avoid any damage of the cores. For example, plugs shall not be inserted in cores to be used for laboratory testing. Methods of core extraction which have been used successfully have been suction cups or wire pulls.

3.3.3 Sampling

(a) General - Core locations shall be as shown on detailed figures in Appendix B. All 4" and 6" coring shall be performed to ensure that cores are taken at an angle of 90 degrees to the surface and to ensure the recovery of straight, intact, smooth-surfaced samples suitable for laboratory testing. Details on tolerances and quality control are included in Section 4.

(b) Asphalt Concrete - Cores shall be dried before packaging. If necessary to obtain cores of suitable quality, the pavement shall be cooled by dry-ice or other means prior to coring.

(c) Reinforced Concrete - Core locations shall be selected to minimize cores containing reinforcing steel or as directed by the SHRP Authorized Representative. Steel locating equipment shall be used to assist this work. Drilling locations of other cores in a group shall be guided by the findings in the first core of each group. As indicated on the detailed sampling plans in Appendix B, all cores in continuously reinforced concrete pavements (GPS-5) shall be 4" outside diameter (O.D.). The 4 inch diameter core, when properly located, provides the best opportunity to avoid reinforcing steel.

(d) Treated Materials - Special care shall be taken to recover suitable samples. The bit type, rate of penetration and cooling medium shall be varied as necessary to minimize tearing and breakage. If 4 or 6 inch cores suitable for testing cannot be recovered due to the nature or condition of the material, chunks or pieces of the treated materials from these layers shall be obtained from the test pit area and packaged and shipped as bulk material in accordance with Section 3.6.5.

3.4 AUGERING OF SUBSURFACE LAYERS FOR BULK SAMPLING

This activity involves pavement coring, augering, and sampling of untreated base and subbase, and augering and sampling of subgrade layers of pavements at

locations as shown on detailed sampling plans in Appendix B to obtain bulk material samples.

3.4.1 Reference Standards

AASHTO T24-86 - "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. AASHTO T203-82(86) - "Soil Investigation and Sampling by Auger Borings". AASHTO M146-70(80) - "Terms Relating to Subgrade, Soil-Aggregate and Fill Materials".

3.4.2 Special Provisions

Equipment - A truck mounted drill rig shall be used. Augers shall be 6 inch and 12 inch diameter helical, continuous flight, solid or hollow stem. Shelby tubes shall be 3 inch OD and 24 inches long.

3.4.3 Sampling

(a) The pavement surface layer and any treated materials shall be cored with a 12 inch diameter bit at the bulk sample augering locations BA1, BA2, BA3 and/or BA4, BA5 and BA6 locations. Two 12 inch diameter asphalt concrete pavement surface cores shall be removed and shipped in accordance with Section 3.6.5. All other 12 inch diameter PCC cores and treated base and subbase portions of cores should be discarded.

(b) Untreated base and subbase layers shall be augered separately to obtain uncontaminated samples of each layer. The material raised by the auger from immediately below any cores of pavement surfaces or bound layers should be wasted due to possible contamination by water or fines from the coring operations. As the auger proceeds into the unbound layer to be sampled, the operator must be on the alert for the presence of material from the next lower layer and if present, the mixed layer material should be wasted. The uncontaminated material from each layer shall be separately retained as large bulk samples and cared for as specified in Section 3.6.5.

Bulk sample quantities required for packaging and shipment are shown in Table 1. A small bag or jar sample for laboratory moisture testing shall be obtained from each layer and cared for as specified in Section 3.6.5.

(c) At the undisturbed sample locations (A1 and A2), the pavement surface layer and any treated materials shall be cored with a 6 inch diameter bit and all cores removed and cared for in accordance with Section 3.6.5.

(d) Undisturbed samples of the natural subgrade or fill material directly beneath base and/or subbase layers at A1 and A2 locations shall be obtained to a depth of 4 feet below the top of the subgrade or fill using Shelby (thinwall) tube sampling. If unable to obtain Shelby tube samples and if approved by the SHRP Authorized Representative, splitspoon samples may be obtained. This sampling shall be accomplished in accordance with AASHTO T206 or AASHTO T207.

(e) If rock, boulders or other forms of refusal are encountered within 4 feet of the top of subgrade or fill, a new sampling location shall be made at an offset of 5 to 10 feet and another attempt made at sampling the subgrade. If rock, boulders or refusal is encountered at the second location, sampling shall be terminated.

3.4.4 Procedure for Shelby Tube Sampling of Subgrade Soil

The first priority for obtaining undisturbed samples of subgrade soils and /or fill material directly below base/subbase layers at locations A1 and A2 shall be by Shelby (thinwall) tube sampling in accordance with AASHTO T207. A truck mounted drill rig shall be used for the Shelby tube sampling. Shelby tubes shall be 3 inch O.D. and 24 inches long.

Table 1. Weight Requirements for Bulk Samples of Unbound Base, Subbase, and Subgrade Layers.

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

3.4.5 Procedure for Splitspoon Sampling of Subgrade Soil

When it is not possible to obtain Shelby tube samples of the subgrade or fill material below the base/subbase layers in accordance with AASHTO T207 because of the presence of gravel or stone fragments or the soil is too hard to penetrate, splitspoon samples may be obtained upon approval of the SHRP Authorized Representative. A truck mounted drill rig shall be used for splitspoon sampling. Sampling shall be done using only a 140 lb. hammer, 30 inch drop, and a sampler as specified in AASHTO T206. Core retainers shall be used when necessary to retain soil. Care shall be exercised to provide a free fall of the hammer (minimum friction and straight pipe) and to minimize variations in drop height. Blow counts shall be recorded on Form S02A (Appendix C of this Guide).

After opening the barrel, the recovered material shall be carefully examined and logged as to the length of recovery and description of the soil. If more than one type or obvious variation within type of soil is encountered the depth and description of each type shall be made. All uncontaminated material shall be placed in the specified jars, taking care to separately sample different soils.

3.5 TEST PIT EXCAVATION AND SAMPLING

This activity involves the test pit excavation and sampling of the bituminous concrete, portland cement concrete, treated and untreated base, subbase, and subgrade layers of pavements. Test pit details are shown in Figures B.25 through B.28. Inclusion of the test pit in the field sampling and testing offers the opportunity to obtain data and information for the NPPD that is not available from any other source. However, motorist and worker safety during test pit excavation, sampling, and testing are of major concern. Consequently, test pits may be deleted at the direction of the state highway agency for safety or other reasons. In such cases, additional bulk samples of untreated layers shall be obtained by 12" augering at the test pit location as described in Section 3.5.4. Detailed SHRP operational guidelines on test pits are included in Appendix D.

3.5.1 Reference Standard

None.

3.5.2 Special Provisions

(a) Equipment - The major equipment needed include a pavement saw, suitable excavation machine, pneumatic pavement breaker and chisel, and a dump truck. Supporting equipment shall include devices for assistance in removal of pieces of pavement and properly loosening and removing base, subbase and subgrade layers. Hand labor will be required to complete excavation to avoid damaging layers with power equipment and to avoid layer contamination.

(b) Procedure - The pavement shall be sawed to the full depth of the pavement surface and treated layers to the specified overall dimensions and into smaller pieces as necessary for removal. Use of cooling water during sawing shall be minimized to reduce water contamination of layers. If saws are not available of sufficient blade diameter to cut through all pavement surface and treated layers, pneumatic spades and chisels shall be used carefully to minimize damage to underlying untreated layers. One 12 inch by 12 inch sample of an AC pavement surface shall be recovered intact for packaging and shipment in accordance with Section 3.6.5. No samples of PCC pavement surface or treated layers are to be retained except when cores of such layers suitable for testing cannot be obtained (see Section 3.5.3.(b).)

(c) Sampling and testing - After removal of the surface and treated layers, the untreated base course shall be tested and sampled in accordance with Section 3.7.4 . The base course layer shall then be carefully removed to expose the subbase and/or subgrade layers. If backhoe buckets with teeth are used to excavate untreated layers, care must be exercised during the last few inches to avoid disturbing the underlying layer. Hand finishing of excavation of untreated layers in preferred. Testing and sampling of the untreated subbase

and subgrade layers shall be conducted in accordance with Section 3.7.4. Excavation shall continue to a depth of 12 inches below the top of the subgrade or fill material to provide the required bulk samples.

(d) Excess materials - All excess materials shall be disposed of off-site in accordance with local legal requirements. Care shall be taken not to disturb pavement layers beyond the limits of the test pit. Test pit details including specific locations for bulk sampling, nuclear density moisture testing, and sampling for moisture content are shown in Figures B.25 through B.28.

3.5.3 Sampling

(a) After sawing of the surface layers, one 12 inch by 12 inch sample of asphalt concrete pavements shall be recovered and retained for shipping. The asphaltic concrete pieces shall be retained in a cloth or plastic bag after removing any water from coring or sawing. The slabs shall be placed with the upper surface down on a wood base prior to insertion in the bag and shall be maintained in that position throughout storage prior to shipping and when packaged for shipping. No samples at PCC pavement surfaces shall be retained.

(b) No bulk samples of asphalt treated layers or portland cement treated layers shall be retained except when cores suitable for testing cannot be obtained from other locations. In such cases, one 12 inch square undisturbed block sample of the full thickness of the treated layers shall be obtained and cared for in accordance with Section 3.6.5.

(c) Large bulk samples of uncontaminated material shall be obtained from all untreated base, subbase, and subgrade layers as specified in Section 3.6.5. Care must be exercised to avoid contamination of material from one layer with material from another layer. Bulk sample quantities required for packaging and shipment are shown in Table

1. A small bag or jar sample for laboratory moisture testing shall be obtained as specified in Section 3.6.5. from each layer.

3.5.4. Test Pit Alternate

If a test pit is not provided at a test section, additional samples shall be obtained from the test pit location shown on the sampling plan using the same procedures for augering described in Section 3.4.3.

3.5.5 Reference Standards

AASHTO T24-86 - "Obtaining and Testing Drilled Cores and Sawed Beams of Concrete". AASHTO T203-82(86) - "Soil Investigation and Sampling by Auger Borings". AASHTO T206-87I - "Penetration Test and Split-Barrel Sampling of Soils". AASHTO T207-87I - "Thin-Walled Tube Sampling of Soils". AASHTO T251-77(81) - "Soil Investigation and Sampling by Hollow-Stem Auger Borings". ASTM D2488-84 - "Description and Identification of Soils (Visual-Manual Procedure)".

3.6 COLLECTION OF SAMPLES

3.6.1 Pavement Cores

All 4 and 6 inch diameter cores extracted from asphaltic concrete and portland cement concrete pavement surface layers and from treated/stabilized base and subbase layers as shown on Figures B.1 through B.24 shall be retained for marking, packaging, and shipping to appropriate testing facilities in accordance with Section 3.6.5. Two 12 inch diameter cores of AC pavement surfaces (GPS-1, GPS-2, and GPS-6) shall be retained and cared for in accordance with Section 3.6.5. All other 12 inch diameter cores should be discarded.

3.6.2 Bulk Samples

Bulk untreated base, subbase, and subgrade materials extracted by augering from 12 inch core holes and test pit excavations shall be identified by layer of the pavement and retained for marking, packaging and shipping to appropriate

testing facilities in accordance with Section 3.6.5. Minimum required quantities of these materials are shown in Table 1.

Small bag or jar samples of untreated base, subbase, and subgrade materials shall be obtained in accordance with Section 3.6.5 for laboratory moisture testing.

3.6.3 Undisturbed Samples

All Shelby tube and splitspoon samples of subgrade material shall be retained for marking, packaging and shipping to appropriate testing facilities in accordance with Section 3.6.5.

3.6.4 Logs and Reports

(a) Core Holes

A separate log shall be prepared 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 tenth of an inch. Data sheets for logs are included in Appendix C. A sample log for a C-type core is shown in Figure 12. Form S01 (Appendix C) should be used to record A.. and BA.. type core holes. The log shall show the general type of material in accordance with standard SHRP terminology in Appendix C (Table C.2).

Remarks shall include type of cooling medium, difficulties encountered in coring, and defects (such as cracks, voids and disintegration) observed in the core.

(b) Auger Holes

The record of each auger hole shall be as specified in T203 and also include:

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____
STATE_____ FIELD MATERIAL SAMPLING
AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____
*FIELD SET NO.*_____

LOG OF PAVEMENT CORES *DCG SHEET: 02*
(ONLY FOR USE AT C-TYPE CORE LOCATIONS)

OPERATOR_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*CORING DATE*___-___-___ CORE BARREL: Tip Type_____ Cooling Medium_____

Note: Each column shown below should be used to record information for all cores extracted from one core hole. "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 Drilled & Recovered	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*
If NO: to be replaced by						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks						

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ ____-____-19__
Crew Chief, Contractor SHRP Representative Date
Affiliation:_____ Affiliation:_____

Form S01A/April 1990
Figure 12. Sample Core Log Sheet.

(1) Material type of each layer and descriptions of untreated materials and soils in accordance with Table C.2.

(2) Thickness of each layer as measured in the hole to the nearest tenth of an inch.

(3) Presence and levels of any water encountered.

(4) Sample numbers and number of bags per sample if more than one.

Appendix C includes log sheets.

(c) Test Pits

Test pits shall be logged as the excavations progress using Forms S03 and S03A included in Appendix C. The record shall include the description of each layer, in accordance with the layer designations provided on the preliminary data sheets, the thickness of each layer to the nearest tenth of an inch, sample numbers and number of bags per sample, test numbers, any water seepage, sloughing, voids and similar occurrences. The thicknesses shall be measured at least at two points on each exposed face for a total of eight measurements.

Additional measurements shall be made if there are variations of over a distance of three-tenths of an inch in surface or treated layers or one inch in untreated layers. Measurements shall also be made of the shoulder surface and base/subbase layers. All measurements shall be recorded on the logs and the log shall include a profile transverse to the pavement.

The SHRP Authorized Representative shall be responsible for obtaining good quality color print photographs of the test pit profile. The photographs shall be taken at and keyed to the locations described on the test pit log (Form S03). The photographs shall be taken to provide a total view of the test pit and close-up views of the pavement profiles. All photos should be taken with the sun behind the photographer (if possible) to avoid shadows. If voids or similar discontinuities exist in the pavement structure, multiple close-up pictures should be taken. The photographs should be sent to the RCOC for processing and

filing for archival purposes.

3.6.5 Marking, Packaging, and Shipping

ASTM D4220-83 - "Preserving and Transporting Soil Samples".

(a) General Provisions

Because of the research nature of this project and because samples will be shipped over long distances, it is extremely important that the packaging be performed very carefully. Field preparation for shipping should be performed in accordance with ASTM D4220-83, Group B, for all soil and other unbound materials. Other specific instructions for each type of sample are given below. General requirements for marking and packaging individual samples are as follows:

- Sample numbering systems are 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 tie-wires. Quart-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.
- Jars for splitspoon samples shall be 8 inches in length, standard soil sample jars with tight fitting, markable, covers or adhesive labels. Jars shall be adequately sealed against moisture loss or gain.

- o Cores shall be placed in "zip-lock" storage bags and sealed, then wrapped for their entire length with tape (e.g. plastic transparent mailing tape 2 inches wide).

(b) Sample Code Number

Each sample (core, block, bulk, moisture, Shelby tube, splitspoon, chunks) shall be assigned a four digit number that must be recorded on Forms S01, S02A, S02B, and S03 for each sample collected. The sample code number will have two letters on the left side and two numbers on the right side.

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

C - core sample
K - block sample
B - bulk sample
M - moisture sample
T - Shelby tube sample
J - splitspoon sample
P - broken pieces or chunks

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

A - asphalt concrete
P - portland cement concrete
T - treated, bound, or stabilized base/subbase
G - untreated, unbound granular base/subbase
S - subgrade soil or fill material

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

CA24 Asphaltic concrete (use 01 to 24 for locations C1 to C24 on the sampling plan).

CP12 PCC cores (use 01 to 12 for locations C1 to C12 on the sampling plan).

CT24 Treated base or subbase cores (use 01 to 24 locations C1 to C24).

KA02 Asphaltic concrete block samples (up to 2 blocks of 1 ft x 1 ft size from the test pit).

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

PA02 Pieces of asphalt concrete, if blocks could not be taken (up to two bags from the test pit).

PT02 Pieces of treated base or subbase (up to two bags from the test pit area or from auger holes BA1, BA2, or BA3). These types of samples must be taken if good cores could not be obtained from the treated layer.

BG01 Bulk samples from granular base or subbase material (01, 02, 03; from different auger holes of BA1, BA2, and BA3 type; and 55 and higher number for samples from the test pit). For example, assign BG01 (for base) and BG02 (for subbase) for samples of granular layers from auger hole BA1; BG03 and BG04 for BA2 samples; and BG05 and BG06 for samples from auger hole BA3.

BS01 Bulk samples from subgrade material (01, 02, 03; from different auger holes of BA1, BA2, and BA3 type; and 55 and higher number for samples from the test pit).

MG01 Granular base/subbase samples for moisture content (01, 02, 03 and up to 50 from BA1, BA2, BA3, A1 and A2 type auger holes, and 55 and higher number for samples from the test pit).

MS01 Subgrade samples for moisture content (01, 02, 03 and up to 50 for samples from BA1, BA2, BA3, A1 and A2 type auger holes, and 55 and higher number for samples from the test pit).

TS04 Shelby tube samples from subgrade (two Shelby tubes from A1 and two from A2 locations).

JS01 Jar samples of subgrade from splitspoon sampler (01 and higher numbers from A1 and A2 locations).

For core sample numbers, 01 to 24 should be used to define samples for core locations C1 to C24 on the sampling plan and up to 50 for additional "C" type cores. The cores taken from locations A1 and A2 and other similar type locations should be numbered 51, 52, and up to 60. The cores taken from locations BA1, BA2, and BA3 and from other similar location types should be assigned 61 and higher numbers up to 99. If a bulk sample is contained in more than one bag then the number of bags should be recorded but the bulk sample number should be the same on each bag.

(c) Cores and Undisturbed Samples

All core, Shelby tube, and splitspoon samples shall be marked with a sample number after cleaning, drying, wrapping and packaging in accordance with this section. Indelible ink marking pens of suitable color shall be used.

If cores of the pavement surface layer and treated base/subbase layer are extracted as one piece, no attempt should be made in the field to separate the cores into separate layers. The core should be labeled separately, packaged in accordance with this section and prepared for shipment to the regional laboratory. Examples are cores of AC layer over stabilized base, AC layer over PCC layer, PCC layer over AC treated layer, PCC layer over stabilized/treated layer including econocrete and cement treated base. The only exception is the cores of PCC overlay over PCC pavement which should be shipped to the PCC testing laboratory.

(d) Labels and Tags

Each sample shall be labeled before packing in boxes and cartons. For easy identification of samples, tags and labels should be printed in these three colors:

White - all PCC cores
Sky Blue - all AC cores
Yellow - samples of base, subbase, and subgrade material

As a minimum the following information should be included on tags and labels:

SHRP SECTION I.D. (unique six digit SHRP section I.D.)
CORE/SAMPLE LOCATION (as marked on sample layout plans)
SAMPLE NUMBER (four digit code, as explained later in this section)
DATE (mm-dd-yy, sampling date)
FIELD SET (one digit number which will be 1 for the first round of sampling and 2 if a second round of sampling is attempted at the same general location in the future)

Every sample (core, bulk, block, Shelby tube, splitspoon, pieces) shall be identified by filling out a color coded tag or label with the above information as shown in Figure 13 and securing it to the individual sample before packaging. The labels outside the shipping boxes and other containers should include, as a minimum; test section I.D. location(s), date, and field set number. These outside labels shall be secured to the containers in such a manner as to prevent becoming detached during shipment, handling, and storage.

(e) Packaging

Instructions for combining the samples for shipment are as follows:

(1) All samples of like material (e.g. asphaltic concrete surface and binder, cement treated base/subbase/subgrade) 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 prior to testing.

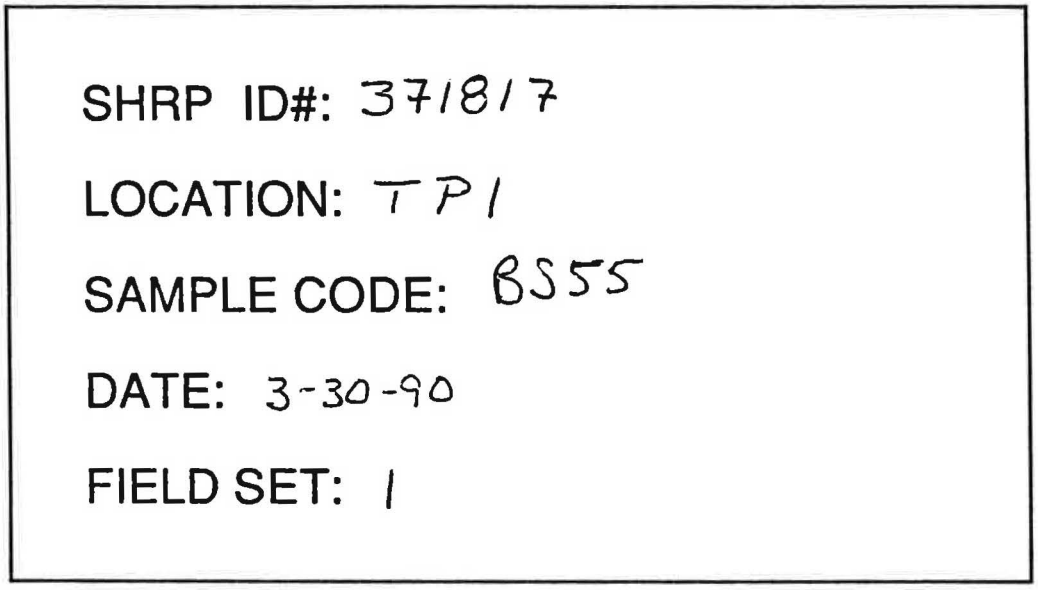


Figure 13. Example Sample Tag.

(3) Each core shall be surrounded with "bubble-wrap" or other acceptable cushioning material on all sides within the shipping box. Tape which is used to secure the "bubble-wrap" should not touch the surface of the core.

(4) Block samples of treated materials shall be sealed with wax on all sides, packaged in boxes with cushioning such as "bubble-wrap" or other acceptable material for shipment to appropriate testing laboratory.

(5) Bulk samples obtained from 12 inch diameter auger holes and test pits 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. Pieces from treated layers of coring operations not suitable for testing as cores shall be retained and packaged for shipment as bulk samples.

(6) Shelby tube samples and jar samples from splitspoons shall be packaged in boxes with cushioning such as "bubble-wrap" or other acceptable material for shipment to the appropriate testing laboratory.

(7) All shipping boxes shall be wood of suitable grade and construction to withstand shipping and subsequent moving without breakage of the box or damaging of samples.

(8) All boxes shall be adequately secured by nails or screws prior to shipping.

(9) A copy of the Project Site Report shall be included with each shipment.

(f) Shipping

All samples shall be shipped within 5 days of sampling by ground transportation. Delivery points will be the SHRP Laboratory Materials Testing Contractors as identified by SHRP. Each box shall be labeled to include the Project Identification Number, type(s) of samples, Box Number (for each series of boxes for the specific project to each delivery point), etc. The boxes shall also be labeled "Handle With Care" or similar wording as specified by the transporting organization to insure careful handling and protection from freezing and overheating. The shipping organization for transporting the samples shall be as proposed by the Drilling and Sampling Contractor and as approved by the SHRP Regional Engineer and the SHRP Authorized Representative.

Each shipment shall be insured for an amount to cover at least twice the cost of the field work performed 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 SHRP Regional Coordination Office along with the field data packet for the related field sampling and testing.

3.7 FIELD TESTING

3.7.1 In situ Density and Moisture Measurements

One in situ density and moisture measurement shall be made on the surface of all untreated base, subbase, and subgrade layers during excavation of the test pit. The reference standards are AASHTO T238-86, Method B-Direct Transmission, AASHTO T239-86, and ASTM D2950-82. As noted in the reference standards and the SHRP Technical Provisions, one measurement (i.e. test) shall be the result of the average of four readings made during each 90° rotation of the nuclear gauge through a full 360°.

3.7.2 Special Provisions

Two nuclear gauges will be available at the test site. One gauge will serve as a stand-by in the event the regular test gauge becomes inoperative, or is of questionable accuracy. Nuclear equipment and testing will be conducted in full compliance with all Federal, state, and local regulations. Nuclear gauge operators shall be licensed or qualified in accordance with requirements of appropriate agencies. Dosimeter badges should be provided to all field crew members involved in use of the nuclear gauges and the SHRP Authorized Representative. The badges should be periodically checked as required by Federal, state and local regulations.

Standardization of the nuclear density testing equipment on a reference standard is required at the start of each day's use and when the test measurements are suspect. Calibration of the nuclear gauges shall be performed annually and at such other times that the accuracy of test results are questionable. Further details of verification and calibration procedures designed to assure accuracy of nuclear moisture and density measurements are included in Section 4.

3.7.3 Subsurface Tests

One density and one moisture measurement shall be made on each untreated base, subbase, and subgrade soil layer, using the direct transmission method for density and backscatter method for moisture. For the density test the rod shall be imbedded 4 to 8 inches below the layer surface as appropriate to test the full layer. Each measurement shall be the average of 4 readings of one minute each taken at the same general location but with the instrument rotated 90° between each reading.

Prior to testing, the surface shall be leveled and smoothed and water, if present, in the test area shall be removed. The test shall be performed in accordance with AASHTO T238-86 and T239-86.

A bag and jar sample shall be obtained beneath each test for laboratory moisture testing. Location for the test and obtainment of samples shall be as

shown in Figures B.24 through B.28 and as directed by the SHRP Authorized Representative. Minimum sample sizes shall be: 1 lb. for material having a maximum particle size of 1/4 inch; 3 lbs. for 1 inch maximum particle material, and 5 lbs. for over 1 inch maximum particle size materials. Extreme care shall be taken to obtain samples at the true natural field moisture condition.

Report the density, moisture, type of material, rod end depth, and thickness of the layer for each tested layer. Report any unusual findings during the testing and bulk sampling such as voids, oversize aggregate or cobbles, foreign material, trapped water, etc. which may have affected the measurements. The SHRP standard form for field test record is included in Appendix C. Tests will not be required on subgrades containing an amount of rock sufficient to preclude accurate testing. Attach test report to the log of the excavation.

3.8 AUGER PROBE

The purpose of the auger probe is to determine if bedrock or other significantly dense hard layers exist within 20 feet of the pavement surface. This determination is extremely important for later analysis of the pavement test sections. However, it is possible that under certain geologic conditions where rock occurs at very deep depths, the need for shallow auger probes would not be warranted or justified. Maps from the USGS and the U.S. Department of Agriculture, county soil surveys, plus other available local information should be used to assess the need for this auger probe. The information sources may contain appropriate depth ranges to bedrock for the mapped areas and thereby give an indication of the need for auger probes.

Where required by the SHRP Authorized Representative, augering shall be performed with a truck mounted drill rig using a 4 or 6 inch continuous flight, solid, helical augers. The auger probe shall be made in the shoulder at a location approximately in the middle of the test section.

Augering shall be performed to a depth of 20 feet or refusal, whichever is less. When refusal occurs prior to 20 feet, the probe shall be continued at a nearby location (5' to 10') as directed by the SHRP Authorized Representative. When refusal occurs at the second location, the auger probe activity shall be terminated.

Each probe shall be logged using Form S05 (Appendix C). Include the types and thicknesses of materials encountered and the total depth of probe. No material samples should be retrieved from the auger probe location.

3.9 TEST PIT RESTORATION

Following completion of the test pit activities, the Contractor will be responsible for removal of all debris and preparation of the pit for restoration and patching by state highway agency personnel. The state foreman should be contacted to determine his desires concerning the restoration of the pit. With proper communication and coordination, it will be possible to restore asphalt concrete sections to their original condition during the day of sampling and testing. Test pits in portland cement concrete other than continuously reinforced concrete pavements may be restored the day of sampling and testing by use of the following procedure (this procedure has been used with success in one of the SHRP Regions):

- Saw completely through concrete surface along all edges of the test pit and place anchor plugs in the pavement slab to be removed.

- Place anchor bolts in the plugs and string steel cable through the eyelets.

- With backhoe or front end loader attached to the cable, lift the test pit slab in one piece and place beside test pit area.

- Complete regular sampling and testing activities.

- Replaced sampled areas with suitable base and subbase material and compact with pneumatic tampers to maximum attainable density to a level even with the bottom of the concrete surface.

- Replace concrete slab, remove anchor bolts, and seal joints as per the appropriate state specifications.

In continuously reinforced concrete or other instances when the above procedure is not feasible, an overnight lane closure followed by permanent patching the following day or the placement of a temporary patch at the completion of the sampling and testing followed by permanent restoration at a later time may be employed.

If temporary patching is elected, the following procedure can be considered:

- After completion of the testing, place aggregate base material equivalent to that removed.
- Compact with pneumatic tampers to maximum attainable density.
- Place asphalt concrete temporary patch mixture (hot mix or cold mix of high stability) in 2 layers and compact each layer with pneumatic tampers to maximum attainable density.
- This temporary patch should be replaced by a more permanent restoration of the pavement surface at a more suitable time.

3.9.1 Site Cleanup

The drilling and sampling contractor will be responsible for removing from the work site all material and debris created by his operations. This shall include but not be limited to loose soil, particles of aggregate, concrete, asphalt, and mud coatings on the roadway and shoulder. Material removed from the test pit by the Contractor that are not required to be shipped or used to restore the test pit shall be disposed of off the State Right-of-Way and in accordance with state highway and local legal requirements.

3.10 REPORTS

3.10.1 General

A set of reports will be prepared on each site by the drilling and sampling contractor. Each report must be made using SHRP standard forms and signed by the crew chief and SHRP Authorized Representative. Reproducible copies of these forms are included in Appendix C. These include exploration logs, test records, and project site reports. It is essential that the reports be prepared in duplicate or duplicated prior to submittal. One copy of the reports for each site must be forwarded to the SHRP Regional Engineer along with the weekly progress report. The four week schedule should also be updated and submitted every week.

3.10.2 Exploration Logs

Section 3.6.4 describes the procedures for preparing exploration logs. A separate log must be prepared for each core, auger hole and test pit.

3.10.3 Test Records

In situ test results for density and moisture should be recorded on Form S03 of Appendix C.

3.10.4 Project Site Report

A project site report (Form S07, Appendix C) shall be prepared after completing the field work. An actual marked as sampled and tested field material sampling and field testing plan shall be attached to the project site report. See Appendix E for an example completed field data packet.

April 1990

SECTION 4

QUALITY CONTROL AND QUALITY ASSURANCE

SECTION 4. QUALITY CONTROL AND QUALITY ASSURANCE

4.1 GENERAL

SHRP requires consistent high quality field material sampling and field testing from all drilling and sampling contractors. To achieve this goal, SHRP will implement uniform quality assurance (QA) and quality control (QC) procedures in each region. The definitions for quality, quality assurance and quality control can be found on page 4-7 of this section. In general, the QA and QC procedures will provide guidance in those activities within the scope of work which affect the quality of field material sampling and field testing and shall be followed to an extent consistent with the production of an acceptable quality of coring, boring, augering, disturbed and undisturbed sampling, bulk sampling from the test pits, and in situ field testing. As a minimum, the QA and QC program provides a methodology for the review, assessment and corrective action in the following activities:

1. Overall project supervision.

2. Locations of exploration holes, test pits, and field tests.

3. Materials sampling, including all coring, augering, Shelby tube, splitspoon, test pit, moisture, and bulk sampling activities.

4. Handling of samples.

5. Adherence to specified field testing procedures for in-situ density and moisture measurements.

6. Accuracy in measurements.

7. Equipment maintenance and calibration.

8. Data collection and recording.

9. Preparation and submittal of reports.

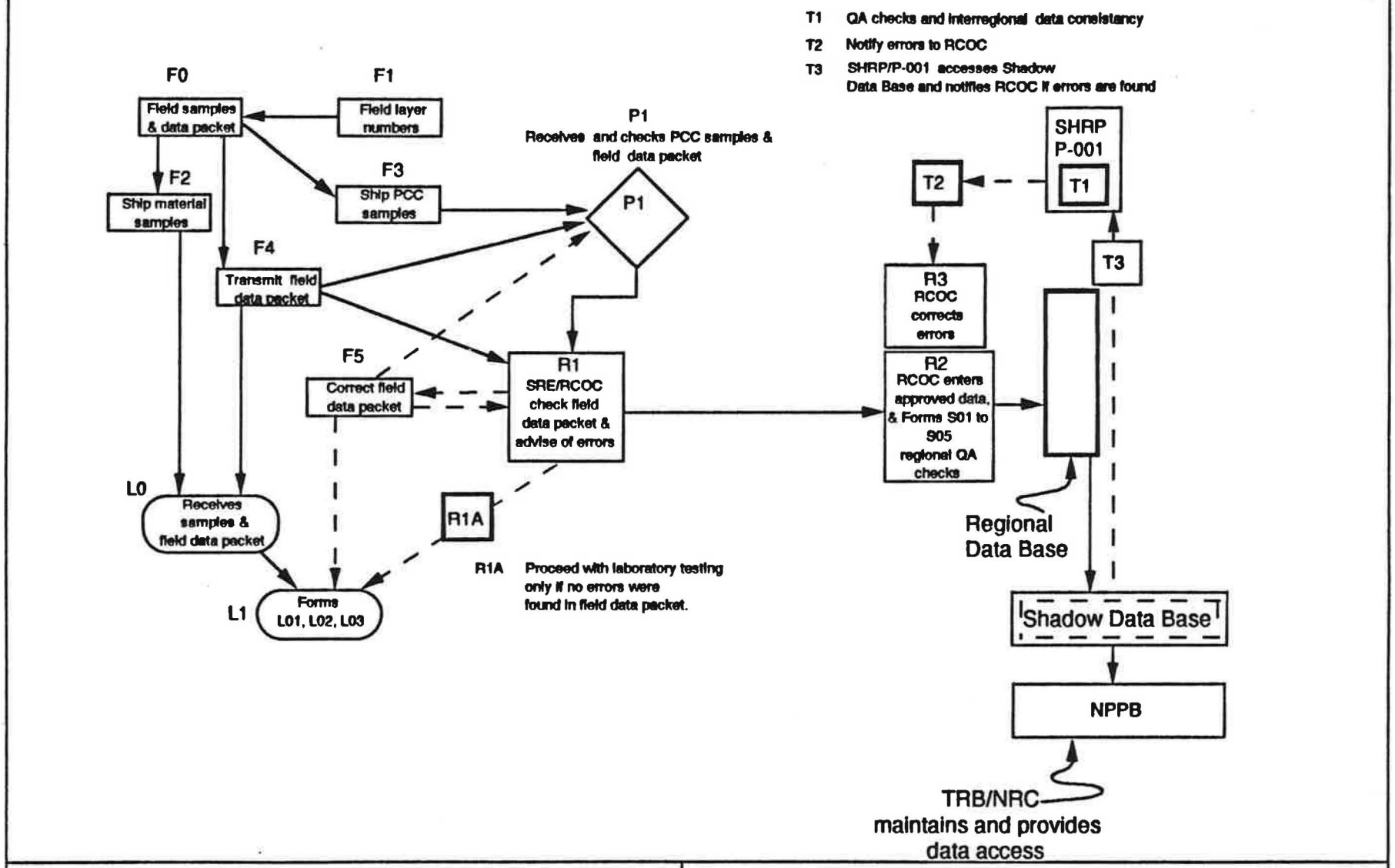
SHRP expects each drilling and sampling contractor to use its own standard manual for QA and QC procedures and operate a program of periodic review and assessment of field operations. High quality field material sampling and field testing is a cornerstone of the LTPP Program. The SHRP Authorized Representative, SHRP Regional Engineer, RCO staff, Drilling and Sampling Contractor field and office staff, and SHA personnel are all expected to be committed to achieve the desired level of uniformity, consistency, and quality. Strict adherence to the procedures and specifications contained in this Guide is essential to insure regional data quality and inter-regional data consistency. However, this may not be achieved without adequate implementation of quality control (QC) and quality assurance (QA) checks and the assignment of associated responsible persons/agencies at every level of the LTPP pavement data acquisition process. A summary of the sequence of activities in this process is shown in Figure 14 and Table 2.

4.2 FIELD MATERIAL SAMPLING QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS

SHRP requirements for quality assurance and quality control of the field material sampling and field testing program are described in the following sections.

4.2.1 Definitions

Consistent high quality LTPP field materials sampling and field testing is attainable only if all agencies and persons involved in these specific activities understand SHRP expectations and are assigned specific QA and QC responsibilities. Persons with responsibilities in this undertaking include: the field staff, crew chief, project manager of the regional drilling and sampling contractor; the SHRP Authorized Representative (SAR), SHRP Regional Engineer (SRE), SHRP Project Manager, RCO staff, laboratory chiefs and project managers of the regional laboratory testing contractor and PCC testing contractor, SHRP Quality Assurance Manager (QAM), other designated SHRP and SHRP Technical Assistance staff and the SHRP-LTPP Program Manager.



LEGEND

NPPB : National Pavement Performance Data Base
SRE : SHRP Regional Engineer
RCOC , R : Regional Coordination Office Contractor Staff
F : Regional Field Drilling and Sampling Contractor
L : Regional Laboratory Material Testing Contractor
P : Laboratory PCC Testing Contractor
T : SHRP-P001 Staff

NOTE: See Table 2 for detailed description of activities F0 through T3.

Figure 14. Regional Field Material Sampling and Field Testing Data Flow.

Table 2. Explanation of symbols of field material sampling and laboratory testing activities shown in Figure 14.

Activity Symbol	Activity Title	Description of Activity	Next Activity
F1	Field layer numbers.	The Regional Drilling and Sampling Contractor assigns field layer numbers on Form S06A after completing drilling and sampling operations.	F0
F0	Field samples and data packet.	The Regional Drilling and Sampling Contractor marks and prepares samples, and prepares field data packet.	F2, F3, F4
F2	Ship material samples.	The Regional Drilling and Sampling Contractor ships material samples of asphalt, base, subbase, and subgrade samples to the Regional Laboratory Material Testing Contractor (L0) after SHRP Authorized Representative's approval of field data packet.	L0
F3	Ship PCC samples.	The Regional Drilling and Sampling Contractor ships PCC samples to the Laboratory PCC Testing Contractor (P1).	P1
F4	Transmit field data packet.	The Regional Drilling and Sampling Contractor transmits copies of the field data packet to the SHRP Regional Engineer and RCOC (R1), Regional Laboratory Material Testing Contractor (L0) and Laboratory PCC Testing Contractor (P1).	P1, R1, L0
L0	Receives samples and field data packet.	The Regional Laboratory Material Testing Contractor receives pavement material samples and checks completeness of the field data packet.	L1
P1	Receives PCC samples and field data packet.	The PCC Testing Contractor receives PCC samples and checks completeness of the data packet.	P2

Table 2. Explanation of symbols of field material sampling and laboratory testing activities shown in Figure 14 (continued).

Activity Symbol	Activity Title	Description of Activity	Next Activity
R1	SRE/RCOC check field data packet and advise of errors.	The RCOC checks the field data packet and advises the Regional Drilling and Sampling Contractor (F5) of any errors that are found and also notifies the Regional Laboratory Material Testing Contractor to postpone further laboratory activities (R1A).	F5
F5	Correct field data packet	The Regional Drilling and Sampling Contractor makes corrections in the field data packet and transmits the corrected packets to the SHRP Regional Engineer, RCOC (R1), Regional Laboratory Material Testing Contractor (L1) and Laboratory PCC Testing Contractor (P1).	P1, R1, L1
R1A	Proceed only if no errors were found in field data packet.	The Regional Laboratory Material Testing Contractor is allowed to proceed with further activities after receiving the corrected and approved field data packet.	L1
L1	Forms L01, L02, L03.	The Laboratory Chief inspects samples and compares with Forms S06 and S06A, and Testing Contractor uses Forms L01, L02, and L03 to prepare the sample receipt for each SHRP pavement section and sends them to SRE/RCOC (R2) for review and approval.	R2, L2
R2	RCOC enters approved data, Form L05, regional QA checks.	RCOC enters approved test data and Form L05 information in the regional data base, and performs regional quality checks.	T1, T3
T1	QA checks and interregional data consistency.	SHRP/P-001 perform quality assurance and inter-regional data consistency checks.	T2, T3

Table 2. Explanation of symbols of field material sampling and laboratory testing activities shown in Figure 14 (continued).

Activity Symbol	Activity Title	Description of Activity	Next Activity
T2	Notify errors to RCOC.	SHRP/P-001 notify errors to RCOCs.	R3
R3	RCOC corrects errors.	RCOC corrects errors in the regional data base.	T3
T3	SHRP/P-001 accesses the Shadow Data Base and notifies the RCOC if errors are found.	SHRP/P-001 accesses the Shadow Data Base and notifies the RCOC if errors are found. Only corrected and approved data is transferred from Shadow Data Base to the NPDB.	TRB/NRC maintains and provides data access to NPDB.

The following basic definitions related to quality management terminology will be used throughout the SHRP-LTPP material sampling and testing program:

- o QUALITY is conformance to requirements established by SHRP.
- o QUALITY CONTROL (QC) is insuring completion of work activities and assessing the results before releasing it to SHRP.
- o QUALITY ASSURANCE (QA) is the verification of quality control measures, in other words, verifying that quality control is operational and adequate.

SHRP REQUIREMENTS FOR FIELD SAMPLING AND FIELD TESTING WORK ARE PROVIDED IN THIS GUIDE.

4.2.2 QC and QA Responsibilities

Each of the material sampling activities described in Figure 14 and Table 2 of this Guide and the data generated from these activities shall be checked at various technical levels to assure quality. It is imperative that individuals be designated as QA/QC personnel and assigned specific QA and QC responsibilities in each SHRP region and at the national level.

The following assignments of responsibilities are made to implement quality management in the SHRP-LTPP field material sampling, handling, field testing and data base activities. References made to laboratory and data base personnel are included herein to provide an "overall picture" of field material sampling and testing QA and QC.

Agency/Person(s)	Responsible for
Regional Drilling and Sampling Contractor/Crew Chief/Project Manager	QC - Field Sampling and Field Testing Activities, Field Data Packet, Shipment of Samples to Laboratory
	QC - Implementation of SHRP Procedures and Directives in the Field

RCOC/SHRP Authorized Representative	QA - All Field Activities QC - Field Data Packet
Regional Laboratory Testing Contractor/Lab Chief/Project Manager	QC - Sample Receipt and Check of Samples
PCC Laboratory Testing Contractor/Lab Chief/Project Manager	QC - Sample Receipt and Check of Samples
SHRP Regional Engineer/RCO	QA - Regional Field Data QC - Regional Data Base
SHRP Quality Assurance Manager	QA - Field Equipment and Procedures
SHRP and P-001 Staff	QA - Interregional Field Data QA - Data Base

Table 3 lists specific activities and assigned QA and QC responsibilities.

4.2.3 Project Supervision

The Drilling and Sampling Contractor's field crew shall include a qualified and experienced on-site project supervisor (called Crew Chief in this guide). The crew chief shall be a senior technician, geologist or engineer with at least five years of experience in subsurface explorations and at least three equivalent years of experience in field sampling and testing of existing pavements. This person must be familiar with all aspects of the drilling and sampling contract, this guide, as well as, the scheduling and coordination requirements of the SHRP Authorized Representative and SHA personnel. The crew chief shall be cognizant of his own and each crew member's responsibilities and specific duties and shall be familiar with on-site safety, traffic control, and other legal requirements. The crew chief should have the authority to make timely decisions for the drilling and sampling contractor on site. He is also responsible for having and using copies of pertinent standards, memoranda, directives and this Guide at the drilling and sampling site.

Table 3. LTPP materials sampling and laboratory testing activities and assigned responsibilities of SHRP and SHRP contractors.

ACTIVITIES	RESPONSIBILITIES: Regional QC	Regional QA *
1. Field Drilling, Material Sampling and Field Testing		
a. Corings, Explorations Sampling, Field Testing	Crew Chief (Regional Drilling and Sampling Contractor)	SAR (SHRP Authorized Representative)
b. Sample Identification, Packing and Shipping to Laboratories	Crew Chief	SAR
c. Field Data Sheets; Field Data Packets sent to Regional Laboratory, SHRP RCOC, and to PCC Laboratory, if Necessary	Crew Chief SAR	SAR, SRE (SHRP Regional Engineer) and Designated RCOC Staff

FOR FIELD PACKET CORRECTIONS

ACTION(S) AS MAY BE NEEDED:

(1) Correction(s) should be made in field data packet, if necessary, by the Regional Drilling and Sampling Contractor, as directed by SAR, SRE and the Designated RCOC staff.

(2) The Laboratory Testing Contractor(s) shall be notified to postpone laboratory activities until advised by SRE. The laboratory activities should only be started after receiving the corrected field data packet.

* Inter-regional QA by SHRP QAM/P-001 staff.
SRE = SHRP Regional Engineer, QAM = SHRP Quality Assurance Manager.

Table 3. LTPP materials sampling and laboratory testing activities and assigned responsibilities of SHRP and SHRP contractors. (Continued)

ACTIVITIES	RESPONSIBILITIES Regional QC	Regional QA *
2. Regional Laboratory Sample Receipt.		
a. Sample Receipt Report (Forms L01, L02, L03 to SRE for approval)	Laboratory Chief	SRE/Designated RCOC staff
3. Laboratory PCC Testing		
a. Sample Receipt Report to SRE for approval	Laboratory Chief	SHRP Project Manager/SRE
4. LTPP Data Base Entries		
a. Field Sampling and Field Testing Data Entry to Regional Data Base by RCOC (Field Data Packet; Forms S01, S01A, S02, S03, S04, S05)	Regional Data Base Manager	In-Built IMS QA checks
b. Shadow National Data Base and Preliminary Analysis by SHRP Technical Assistance Contractor	SHRP P-001 Contractor (National Responsibility)	
5. National Data Base		

GENERAL

ACTION(S) AS MAY BE NEEDED:

(1) Laboratory Testing Contractor should notify SRE if a discrepancy is found between Form S06 of the field data packet and Form L02.

(2) Laboratory PCC Testing Contractor should notify SRE if a discrepancy is found between Form S06 of the field data packet and Form L02.

(3) The SHRP P-001 contractor and the SHRP QAM should provide feedback to the Regional data base managers for corrections, if needed, of the Regional Data Bases.

(4) Only after QA checks of Shadow National Data Base and appropriate corrections of Regional and Shadow Data Bases, the data should be transferred to National Data Base.

* Inter-regional QA by SHRP QAM/P-001 staff

SRE = SHRP Regional Engineer, QAM = SHRP Quality Assurance Manager

In addition, the Drilling and Sampling Contractor shall assign a Project Manager who will be responsible for overall project supervision. The Project Manager shall maintain communications with the crew chief, the SHRP Authorized Representative, and SHRP Regional Engineer and RCO staff. The Project Manager shall also assist with the implementation of the QA and QC procedures, as well as, any other special SHRP procedures for sampling and testing quality and consistency.

4.2.4 Locations of Exploration Holes, Test Pit and Field Tests

The locations of all core and auger holes shall be clearly marked for each pavement site based on Figures B.1 through B.24 and specific instructions of the SHRP Authorized Representative. The field locations should generally vary not more than one foot in the longitudinal direction nor three inches in the transverse direction on the pavement for all core and auger holes.

An exception to this general rule would be warranted if the drilling and sampling location would fall within a "non-representative" area of the test section monitoring area. Examples of this would include patched areas or other isolated distress occurrences in the sampling area. In these instances, it is allowable, with the SHRP Authorized Representatives concurrence, to move the sample locations more than one foot in the longitudinal direction and three inches in the transverse direction to avoid this occurrence.

The field location of the test pit shall not vary by more than one foot in the longitudinal direction and one foot in the transverse direction in relation to the location on the plan sheets (Figures B.1 through B.24). Again, however, if the location of the test pit coincides with a "non-representative" portion of the test section, the location of the test pit will be as directed by the SHRP Authorized Representative. The locations of field tests and bulk sampling in the test pit should be as shown on the plans (Figures B.25 through B.28) and as instructed by the SHRP Authorized Representative. The Crew Chief

should identify these locations before authorizing the field crew to commence field testing.

The "as drilled, sampled or tested" locations shall be marked by the Crew Chief on the plan and a copy should be attached with the Project Site Report.

4.2.5 Coring, Augering, and Test Pit Operations

Cores of various diameters are required on asphaltic concrete, portland cement concrete surfaces and other stabilized/treated pavement layers. These requirements are described in Figures B.1 through B.24 for each experiment. The SHRP Authorized Representative will check the quality of cores in accordance with the following procedures. This is important to assure AC cores and PCC cores of suitable quality for laboratory testing.

Projections/Depressions. The following is a criteria for evaluating the suitability of surface AC and surface PCC cores as the field material sampling work is taking place. This criteria should be followed to obtain suitable cores appropriate for testing in the regional laboratories. The suitability of the cores with respect to projections and depressions is as follows:

Excellent - The projections/depressions on the circular surface of the core are less than 0.01 inches (0.25 mm) in height/depth. Ship these cores to the SHRP regional laboratory.

Good - The projections/depressions on the circular surface of the core are between 0.01 and 0.1 inches (0.5 mm to 2.5 mm) in height/depth. These cores are considered marginal and should be shipped to the laboratory only if cores rated "excellent" can not be obtained.

Poor - The projections/depressions on the circular surface of the core are more than 0.1 inches (2.5 mm)in height/depth. These cores are not acceptable and should not be shipped to the laboratory

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 "best" of the two drilled cores. The "worst" core of the two should be discarded. If many cores are retrieved in the "poor" condition, the SHRP Authorized Representative should determine whether the drilling and sampling contractor is using the proper equipment and that the proper procedures are being followed.

Skewness. The following is a criteria for evaluating the surface AC and surface PCC 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 (1/16 of an inch in 6 inches). 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 "best" core from the two and ship to the appropriate laboratory. The "worst" core of the two shall be discarded.

Embedded Steel. For acceptance purposes, steel observed embedded in a core must be more than one-third the radius away from the edge of the core. Embedded steel also should not run through the exact middle of the core (see Figure 15). Of course, reinforcing steel should be avoided at all costs, however, if it is unavoidable, this criteria applies. If the core does not meet this criteria, the core should be discarded and a substitute core drilled. The location of the substitute core should be shown on the as-sampled layout plan.

Cores which have been separated during the drilling and handling procedures should be rematched and put together in the same orientation. The parts of the

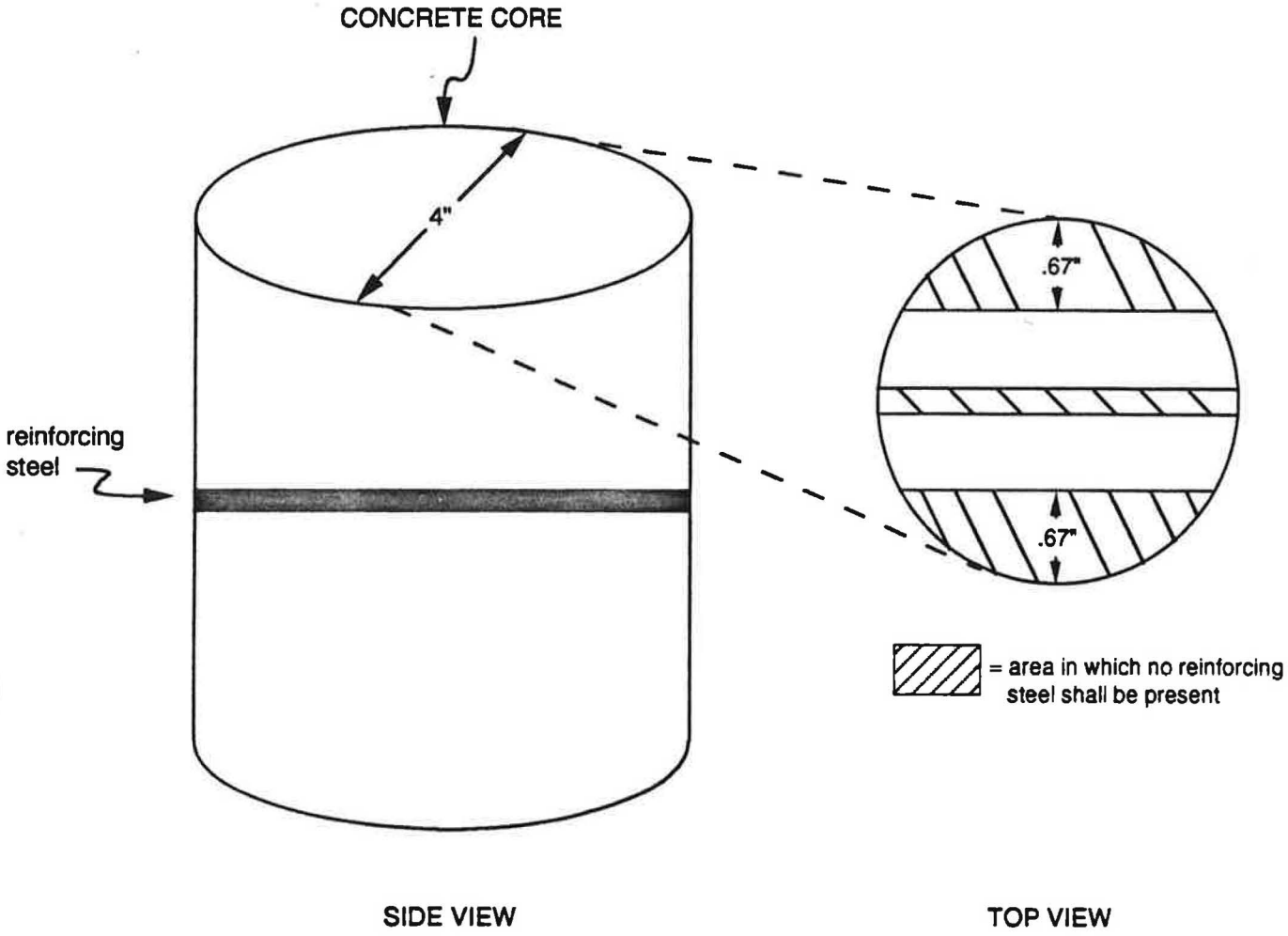


Figure 15. Location of Embedded Reinforcing Steel for Acceptance of CRCP Cores.

core must then be taped together at the separation interface before final wrapping.

Procedures which cause mechanical damage to cores which are to be shipped to the regional laboratories should be avoided. For example, rods should not be inserted in the core in order to pull it out of the core hole. Some other means, such as wire pulls or suction cups, should be employed.

All auger holes and test pits shall be properly logged as described in Section 3.6.4. Ground water conditions or seepage in bore holes shall also be observed and recorded.

4.2.6 Sampling

The requirements for Shelby tube and splitspoon subgrade sampling are described in Sections 3.4.4 and 3.4.5. Extreme caution should be exercised in handling the recovered samples. Inadequate preservation and/or improper shipment of these samples could result in significant damage and their elimination for SHRP testing/analysis purposes.

Bulk samples of untreated pavement layers and subgrade should be collected from the test pit as shown in Figures B.25 through B.28. Adequate quantities of materials as indicated in Table 1 (Section 3) should be collected from each layer. Jar or bag samples for moisture content determinations in the laboratory are also required. Bulk samples of unbound layers will also be obtained from the 12 inch, BA-type boreholes.

Quantities of bulk samples from each layer should be obtained as specified in Table 1 of this Guide. Care must be taken to insure that materials from adjacent layers are <u>not</u> intermingled during the sampling and handling operations. Special care should also be taken to thoroughly clean the augering bits after each borehole and especially after each test section is completed so as not to contaminate the samples from the next borehole sampled. Non-contamination of samples is of utmost importance.

Adjustments and changes in scope of the field sampling quantities and field sampling procedures due to problems in the field should be clearly noted in the field data packet. Any problems should be corrected immediately.

All samples shall be properly marked and labeled. A separate label shall always be kept inside the container of bulk samples. Labels should also be affixed to the exterior of the container. The crew chief shall be responsible for preparing a list of samples using Form S06 and have it verified by the SHRP Authorized Representative.

There must be a clear understanding of the quantity, type and storage requirements for each sample retrieved. The samples that are to be retained and shipped to SHRP laboratories for each experiment should be clearly understood by all field personnel. The crew chief is responsible for acquiring adequate, safe temporary storage for the samples prior to shipping to assure against loss or loss of integrity of the samples.

Prior to shipping, the crew chief should assure that the box containing the pavement samples is in good order and tightly secured. The samples will be most vulnerable to loss or loss of integrity during the shipping process and all reasonable actions should be taken to insure the sample boxes are clearly marked and in good condition.

4.2.7 Adherence to the Field Testing Procedures

The in situ density and moisture determinations by nuclear devices shall be performed using the specified procedures and special provisions contained in Section 3.7.

4.2.8 Accuracy in Measurements

The Drilling and Sampling Contractor's field personnel must regularly be appraised of the importance of accuracy in measurements. Inaccurate measurements

can produce data logs and test results which are inaccurate and misleading and can greatly diminish the value of the National Pavement Performance Data Base.

4.2.9 Equipment Maintenance and Calibration

It is imperative that all equipment be maintained and accurately calibrated so that quality samples and test data can be obtained. Calibration of measuring and testing equipment will be performed at regularly scheduled intervals. These calibrations should be performed by outside agencies, with in-house reference standards, or as instructed by the Project Manager.

Maintenance. Good, well-maintained drilling, coring and augering equipment is essential to cost-effective conduct of the field material sampling and field testing work to meet the desired quality required by SHRP. A preventative maintenance program will be necessary to achieve this goal and reduce the down time on the project site.

Drill Rigs. The height of drop and weight of the drive hammer for the standard penetration test shall be checked for each drill rig. It is essential that a clearly visible reference mark be identified on the splitspoon drop hammer rod so that the drop height is consistent. Also, the drop hammer should be weighed periodically to insure it is within the tolerances specified in AASHTO T206-81. Recalibration also shall be performed at any time there is a question as to the accuracy of the equipment. All data forms for drilling and sampling have locations for the recording of equipment used. The crew chief should be as descriptive as possible in recording this information. Calibration records shall be available at all times for review by the SHRP Authorized Representative.

Nuclear Devices. Periodically, nuclear moisture-density equipment must be checked to assure that the measurements made by the equipment on standard materials of known density and moisture are within certain acceptable limits. A calibration/verification program, as herein described, has been established to assure the accuracy and consistency of the data obtained by these devices. It is particularly important that such assurance be obtained since the in situ

nuclear density-moisture data is being collected by four different contractors using different nuclear equipment on different material types in four different SHRP regions.

The nuclear density devices will be managed as follows:

(a) The Drilling and Sampling Contractor must be licensed by state and Federal regulatory authorities for the possession and use of radioactive material for the purpose of moisture/density measurements.

(b) Transportation across state lines and/or use in other states requires notification to the cognizant regulatory authority. This will be handled by the Contractor's Project Manager.

(c) Any special regulation for the use of nuclear density devices in any state must be followed.

(d) Daily calibration checks must be performed by the field technician.

(e) Leak tests must be performed as specified by regulations.

(f) All field crew members involved in use of the nuclear gauges, including the crew chief and the SHRP Authorized Representative must be given dosimeter badges for radiation monitoring. These badges shall be checked for radiation levels as specified by regulations.

(g) Verification and calibration must be accomplished as described in the following paragraphs.

A multi-step process in the verification of the nuclear density equipment has been established in LTPP Materials Directive No. 15 and consists of the following:

1. Verification

Materials of known density (traceable to the National Institute of Standards and Technology, NIST) shall be used to verify that the nuclear density device is recording measurements within an acceptable range of the known density and moisture.

2. Calibration

A process in which relatively minor adjustments are made to bring the nuclear density device within the acceptable range of limits when making measurements on materials of known density and moisture.

3. Repair

An activity that results in correction of the deficiencies encountered in the nuclear density device that involves work beyond a minor adjustment. Items such as replacing circuit boards and repairing electronic circuits are classified as a repair activity.

Verification Agent. SHRP has completed arrangements with Troxler Electronics Inc. to conduct the nuclear device verification. SHRP drilling and sampling contractors will send their gauges (whether the device is a Troxler or not) to: Troxler Electronics Inc., Southwestern Branch Office, 2000 East Randall Mill Road, Suite 211, Arlington, Texas 76011, telephone - (817) 275-0571.

SHRP regional drilling and sampling contractors are required to have this verification completed at least once during the SHRP-LTPP Program for each individual nuclear testing device. This verification procedure is also required when the nuclear gauge is suspected of producing erroneous results at the discretion of the SHRP Authorized Representative and the SHRP Regional Engineer in consultation with the crew chief.

4.2.10. Review and Checking of Data

The crew chief is responsible for review and checking of all logging, sampling, and test data. The SHRP Authorized Representative will verify the information on all data sheets for each site.

4.2.11. Presentation of Data and Reports

The crew chief will also record the data, project site report, and material samples inventory on SHRP standard forms. The Drilling and Sampling Contractor shall provide a sufficient supply of printed forms to the crew chief. The SHRP Authorized Representative will verify these reports.

The crew chief and SHRP Authorized Representative's signatures on the completed forms in the field data packet verifies that proper QA and QC procedures were followed in the field drilling and sampling work for each test section.

April 1990

SECTION 5

VERIFICATION AND PAYMENT

SECTION 5: VERIFICATION AND PAYMENT

5.1 GENERAL

Work will be paid for on the basis of records provided by the Contractor and approved by the SHRP Authorized Representative and the SHRP Regional Engineer. The Contractor shall summarize units of work such as number of sections completed, cores, hours worked, travel mileage and others as appropriate and as specified in the Contract Fee Schedules. SHRP data forms for these records are included in Appendix C. It will be the Contractor's responsibility to obtain approval for each completed site from the SHRP Authorized Representative.

5.2 COMPLETION OF WORK

The drilling and sampling contractor will be responsible for accomplishing all the work as herein specified. The SHRP Authorized Representative will observe the work and conditions encountered and will have the authority to order changes in the scope of work and corrections of deficiencies in the quality of results obtained.

When no SHRP Authorized Representative is on the site and the Contractor requires or desires instructions, it shall be the Contractor's responsibility to immediately contact the SHRP Regional Engineer or RCO staff person by telephone and request instructions.

A series of fee schedules have been set up to record the completed work and prepare invoices. The schedules include:

a. Basic Inventory Phase Work for GPS Experiments (Schedule A) as defined in Appendix B.

b. Extra or Deleted Work for GPS Experiments During Basic GPS Inventory Phase Work (Schedule B).

c. Extra Work After Basic GPS Inventory Phase Work (Schedule C).

d. Basic Work for SPS Experiments and other SHRP Work During Basic GPS Work.

e. Extra or Deleted Work for SPS Experiments and other SHRP Work During Basic GPS Work.

f. Basic or Extra Work for SPS Experiments and other SHRP Work After Basic GPS Work.

g. Other arrangements on schedules for payment as agreed on by the SHRP Regional Engineer and the drilling and sampling contractor.

The following notes pertain to the above schedules:

- "During Basic GPS Work" means during the same day or following day(s) as Basic GPS Work is being done at any individual site.

- "After Basic GPS Work" means that additional travel to the site will be required. A different complement of personnel and equipment than required for Basic GPS work may be necessary.

After completion of work on a given site, a project site report shall be prepared and signed by the Contractor's crew chief on a SHRP standard form (Form S07, Appendix C). In addition, a material samples inventory will be prepared for each section. The SHRP Authorized Representative shall verify and sign these reports, in order that the drilling and sampling contractor can use these reports to prepare an invoice and support documents (summary of approved work and summary of approved travel) for SHRP.

5.3 REPORTS

A number of written documents are required from the field materials sampling and field testing contractor. These include: exploration logs (Forms S01, S01A, S02A, S02B, S03, S03A and S05), test records (Form S04), material samples inventory (Forms S06 and S06A), project site report (Form S07), summary of work

(Form S08), summary of approved travel (Form S09), four week schedule (Form S10), and weekly progress report (Form S11). SHRP standard forms for these records are included in Appendix C. The crew chief should have an adequate supply of these forms on-site at all times.

5.3.1 Four Week Schedule and Weekly Progress Reports

The contractor must submit a progress report to the SHRP Regional Engineer through the SHRP Authorized Representative on a weekly basis to show the actual progress, the scope of work performed and other information on Form S11 provided in Appendix C.

In addition, a periodic summary report of approved work, to be submitted with the monthly invoice, is also required. This summary report should include the number of sections completed (for which the invoice is prepared) during a given period and details of any extra or deleted work. A data sheet (Form S08) for this summary report is included in Appendix C. A summary of approved travel (Form S09) for the period covered in the invoice is also required to accompany the invoice. Both summary reports must be checked and approved by the SHRP Authorized Representative.

5.3.2 Weather and Other Work Limitations

Guidelines provided in Section 2.3 should be followed in preparing schedules for effective and efficient use of the drilling, sampling, and field testing crews. Work should not be carried out in adverse weather conditions such as heavy rainfall, snow storm, and freezing conditions. If possible, the Authorized SHRP Representative, SHRP Regional Engineer, and concerned SHA personnel should be notified of any cancellation at least 24 hours in advance.

Any cancellation in schedule due to unexpected adverse weather conditions, equipment breakdown, or other reasons should be reported by phone to the SHRP Authorized Representative and SHA personnel by 7:00 a.m. on the day of cancellation. This will require that the crew chief, the SHRP Authorized Representative, and the concerned SHA personnel have access to each other's home

phone numbers, or other means of contact so that communication after regular working hours is possible.

5.3.3 Standby and Overtime Authorization

It is the intent that the GPS inventory sampling and testing at each site be completed within a single eight hour working day. Time periods for SPS and other work will be specified in Supplemental Agreements. Overtime for individual work sites may be authorized by the SHRP Authorized Representative due to inclement weather, delays caused by other parties, added work, or other reasons. In lieu of overtime, the SHRP Authorized Representative may require that work be continued on the following day if it is more cost effective for SHRP or if revised scheduling can be approved for the next day.

Traffic control and patching by the SHA or the contractor may need to extend beyond an eight hour day. Also, work may be required on weekends, holidays or at night at certain sites because of traffic control and patching requirements.

SHRP desires to achieve a reasonable balance between meeting day-to-day and overall schedules and payments for travel, delays to the contractor, and approved and authorized work beyond eight hour days. Provisions have been made to authorize standby and overtime payments when necessary. The drilling and sampling contractor is expected to arrange schedules, travel, and perform work in order to reasonably minimize the total costs to SHRP.

5.3.4 Quarterly Reports

The contractor must prepare and submit a Quarterly Report within ten (10) working days following the end of each quarter. The report shall coincide with calendar quarters regardless of contract dates and shall indicate financial and operational progress. Fifteen (15) copies of the report shall be sent to the appropriate SHRP Regional Engineer for review and forwarding to SHRP's Washington D.C. office. The format for the Quarterly Report is described in further detail in Appendix F.

5.4 INVOICES AND PAYMENT

5.4.1 Invoices

The contractor shall submit invoices based on detailed fee schedules. A sample of the NAS invoice voucher is shown in Figure 15. A summary report of approved work (Figure 16) and a summary report of approved travel (Figure 17), must accompany the NAS invoice voucher for back-up information. Payments will be made by SHRP upon approval by the SHRP Regional Engineer and after processing by SHRP Headquarters. Any disputes or claims will be processed in accordance with SHRP procedures.

5.4.2 Scope of Payment

The following information has been partially extracted from the Drilling and Sampling Contract Technical Provisions (May 6, 1988) and shall be adhered to for the Drilling and Sampling Operations.

The contractor shall accept the compensation as herein provided as full payment for furnishing all materials, labor, tools, and equipment necessary to complete the work, and for performing all work contemplated and embraced by the contract and as defined on the Fee Schedules. Any time extension for work on an individual site and approval for standby and overtime must be approved by the SHRP Authorized Representative using the guidelines provided in Section 5.3.3. This compensation shall also include all loss or damage arising from the nature of the work, action of the elements, unforeseen difficulties which may be encountered during the prosecution of the work, and for all expenses incurred in consequence of the suspension or discontinuance of the work under the contract except as provided herein.

(a) Compensation for Altered Quantities on Lump Sum Items.

When the actual quantities of sampling and testing ordered and performed vary from the quantities of work specified for the Work Lump Sum Items in Schedule A of the Technical Provisions or any other applicable Lump Sum Schedule, the Contractor shall accept as payment in full, so far as contract items are

AQAP-06-0577
OCTOBER 1987

NATIONAL ACADEMY OF SCIENCES
ACCOUNTING OFFICE
2101 Constitution Avenue, Washington, D.C. 20418

April 1990

ORIGINAL
SEE INSTRUCTIONS ON REVERSE OF VENDOR/CLAIMANT COPY

INVOICE VOUCHER

PLEASE PRINT OR TYPE

MAKE CHECK PAYABLE TO: _____
(Limit 27 Characters)

DATE THIS VOUCHER SUBMITTED _____

☐ MAIL CHECK TO: _____
(Address)

NAS PURCHASE ORDER NO. _____

-OR-

☐ DELIVER CHECK TO: _____
(Name)

BLDG. _____ ROOM NO. _____

VENDOR'S NO. OR REFERENCE _____

DESCRIPTION	QUANTITY	UNIT PRICE	AMOUNT

TERMS OR DISCOUNT _____

CERTIFICATE OF VENDOR/CLAIMANT: I CERTIFY THAT THE ABOVE CLAIM IS CORRECT AND PROPER AND THAT PAYMENT THEREFOR HAS NOT BEEN RECEIVED.

_____ BY _____ _____
VENDOR/CLAIMANT SIGNATURE DATE

VENDOR/CLAIMANT NOT TO WRITE BELOW THIS LINE

APPROVAL: I CERTIFY THAT THE ABOVE EXPENDITURE WAS DULY AUTHORIZED AND I APPROVE CLAIM FOR PAYMENT.

NAME OF OFFICE SUBMITTING VOUCHER _____ PHONE EXTENSION _____

_____ _____
SIGNATURE SIGNATURE

COST CENTER NUMBER	ACCOUNT NUMBER	AMOUNT	PAYEE AND OPTIONAL DESCRIPTION (Limit 27 Characters)	FOR ACCOUNTING OFFICE USE ONLY: IRS	INCURRED DATE	COMMITMENT NUMBER	P/F
-	-	.					
-	-	.					
-	-	.					
-	-	.					
-	-	.					

FOR ACCOUNTING OFFICE USE ONLY

AUDITED _____ DATE _____

APPROVED _____ DATE _____

SPECIAL APPROVAL _____ DATE _____ REFERENCE NO. _____ DATE _____

Figure 16. Sample NAS Invoice Voucher

SHRP-LTPP

SHRP REGION_____ FIELD MATERIAL SAMPLING DRILLING & SAMPLING

SHRP RCOC_____ AND FIELD TESTING CONTRACTOR_____

SUMMARY OF APPROVED WORK

PERIOD COVERED FROM : (a) From ____-____-____ (b) To ____-____-____ SHEET NO._____OF____

SHRP ASSIGNED ID	STATE	LTPP EXPT	PROGRAM OF WORK**	REGULAR TIME (HRS)	STANDBY TIME EXTRA (HRS)	OVER TIME (HRS)	NIGHT AND WKND (HRS)	HOLIDAY WORK (HRS)	SAMPLE SHIPPING WEIGHT (LBS)

** Enter "Basic GPS" (Schedule A) or "Extra GPS" (Schedule B) or "Deleted GPS" (Schedule B) or "After Basic GPS" (Schedule C) or "Other".

GENERAL REMARKS:_____

A COPY OF FORMS S08 AND S09 MUST ACCOMPANY NAS INVOICE VOUCHER

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-_____-19___

Contractor Representative SHRP Representative DATE

Affiliation:_____ Affiliation:_____

Form S08/April 1990

Figure 17. SHRP Standard Form For Summary of Approved Work

SHRP REGION _____
SHRP RCOC _____

SHRP-LTPP
FIELD MATERIAL SAMPLING AND FIELD TESTING

DRILLING & SAMPLING CONTRACTOR _____

SUMMARY OF APPROVED TRAVEL

PERIOD COVERED FROM: (a) From ____-____-____ (b) To ____-____-____ SHEET NO.____OF___

DATE MM-DD-YY	TRAVEL DESCRIPTION AND PURPOSE	MILES

TOTAL APPROVED MILEAGE: _____

GENERAL REMARKS: _____

_____

A COPY OF FORMS SO8 AND SO9 MUST ACCOMPANY NAS INVOICE VOUCHER

CERTIFIED

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation:_____

MONTH-DAY-YEAR

____-____-19___
DATE

Form SO9/April 1990
Figure 18. SHRP Standard Form for Summary of Approved Travel

concerned, payment at the Schedule B of the Technical Provisions or other applicable contract units prices for the actual quantities of work done. No allowance or other adjustment will be made for any increased expense, loss of expected reimbursement, or loss of anticipated profits suffered or claimed by the Contractor resulting either directly from such alterations or indirectly from unbalanced allocation among the contract items for expenses on the part of the Contractor. Also, no allowance or other adjustment will be made for any subsequent loss of expected reimbursements from the above or any other cause except for the actual quantity completed at the original contract unit prices.

The SHRP Authorized Representative will have the authority to order minor changes in the work under Lump Sum items during the Basic Work, such as additional cores, based on the conditions encountered in the field.

Major alteration of the quantities or character of Basic Work will be subject to Supplemental Agreements and will be paid for as stipulated in the following two paragraphs.

(b) Compensation for Special Work Items.

The performance and compensation for certain special work must be approved to and scheduled prior to conduct of the work. Those items include night and weekend work, test pit excavation, traffic control, and patching. The SHRP Regional Engineer or the SHRP Authorized Representative will have authority to order this work by Supplemental Agreement.

(c) Supplemental Agreements.

A supplemental agreement covering methods and fee schedules at unit prices or lump sums will be agreed upon in writing by the Contractor and SHRP before the following types of work shall be undertaken:

- Extra or deleted sampling and testing work beyond that provided for in the Basic Work Fee Schedule.

- SPS work and other special work items.

- Major changes in Basic GPS work.

- Major changes in basic SPS work and other SHRP work.

This work will be paid for or deducted according to the terms of the Supplemental Agreement. Any time extension for extra work will be approved by the SHRP Authorized Representative.

APPENDIX A

NAMES AND ADDRESSES OF APPROPRIATE ORGANIZATIONS AND PERSONNEL

APPENDIX A: NAMES AND ADDRESSES OF APPROPRIATE ORGANIZATIONS AND PERSONNEL

This Appendix includes contact information for various organizations and personnel for: (1) SHRP-LTPP field material sampling and field testing, (2) SHRP-LTPP laboratory material testing activities and (3) LTPP contact engineers for various states and Canadian provinces.

Table A.1 provides names and addresses of SHRP-LTPP personnel and SHRP-LTPP contractor personnel. Tables A.2(a) to (d) provide names and addresses of LTPP Contact Engineers for state and province highway agencies by region. The Regional Drilling and Sampling Contractors will find it useful for managing their site operations.

Contact personnel listed in this Appendix are subject to change. When changes occur, the personnel list will be updated by SHRP accordingly. Additionally, if any users of this Guide notice changes or errors in contact personnel, they should contact the appropriate SHRP personnel so that this Appendix may be kept up-to-date.

Table A.1. SHRP-LTPP sampling and testing organizations and personnel.

LTPP Management

Neil Hawks LTPP Program Manager	Strategic Highway Research Program 818 Connecticut Avenue, NW 4th Floor
Adrian Pelzner Senior Staff Engineer All field sampling and field testing and laboratory material testing contracts	Washington, DC 20006 202/334-3774 FAX: 202/223-2875
Guy Dore SHRP-LTPP Staff Contact	
Amir Hanna Project Manager Lab PCC Testing Contractor (P-008)	
Ivan Pecnik North Atlantic Project Manager Field Sampling and Field Testing Contract (P-022) and Laboratory Material Testing Contract (P-012)	Pavement Management Systems Inc. 415 Lawrence Bell Drive Unit #3 Amherst, NY 14221 716/631-5205 FAX: 716/632-4808
Richard Ingberg North Central Project Manager Field Sampling and Field Testing Contract (P-024) and Laboratory Material Testing Contract (P-014)	Braun Pavement Technologies Inc. 1404 Concordia Avenue St. Paul, MN 55104 612/644-1919 FAX: 612/644-1045
Homer Wheeler Southern Project Manager Field Sampling and Field Testing Contract (P-023) and Laboratory Material Testing Contract (P-013)	Brent Rauhut Engineering, Inc. 8240 MoPac Expressway Suite 220 Austin, TX 78759 512/346-7477 FAX: 512/346-8750
Calvin Berge Western Project Manager Field Sampling and Field Testing Contract (P-025) and Laboratory Material Testing Contract (P-015)	Nichols Consulting Engineers, Chartered 828 Jones Street Reno, NV 89503 702/329-5018 FAX: 702/329-5098

Table A.1. SHRP-LTPP sampling and testing organizations and personnel. (continued)

LTPP Technical Assistance Contractor (P-001)

John German President	Texas Research & Development Foundation Central Office 2602 Dellana Lane
William Hadley Director of Research	Austin, TX 78746 512/327-4211 800/234-8733 FAX: 512/328-7246
Gary E. Elkins Vice President	Texas Research & Development Foundation East Coast Office 6811 Kenilworth Avenue
Jonathan Groeger Research Engineer	Suite 230 Riverdale, MD 20737 301/779-2505 800/456-8733 FAX: 301/779-2507

Laboratory PCC Testing Contractor (P-008)

Wilbur C. Greer Jr. Vice President	Law Engineering 396 Plasters Avenue, NE Atlanta, GA 30324
John E. Lynch Lab. Service Manager (Laboratory Chief)	404/873-4761

Table A.1. SHRP-LTPP sampling and testing organizations and personnel. (continued)

North Atlantic Region

Regional Coordination Office Contractor (P-004)

William Phang Program Manager	Pavement Management Systems, Inc. 415 Lawrence Bell Drive Suite #3
Andrew Brigg SHRP Authorized Representative	Amherst, NY 14221 716/632-0804 FAX: 716/632-4808
Brandt Henderson Field Operations Coordinator	

Drilling and Sampling Contractor (P-022)

Larry Matthews Senior Vice President	Westinghouse Environmental & Geotechnical Services 3109 Springforest Road Raleigh, NC 27658 919/872-2660
Michael Noggle Branch Manager	Westinghouse Environmental & Geotechnical Services 1518 E. Parham Road P.O. Box 28007 Richmond, VA 23228 804/264-5068 FAX: 804/266-7274

Laboratory Materials Testing Contractor (P-012)

William H. Levelius Vice President	Professional Service Industries, Inc. Pittsburgh Testing Lab Division 850 Poplar Street Pittsburgh, PA 15220 412/922-4000 FAX: 412/922-4014

Table A.1. SHRP-LTPP sampling and testing organizations and personnel. (continued)

Southern Region

Regional Coordination Office Contractor (P-005)

Brent Rauhut Program Manager	Brent Rauhut Engineering, Inc. 8240 MoPac Expressway Suite 220
Harold VonQuintus Associate Program Manager	Austin, TX 78759 512/346-0870 FAX: 512/346-8750
Steve Davis SHRP Authorized Representative	
Lawrence Peirce FWD Operator	

Drilling and Sampling Contractor (P-023)

Charles Greer Jr. Program Manager	Law Engineering 396 Plasters Avenue, NE Atlanta, GA 30324 404/873-4761
David F. Martinez Project Manager	Southwestern Laboratories 222 Cavalcade Street P.O. Box 8768 Houston, TX 77249 713/692-9151

Laboratory Materials Testing Contractor (P-013)

Charles Greer Jr. Project Manager	Law Engineering 396 Plasters Avenue, NE Atlanta, GA 30324 404/873-4761
John Lynch Soils Laboratory Manager	
David F. Martinez Program Manager	Southwestern Laboratories 222 Cavalcade Street P.O. Box 8768 Houston, TX 77249 713/692-9151

Table A.1. SHRP-LTPP sampling and testing organizations and personnel. (continued)

North Central Region

Regional Coordination Office Contractor (P-006)

Eugene Skok Program Manager	Braun Pavement Technologies, Inc. 1404 Concordia Avenue St. Paul, MN 55104
Ronald Urbach SHRP Authorized Representative	612/644-2996 FAX: 612/644-1045
Robert Van Sambeck FWD Operator	
Cary Keller SHRP Authorized Representative	Soil and Material Engineers 3915 Research Park Drive Suite A13 Ann Arbor, MI 48108 313/994-5055 FAX: 313/994-5765

Drilling and Sampling Contractor (P-024)

Cameron Kruse Senior Vice President	Braun Engineering Testing, Inc. P.O. Box 35108 Minneapolis, MN 55435 612/941-5600 FAX: 612/941-4151

Laboratory Materials Testing Contractor (P-014)

David A. Clauson Bituminous Lab Supervisor	Braun Engineering Testing, Inc. P.O. Box 35108 Minneapolis, MN 55435
Bill Weyrauch Laboratory Chief	612/941-5600 FAX: 612/941-4151

Table A.1. SHRP-LTPP sampling and testing organizations and personnel. (continued)

Western Region

Regional Coordination Office Contractor (P-007)

James Nichols Program Manager	Nichols Consulting Engineers, Chartered 828 Jones Street Reno, NV 89503
John Docherty FWD Operator	702/329-4955 FAX: 702/329-5098
Wayne Eddins SHRP Authorized Representative	
Jon Epps Consultant	

Drilling and Sampling Contractor (P-025)

William Braun Project Manager	Chen-Northern 97 South Zuni Street Denver, CO 80223 303/744-7105 FAX: 303/744-0210

Laboratory Materials Testing Contractor (P-015)

Phillip D. Feliz Laboratory Chief	Western Technologies Inc. 3737 East Broadway Road P.O. Box 21387 Phoenix, AR 85036 602/437-3737
Michael S. Mamlouk Associate Professor of Civil Engineering	College of Engineering and Applied Sciences Arizona State University Center for Advanced Research in Transportation Tempe, AR 85287-6306 602/965-2001

Table A.2(a). Addresses of state LTPP contact engineers for the North Atlantic Region.

Connecticut
Mr. Chuck Larson
Connecticut Department of Transportation
280 West Street
Rocky Hill, Connecticut 06067
203/258-0315
FAX: 203/257-7787

Delaware
Mr. David Matsen
Pavement Management Engineer
Delaware Department of Transportation
P.O. Box 778
Dover, DE 19903
302/736-5618

District of Columbia
Mr. Charles F. Williams
Acting Construction Engineer
Bureau of Transp. & Construction
DC Department of Public Works
4701 Shepard Parkway, S.W.
Washington, DC 20032
202/767-8537

Maine
Mr. Warren Foster
Assistant Research & Development Engineer
Technical Services Division
Maine Department of Transportation
State House Station 16
Augusta, ME 04333
207/289-5662
FAX: 207/289-2896

Maryland
Mr. Albin J. Blazucki
Special Projects Engineer
Maryland State Highway Administration
2323 West Joppa Road, Room 152
Brooklandville, MD 21022
301/321-3559
FAX: 301/321-3559

Massachusetts
Mr. Matthew Turo
LTPP Contact Engineer
Massachusetts Dept. of Public Works
10 Park Plaza, Room 4150
Boston, Massachusetts 02116
617/973-8171
FAX: 617/973-8035

New Hampshire
Mr. Philip E. McIntyre, Administrator
Bureau of Materials & Research
Dept. of Transportation
P.O. Box 483/Stickney Drive
Concord, NH 03302-0483
603/271-3151
FAX: 603/271-3914

New Jersey
Ms. Jean Servideo
Project Engineer
New Jersey Department
of Transportation
1035 Parkway Avenue, CN 600
Trenton, NJ 08625
609/530-5500
FAX: 609/530-3893

New York
Mr. Ashley Tyrell
Engineering Research & Development
Bureau
N.Y. Department of Transportation
1220 Washington Avenue, State Campus
Building 7A, Room 700
Albany, NY 12232
518/457-5826
FAX: 518/457-4021

North Carolina
Mr. J. Blackwelder
North Carolina Department of
Transportation
P.O. Box 25201
Raleigh, NC 27611
919/733-2330
FAX: 919/733-1192

Table A.2(a). Addresses of state LTPP contact engineers for the North Atlantic Region. (continued)

Pennsylvania
Mr. Dennis Morian
Pennsylvania Department of
Transportation
Room 1009, Transportation &
Safety Building
Harrisburg, PA 17120
717/787-4246
FAX: 717/783-8217

Rhode Island
Mr. Jose Lima
Civil Engineer
Rhode Island Department of Transportation
018 State Office Building
Providence, RI 02903
401/277-2524

Vermont
Mr. Richard Haupt
State of Vermont Agency of Transportation
133 State Street
Montpelier, Vermont 05602
802/828-2561
FAX: 802/828-2792

Virginia
Mr. Ken McGhee
V.A. Transportation Research Council
P.O. Box 3817 University Station
Charlottesville, Virginia 22903
804/293-1956
FAX: 804/293-1990

West Virginia
Mr. Joe Martin
Department of Highways
1900 Washington Street, East
Charleston, WV 25305
304/348-3165
FAX: 304/348-4076

Table A.2(a). Addresses of state LTPP contact engineers for the North Atlantic Region. (continued)

Canadian Provinces

New Brunswick
Mr. Mike Jackard
Research Engineer
New Brunswick Department of Transportation
P.O. Box 6000
Fredericton, New Brunswick E3B 5H1
506/453-7955
FAX: 506/453-2900

Newfoundland
Mr. Terrence McCarthy
Director of Highway Design
Newfoundland Department of Transportation
Sixth Floor, West Wing
Confederation Building Complex
Prince Phillip Parkway
St. John's, NF A1C 5T7
709/576-3796
FAX: 709/576-6934

Nova Scotia
Mr. L. Rankin
Assistant Chief Engineer Operations
Nova Scotia Department of Transportation
P.O. Box 186
Halifax, Nova Scotia B3J 2N2
902/424-6308
FAX: 902/425-6308

Ontario
Dr. Jerry Hajek
Ministry of Transportation
3rd Floor, Central Building
1201 Wilson Avenue
Downsview, Ontario M3M 1J8
416/235-4681
FAX: 416/235-4872

Prince Edward Island
Mr. Michael J. Bailey
Director of Planning and Evaluation
P.E.I. Transportation and Public Works
P.O. Box 2000
Charlottetown P.E.I. CIA 7M8
902/892-0921
FAX: 902/892-3420

Quebec
Mr. Jeanne-Pierre Leroux
Mininistere des Transports
200, Dorchester Sud
4e Etage
Quebec (Quebec) G1K 5Z1
418/643-1665
FAX: 418/646-5415

Table A.2(b). Addresses of state LTPP contact engineers for the Western Region.

Alaska
Mr. David C. Esch
Research Engineer
Alaska Department of Transportation
and Public Affairs
2301 Peger Road
Fairbanks, AK 99701
907/474-2471

Arizona
Mr. Frank R. McCullagh
Director
Transportation Research Center
Arizona State University
ERC 405
Tempe, AZ 85287
602/965-2368

California
Mr. Jim Woodstrom
Supervising Materials & Research Engineer
5900 Folsom Boulevard
P.O. Box 19128
Sacramento, CA 95819
916/739-2479
FAX: 916/739-2822

Colorado
Mr. Ahmad Ardani
Supervising Highway Engineer
Colorado Department of Highways
4201 E. Arkansas Avenue
Denver, CO 80222
303/757-9974

Hawaii
Mr. Dennis D. Santo
Soil Engineering & Pavement
Design Center
Hawaii Department of Transportation
2530 Likelike Highway
Honolulu, HI 96819
808/841-2876

Idaho
Mr. Bruce MacEwan, P.E.
Pavement Management Engineer
Idaho Transportation Department
P.O. Box 7129
Boise, ID 83707-1129
208/334-8211

Montana
Mr. James R. Stevenson
Pvmt. Analysis Unit
Montana Department of Highways
2701 Prospect Avenue
Helena, MT 59620
406/444-6291

Nevada
Mr. Chuck Bosch
Operations Analysis Engineer
Nevada Department of Transportation
1263 South Stewart Street
Carson City, NV 89712
702/885-3550

Oregon
Mr. Keith L. Martin, P.E.
Research Unit Engineer
Oregon Department of Transportation
800 Airport Road, S.E.
Salem, OR 97310
503/378-2318
FAX: 503/373-1312

Utah
Mr. David Blake, P.E.
Pavement Management Engineer
Utah Department of Transportation
4501 South 2700 West
Salt Lake City, UT 84119
801/965-4341

Table A.2(b). Addresses of state LTPP contact engineers for the Western Region. (continued)

Washington
Mr. Newt C. Jackson
Pavement and Soils Engineer
Washington Department of Transportation
Materials Laboratory
1655 South Second Avenue
Olympia, WA 98504
206/753-7110

Wyoming
Mr. G. Spencer Garrett
Transportation Planning Engineer
Wyoming Highway Department
Planning Branch
P.O. Box 1708/5300 Bishop Boulevard
Cheyenne, WY 82002-9019
307/777-7553

Canadian Provinces

Alberta
Mr. Ray Filipiak
Research Engineer
Alberta Transportation & Utilities
Twin Atria Building
4999-98th Avenue
Edmonton, Alberta T6B 2X3
403/422-2750
FAX: 403/468-2473

British Columbia
Mr. David Haughton
Research and Pavement Design Engineer
B.C. Ministry of Transportation and Highways
Geotechnical and Materials Engineering Branch
4A-940 Blanschard
Victoria, British Columbia V8W 3E6
604/387-5859
FAX: 604/387-1881

Table A.2(c). Addresses of state LTPP contact engineers for the North Central Region.

Illinois
Mr. Eric Harm
Engineer of Physical Research
Illinois Department of Transportation
126 E. Ash Street
Springfield, IL 62704-4766
217/782-6732

Indiana
Mr. Keith J. Kercher
Manager - Pavement Research Section
Division of Research
Indiana Department of Highways
1205 Montgomery Street
P.O. Box 2279
West Lafayette, IN 47906
317/463-1521

Iowa
Mr. Jerry Bergren
Assistant Materials Engineer
Iowa Department of Transportation
800 Lincoln Way
Ames, IA 50010
515/239-1130

Kansas
Mr. W.H. Parcells
Pavement Surface Research Engineer
Kansas Department of Transportation
2300 Van Buren
Topeka, KS 66611-1195
913/296-7410

Kentucky
Mr. Rolands L. Rizenbergs
Pavement Management Engineer
State Office Building
Room 71 Clinton & High Streets
Frankfort, KY 40622
502/564-2080
FAX: 502/564-6640

Michigan
Mr. Robert A. Welke
Deputy Director - Operations
Michigan Department of Transportation
P.O. Box 30050
Lansing, MI 48909
517/373-4656

Mr. C. David Church
Assistant to Engineer of Materials
and Technology
MI Department of Transportation
P.O. Box 30049
Lansing, MI 48909
517/322-5688
FAX: 517/322-5664

Minnesota
Mr. Fred Maurer
Assistant Pavement Management Engineer
Minnesota Department of Transportation
1400 Gervais Avenue
Maplewood, MN 55109
612/297-3346

Missouri
Mr. Eugene W. Myers
Materials Research Director
Missouri Highway & Transportation Dept.
P.O. Box 270
Jefferson City, MO 65102
314/751-1040

Nebraska
Mr. George Woolstrum
Special Projects Engineer
Nebraska Department of Roads
Materials and Test Division
1500 Highway 2
P.O. Box 94759
Lincoln, NE 68509-4759
402/479-4791
FAX: 402/479-4325

Table A.2(c). Addresses of state LTPP contact engineers for the North Central Region (continued)

North Dakota
Mr. Ron Horner
Research Engineer
NDSHD
600 E. Boulevarde Ave.
Bismarck, ND 58505
701/224-4382

Ohio
Mr. Roger L. Green
Pavement Design Engineer
Ohio Department of Transportation
Pavement and Soils Section
25 S. Front Street
Room 620
Columbus, OH 43215
614/466-3418

South Dakota
Mr.David Huft
Research Engineer
South Dakota Department of Transportation
700 Broadway Avenue, East
Pierre, SD 57501-2586
605/773-3292

Wisconsin
Mr. Karl H. Dunn
Chief Pavement Engineer
Division of Highway and
Transportation Services
Materials Center
Wisconsin Dept. of Transportation
3502 Kinsman Blvd.
Madison, WI 53704-2583
608/246-7909
FAX: 608/246-4669

Canadian Provinces

Manitoba
Mr. Ray Van Cauwenberghe
Manitoba Highways and Transportation
1181 Portage Avenue (Annex)
Winnipeg, Manitoba R3G OT3
204/945-0560
FAX: 204/945-6499

Saskatchewan
Mr. George Stamatinos
Acting Director, Technical Research Branch
Saskatchewan Highways and Transportation
1855 Victoria Avenue
Regina, Saskatchewan S4P 3V4
306/787-1696
FAX: 306/525-2560

Table A.2(d). Addresses of state LTPP contact engineers for the Southern Region.

Alabama
Mr. Stanley R. Armstrong
Assistant Materials and Test Engineer
Alabama Highway Department
1409 Coliseum Boulevard
Montgomery, AL 36130
205/242-6527
FAX: 205/264-2042

Arkansas
Mr. William Staggs
Programming & Scheduling
Arkansas Highway and Transportation Department
P.O. Box 2261
Little Rock, AR 72203
501/569-2265
FAX: 501/568-1565

Florida
W.G. Miley
State Pavement Evaluation Engineer
Bureau of Materials & Research
Florida Department of Transportation
2006 N.E. Waldo Road
P.O. Box 1029
Gainesville, FL 32602-1029
904/372-5304
FAX: 904/375-8073

Mr. William N. Lofroos
State Pavement Design Engineer
Florida Department of Transportation
605 Suwannee Street, MS-32
Tallahassee, FL 32399-0450
904/487-1700
FAX: 904/487-3403

Georgia
Mr. Dennis Richardson
Associate Research Engineer
Georgia Department of Transportation
15 Kennedy Drive
Forest Park, GA 30050
404/363-7669
FAX: 404/363-7684

Mississippi
Mr. Alfred B. Crawley
Assistant Research & Development Engineer
Mississippi State Highway Department
P.O. Box 1850
Jackson, MS 39215-1850
601/359-1174
FAX: 601/359-2233

New Mexico
Mr. David Belling
Research Engineer
Materials Lab Bureau
P.O. Box 1149
Santa Fe, NM 87504
505/827-3278
FAX: 505/827-5445

Oklahoma
Mr. C. Dwight Hixon, P.E.
Research and Development Engineer
Oklahoma Department of Transportation
200 N.E. 21st Street, Room 2A2
Oklahoma City, OK 73105
405/521-2671
FAX: 405/521-2524

South Carolina
Mr. Sondley P. Lever
Assistant Maintenance Engineer
South Carolina Department of Highways and Public Transportation
P.O. Box 191
Columbia, SC 29202
803/737-1269

Table A.2(d). Addresses of state LTPP contact engineers for the Southern Region. (continued)

Louisiana
Mr. Steve Cumba
Louisiana Transportation
Research Center
4101 Gourrier Avenue
Baton Rouge, LA 70808
504/767-9106
FAX: 504/767-9108

Texas
Mr. James L. Brown
Engineer of Pavement Design
Texas Department of Highways
and Public Transportation
11th and Brazos Streets
Austin, TX 78701-2483
512/465-6108
FAX: 512/465-6187

Puerto Rico
Eng. Maria Del Carmen Ramirez
Research Engineer
Puerto Rico Highway Authority
P.O. Box 41269
San Juan, Puerto Rico 00940
809/728-1160
FAX PRHA: 809/728-8963

Tennessee
Mr. Kenneth W. Arnold
Transportation Planning Consultant
Tennessee Department of Transportation
Suite 900, James K. Polk Building
Nashville, TN 37219
615/741-1816
FAX: 615/741-2508

April 1990

APPENDIX B

FIELD MATERIAL SAMPLING AND FIELD TESTING PROGRAM AND DETAILED SAMPLING PLANS BY GPS EXPERIMENT TYPE

APPENDIX B: FIELD MATERIAL SAMPLING AND TESTING PROGRAM AND DETAILED SAMPLING PLANS BY GPS EXPERIMENT TYPE

This appendix contains the following tables and figures: (1) summary of verified and approved GPS sections - Tables B.1 - B.5; (2) field materials sampling and testing program for GPS sections - Tables B.6 - B.15; (3) field material sampling layout plans for GPS pavements - Figures B.1 - B.18; (4) typical test pit sampling details for GPS pavements - Figures B.19 - B.22.

SUMMARY OF GPS SECTIONS

The pavement types for each GPS experiment in the SHRP-LTPP program are as follows:

GPS-1. Asphalt concrete over granular base.
GPS-2. Asphalt concrete over bound base.
GPS-3. Jointed plain concrete pavement.
GPS-4. Jointed reinforced concrete pavement.
GPS-5. Continuously reinforced concrete pavement.
GPS-6A. Existing asphalt concrete overlay over asphalt concrete pavement.
GPS-6B. New asphalt concrete overlay over asphalt concrete pavement.
GPS-7A. Existing asphalt concrete overlay over jointed concrete pavement.
GPS-7B. New asphalt concrete overlay over jointed concrete pavement.
GPS-9. Unbonded jointed concrete overlay over concrete pavement.

Only a limited number of GPS pavement projects were selected from a large pool of candidate pavement projects submitted by the states. The RCOC staff has been verifying these selected projects and marking GPS test sections in each SHRP region since May 1988. Tables B.1 through B.4 provide an up-to-date summary of verified and approved GPS sections by State/Province and GPS experiment for SHRP regions. Table B.5 provides an up-to-date summary of verified and approved GPS sections by Region and GPS expeariment for the United States and Canada. Table B.5 is essentially a summary of Tables B.1 to B.4. RCOC staff and the SHRP Regional Engineers will furnish the updated tables and section identification information to the drilling and sampling contractor in each region on an as needed basis.

Table B.1. Verified and approved GPS sections in the North Atlantic Region - April 1990.

STATE/PROVINCE	PAVEMENT TYPE CODE 1	2	3	4	5	6A	6B	7A	7B	9	GPS SECTION TOTALS
Connecticut	1	0	0	2	1	0	0	0	0	0	4
Delaware	0	1	0	2	2	0	0	0	0	0	5
Maine	5	0	2	0	0	0	0	1	0	0	8
Maryland	0	4	0	0	1	0	0	0	0	0	5
Massachusetts	3	0	0	0	0	0	0	0	0	0	3
New Hampshire	1	0	0	0	0	0	0	0	0	0	1
New Jersey	4	3	0	1	0	1	0	0	0	0	9
New York	1	2	0	2	0	0	1	0	0	0	6
North Carolina	11	4	5	0	3	0	0	0	0	0	23
Pennsylvania	3	0	2	2	2	0	2	2	5	2	20
Rhode Island	0	0	0	0	0	0	0	1	0	0	1
Vermont	2	0	0	0	0	0	2	0	1	0	5
Virginia	2	2	0	0	4	0	4	0	0	0	12
West Virginia	0	1	0	2	1	0	0	1	0	0	5
New Brunswick	2	0	1	0	0	1	0	0	0	0	4
Newfoundland	3	0	0	0	0	0	0	0	0	0	3
Nova Scotia	0	0	0	0	0	1	0	0	0	0	1
Ontario	3	3	0	0	0	0	0	0	0	0	6
Prince Edward Island	2	1	0	0	0	0	0	0	0	0	3
Quebec	3	1	4	0	0	0	0	0	0	1	9
Washingt· :, D.C.	0	0	0	0	0	0	1	0	0	0	1
TOTAL	46	22	14	11	14	3	10	5	6	3	134

Table B.2. Verified and approved GPS sections in the Southern Region - April 1990.

STATE/PROVINCE	PAVEMENT TYPE CODE 1	2	3	4	5	6A	6B	7A	7B	9	GPS SECTION TOTALS
Alabama	4	3	1	2	2	2	2	0	0	0	16
Arkansas	0	4	1	5	2	0	0	0	2	0	14
Florida	14	4	7	0	0	0	5	0	0	0	30
Georgia	4	7	8	0	1	0	1	1	0	1	23
Louisiana	0	1	0	1	0	0	0	0	0	0	2
Mississippi	3	6	2	1	4	0	5	2	1	1	25
New Mexico	4	3	1	0	0	4	0	0	0	0	12
Oklahoma	3	7	4	0	1	2	0	1	0	0	18
South Carolina	4	0	1	0	3	0	0	1	0	0	9
Tennessee	3	6	0	0	0	3	4	0	0	0	16
Texas	38	9	3	5	19	5	3	2	0	3	87
Puerto Rico	0	1	1	0	0	0	0	0	0	0	2
TOTAL	77	51	29	14	32	16	20	7	3	5	254

Table B.3. Verified and approved GPS sections in the North Central Region - April 1990.

STATE/PROVINCE	PAVEMENT TYPE CODE										GPS SECTION TOTALS
	1	2	3	4	5	6A	6B	7A	7B	9	
Illinois	2	0	0	2	6	2	0	3	4	0	19
Indiana	2	2	4	2	2	1	0	0	1	1	15
Iowa	1	0	5	0	2	1	0	0	2	0	11
Kansas	4	0	3	6	0	1	0	2	0	1	17
Kentucky	3	0	1	1	0	2	0	0	0	0	7
Michigan	5	0	2	1	1	1	0	1	0	2	13
Minnesota	8	0	2	8	1	1	0	1	0	2	23
Missouri	3	0	0	7	1	1	2	2	3	0	19
Nebraska	1	0	5	1	1	0	1	4	1	1	15
North Dakota	0	1	2	0	1	1	0	0	0	0	5
Ohio	0	0	1	2	1	1	0	1	2	3	11
South Dakota	1	0	7	0	3	0	2	1	0	0	14
Wisconsin	0	0	13	0	2	0	0	1	0	0	16
Manitoba	1	1	1	0	0	0	2	0	1	0	6
Saskatchewan	2	0	0	0	0	2	2	0	0	0	6
TOTAL	33	4	46	30	21	14	9	16	14	10	197

Table B.4. Verified and approved GPS sections in the Western Region - April 1990.

STATE/PROVINCE	PAVEMENT TYPE CODE 1	2	3	4	5	6A	6B	7A	7B	9	GPS SECTION TOTALS
Alaska	5	0	0	0	0	1	0	0	0	0	6
Arizona	16	2	2	0	1	4	0	0	0	0	25
California	4	15	11	0	1	1	2	0	0	3	37
Colorado	4	1	2	0	0	2	3	2	0	2	16
Hawaii	3	0	0	0	0	0	0	0	0	0	3
Idaho	9	0	2	0	1	1	0	0	0	0	13
Montana	2	1	0	0	0	2	2	0	0	0	7
Nevada	2	3	3	0	0	0	0	0	0	0	8
Oregon	0	1	0	0	6	2	0	3	0	0	12
Utah	3	0	3	0	0	4	0	0	0	0	10
Washington	6	0	7	0	0	4	1	0	0	0	18
Wyoming	2	8	1	0	0	3	0	0	0	0	14
Alberta	3	1	0	0	0	0	1	0	0	0	5
British Columbia	1	1	0	0	0	2	0	0	0	0	4
TOTAL	60	33	31	0	9	26	9	5	0	5	178

Table B.5. Verified and approved GPS sections in the United States and Canada by SHRP Region - April 1990

REGION	PAVEMENT TYPE CODE										GPS SECTION TOTALS
	1	2	3	4	5	6A	6B	7A	7B	9	
North Atlantic	46	22	14	11	14	3	10	5	6	3	134
Southern	77	51	29	14	32	16	20	7	3	5	254
North Central	33	4	46	30	21	14	9	16	14	10	197
Western	60	33	31	0	9	26	9	5	0	5	178
TOTAL	216	110	120	55	76	59	48	33	23	23	763

FIELD MATERIAL SAMPLING AND FIELD TESTING PROGRAM FOR GPS SECTIONS

Details of the field material sampling and field testing program for Basic GPS work are provided in Tables B.6 to B.15 as follows:

Table	Applicable to GPS Experiments
B.6	GPS 1
B.7	GPS 2
B.8	GPS 3
B.9	GPS 4
B.10	GPS 5
B.11	GPS 6-Case 1
B.12	GPS 6-Case 2
B.13	GPS 7-Case 1
B.14	GPS 7-Case 2
B.15	GPS 9

In these tables, core/sample/test locations are specified and the related Sampling Guide sections are also shown. "Bound" base and subbase layers can be treated or stabilized layers. These terms have been used interchangeably in the Sampling Guide. "Unbound" base and subbase layers represent the granular or untreated/unstabilized layers.

The coring and sampling operations for experiments GPS-6 and GPS-7 (asphalt concrete overlay over asphalt concrete and asphalt concrete overlay over jointed portland cement concrete, respectively) may occur at two different times; once before the overlay and once after the overlay. Consequently, the GPS-6 and GPS-7 pavement sections will be sampled and tested as either: (a) case 1 or (b) case 2.

(a) Case 1 - If the complete field material sampling and field testing program for a GPS-6 and GPS-7 test section is conducted after the AC overlay has been placed, this section shall be sampled and tested as a "Case 1". A case 1 section will have no field material sampling and testing conducted before the overlay. This is the

simplest and most economical case and it is the preferred plan for GPS-6 and GPS-7 pavements.

(b) Case 2 - If the field material sampling and field testing program for a GPS-6 and GPS-7 test section is conducted in two stages, once before the AC overlay and once after the AC overlay has been placed, then this section shall be sampled and tested as "Case 2". A case 2 section will have the majority of the field material sampling and field testing conducted before placement of the AC overlay and then a second round of field sampling conducted after placement of the AC overlay to retrieve core samples of the AC overlay for laboratory materials testing. This is not the preferred case because it requires that two rounds of field testing be conducted.

Nuclear density and moisture tests (one location per layer per section) are required on all unbound layers and subgrade. On asphalt concrete surfaces, no nuclear density tests are required. Also no density tests are required on surface PCC layers or any treated base/subbase layers.

Two jar samples per unbound layer and subgrade are required for moisture content from the test pit. Similarly one jar sample per unbound layer and subgrade are required for laboratory moisture content testing from each of the 12 inch diameter boreholes (BA1, BA2, BA3) at the time of bulk sampling.

Table B.6. Program scope for GPS Experiment No. 1 - AC Over Granular Base Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE - COMBINED SURFACE AND BINDER COURSES			
Coring - 4 inch diam. cores	3.3	14	C6-12, C18-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
Bulk Sampling - 12 inch by 12 inch slab	3.5	1	TP
2. UNBOUND BASE AND SUBBASE LAYER - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.4)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
4. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.7. Program Scope for GPS Experiment No. 2 - AC Over Bound Base Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE - COMBINED SURFACE AND BINDER COURSES			
Coring - 4 inch diam. cores	3.3	14	C6-C12, C18-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
Bulk Sampling - 12 inch by 12 inch slab	3.5	1	TP
2. UNBOUND BASE AND SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C7-C12, C19-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.8. Program Scope for GPS Experiment No. 3 - JPCP Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. PORTLAND CEMENT CONCRETE (PCC) SURFACE LAYER			
Coring - 4 inch diam. cores	3.3	8	C1-C4, C7-C10
Coring - 6 inch diam. cores	3.3	4	C5, C6, C11, C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
2. UNBOUND BASE AND SUBBASE LAYER - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C1-C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.9. Program Scope for GPS Experiment No. 4 - JRCP
Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. PORTLAND CEMENT CONCRETE (PCC) SURFACE LAYER			
Coring - 4 inch diam. cores	3.3	8	C1-C4, C7-C10
Coring - 6 inch diam. cores	3.3	4	C5, C6, C11, C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
2. UNBOUND BASE AND SUBBASE LAYER - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C1-C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.10. Program Scope for GPS Experiment No. 5 - CRCP
Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. PORTLAND CEMENT CONCRETE (PCC) SURFACE LAYER			
Coring - 4 inch diam. cores	3.3	8	C1-C6, C7-C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
2. UNBOUND BASE AND SUBBASE LAYER - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C1-C12
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.11. Program Scope for GPS Experiment No. 6 - AC Overlay Over AC - Case 1
Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE - COMBINED OVERLAY AND ORIGINAL LAYERS			
Coring - 4 inch diam. cores	3.3	14	C6-C12, C18-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
Bulk Sampling - 12 inch by 12 inch slab	3.5	1	TP
2. UNBOUND BASE AND SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C7-C12, C19-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole, See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.12A. Program Scope for GPS Experiment No. 6 - AC Overlay Over AC - Case 2 (Before Overlay) Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE - ORIGINAL LAYERS			
Coring - 4 inch diam. cores	3.3	14	C6-C12, C18-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
Bulk Sampling - 12 inch by 12 inch slab	3.5	1	TP
2. UNBOUND BASE AND SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam. cores	3.3	12	C7-C12, C19-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	3	BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole, See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.12B. Program Scope for GPS Experiment No. 6 - AC Overlay Over AC - Case 2 (After Overlay) Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE - COMBINED OVERLAY AND ORIGINAL LAYERS			
Coring - 4 inch diam. cores	3.3	14	C6-C12, C18-C24
Coring - 6 inch diam. cores	3.4	2	A1, A2
Coring - 12 inch diam. cores	3.4	2	BA1, BA4

Table B.13. Program Scope for GPS Experiment No. 7 - AC Overlay Over PCC - Case 1 Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE			
Coring of AC Overlay - 4 inch diam.	3.3	10	C6-C10, C18-C22
Coring of AC Overlay - 6 inch diam.	3.3	4	C11, C12, C23, C24
Coring of AC Overlay - 6 inch diam.	3.4	2	A1, A2
Coring of AC Overlay - 12 inch diam.	3.4	3	BA1, BA2, BA3
Bulk Sampling - 12 inch by 12 inch slab	3.5	1	TP
2. PCC LAYER			
Coring of PCC - 4 inch diam.	3.3	8	C7-C10, C19-C22
Coring of PCC - 6 inch diam.	3.3	4	C11, C12, C23, C24
Coring of PCC - 6 inch diam.	3.4	2	A1, A2
Coring of PCC - 12 inch diam.	3.4	3	BA1, BA2, BA3
3. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam.	3.3	12	C7-C12, C19-C24
Coring - 6 inch diam.	3.4	2	A1, A2
Coring - 12 inch diam.	3.4	3	BA1, BA2, BA3
. UNBOUND BASE AND SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
6. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.14A. Program Scope for GPS Experiment No. 7 - AC Overlay Over PCC - Case 2 (Before Overlay) Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. PCC LAYER			
Coring of PCC - 4 inch diam.	3.3	8	C7-C10, C19-C22
Coring of PCC - 6 inch diam.	3.3	4	C11, C12, C23, C24
Coring of PCC - 6 inch diam.	3.4	2	A1, A2
Coring of PCC - 12 inch diam.	3.4	3	BA1, BA2, BA3
2. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam.	3.3	12	C7-C12, C19-C24
Coring - 6 inch diam.	3.4	2	A1, A2
Coring - 12 inch diam.	3.4	3	BA1, BA2, BA3
3. UNBOUND BASE AND SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-wall Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

Table B.14B. Program Scope for GPS Experiment No. 7 - AC Overlay Over PCC - Case 2 (After Overlay) Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. ASPHALT CONCRETE			
Coring of AC Overlay - 4 inch diam.	3.3	14	C6-C12, C18-C24
Coring of AC Overlay - 6 inch diam.	3.4	2	A1, A2
Coring of AC Overlay - 12 inch diam.	3.4	2	BA1, BA4

Table B.15. Program Experiment No. 9 - PCC Overlay Over PCC
Field Sampling and Field Testing

	SAMPLING GUIDE SECTION NUMBER	NUMBER PER LAYER OR SITE	SAMPLE OR TEST LOCATION
1. PCC LAYERS			
Coring of PCC Overlay/PCC - 4 inch diam.	3.3	8	C1-C4,C7-C10
Coring of PCC Overlay/PCC - 6 inch diam.	3.3	4	C5,C6,C11,C12
Coring of PCC Overlay/PCC - 6 inch diam.	3.4	2	A1, A2
Coring of PCC Overlay/PCC - 12 inch diam.	3.4	3	BA1, BA2, BA3
2. BOUND BASE OR SUBBASE LAYERS			
Coring - 4 inch diam.	3.3	12	C1-C12
Coring - 6 inch diam.	3.4	2	A1, A2
Coring - 12 inch diam.	3.4	3	BA1, BA2, BA3
3. UNBOUND BASE OR SUBBASE LAYERS - PER LAYER			
Augering 6 inch diam. holes	3.4	2	A1, A2
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
4. SUBGRADE			
Split Spoon Sampling	3.4	4*	A1, A2
Thin-walled Tube Sampling (Shelby)	3.4	4*	A1, A2
(* 2 tubes or 2 spoons or combination, per hole - See Section 3.5)			
Bulk Sampling in 12 inch diam. holes	3.4	3	BA1, BA2, BA3
Bulk Sampling in Test Pit	3.5	1	TP
In Situ Density and Moisture Content Tests (Nuclear Gauge)	3.7	1	TP
Moisture Content Samples	3.5	5	TP, BA1, BA2, BA3
5. SHOULDER AUGER PROBE(S)	3.8	If and as directed	

FIELD MATERIAL SAMPLING PLANS

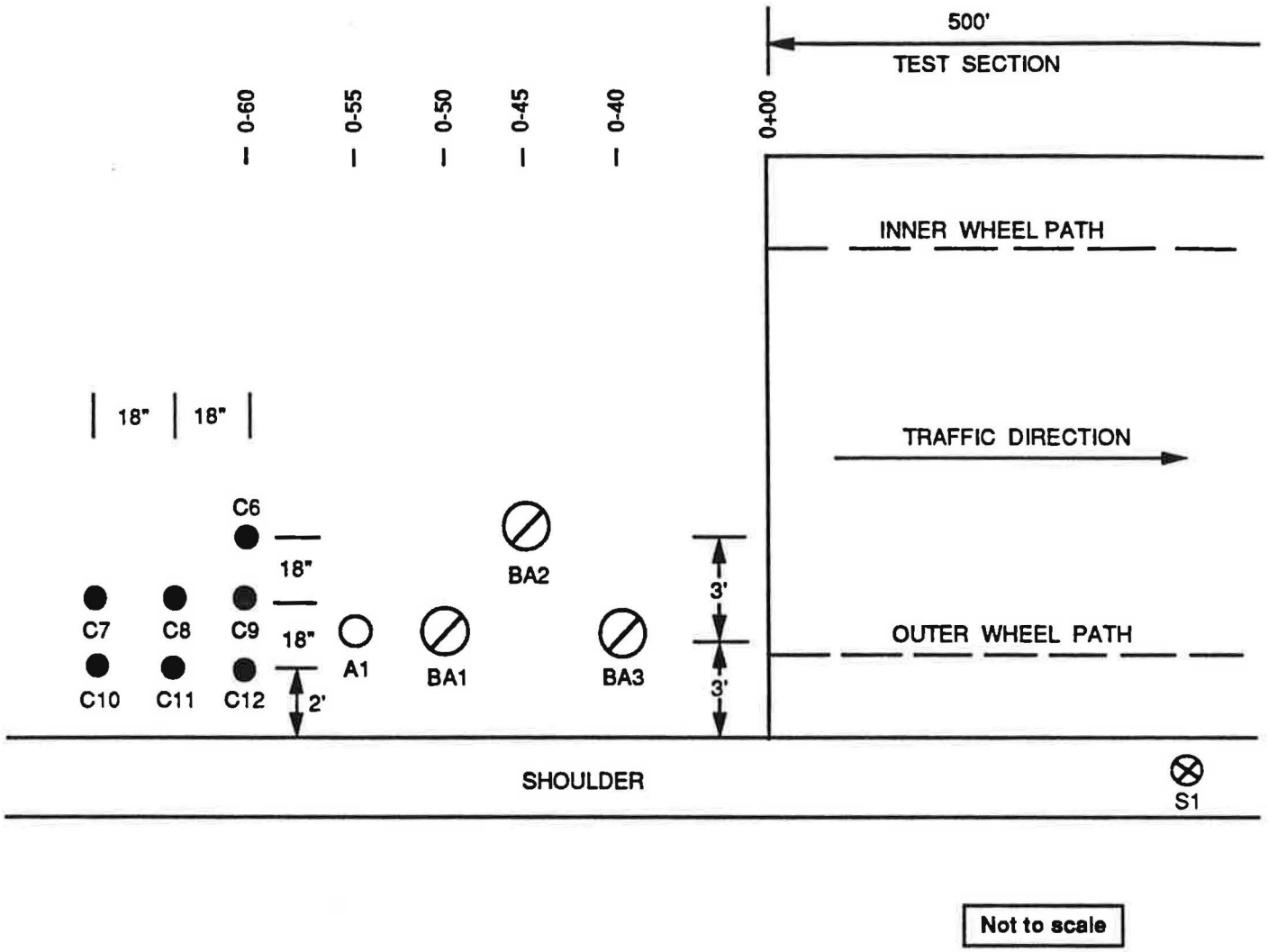
This part of Appendix B contains detailed field material sampling plans for Basic GPS work as follows:

- Figure B.1 - Sampling Point Locations Before Test Section, GPS-1.
- Figure B.2 - Sampling Point Locations After Test Section, GPS-1.
- Figure B.3 - Sampling Point Locations Before Test Section, GPS-2.
- Figure B.4 - Sampling Point Locations After Test Section, GPS-2.
- Figure B.5 - Sampling Point Locations Before Test Section, GPS-3.
- Figure B.6 - Sampling Point Locations After Test Section, GPS-3.
- Figure B.7 - Sampling Point Locations Before Test Section, GPS-4.
- Figure B.8 - Sampling Point Locations After Test Section, GPS-4.
- Figure B.9 - Sampling Point Locations Before Test Section, GPS-5.
- Figure B.10 - Sampling Point Locations After Test Section, GPS-5.
- Figure B.11 - Sampling Point Locations Before Test Section, GPS-6 - Case 1
- Figure B.12 - Sampling Point Locations After Test Section, GPS-6 - Case 1
- Figure B.13 - Before Overlay Sampling Point Locations Before Test Section, GPS-6 - Case 2.
- Figure B.14 - Before Overlay Sampling Point Locations After Test Section, GPS-6 - Case 2.
- Figure B.15 - After Overlay Sampling Point Locations Before Test Section, GPS-6 - Case 2.
- Figure B.16 - After Overlay Sampling Point Locations After Test Section, GPS-6 - Case 2.
- Figure B.17 - Sampling Point Locations Before Test Section, GPS-7 - Case 1.
- Figure B.18 - Sampling Point Locations After Test Section, GPS-7 - Case 1.
- Figure B.19 - Before Overlay Sampling Point Locations Before Test Section, GPS-7 - Case 2.
- Figure B.20 - Before Overlay Sampling Point Locations After Test Section, GPS-7 - Case 2.

- Figure B.21 - After Overlay Sampling Point Locations Before Test Section, GPS-7 - Case 2.
- Figure B.22 - After Overlay Sampling Point Locations After Test Section, GPS-7 - Case 2.
- Figure B.23 - Sampling Point Locations Before Test Section, GPS-9.
- Figure B.24 - Sampling Point Locations After Test Section, GPS-9.
- Figure B.25 - Typical Test Pit Details for GPS-1, GPS-2 and GPS-6 Pavements (No Subbase).
- Figure B.26 - Typical Test Pit Details for GPS-1, GPS-2 and GPS-6 Pavements (With Subbase).
- Figure B.27 - Typical Test Pit Details for GPS-3, GPS-4, GPS-5, GPS-7 and GPS-9 Pavements - (No Subbase).
- Figure B.28 - Typical Test Pit Details for GPS-3, GPS-4, GPS-5, GPS-7 and GPS-9 Pavements - (With Subbase).

Figure B.1 through Figure B.24 will be used by the SHRP Regional Drilling and Sampling Contractors when performing the Field Material Sampling and Field Testing work for GPS pavements. The Drilling and Sampling Contractor will follow these sampling layout plans as closely as possible (field conditions permitting) to obtain samples from each respective GPS pavement. The sampling layout plans contain information regarding the location of each sampling area, the samples to be obtained and the field tests to be performed at each sampling area.

Figure B.25 through Figure B.28 contain details regarding the typical field sampling and field testing activities that are to be conducted by the Drilling and Sampling Contractor at the test pit locations for all GPS pavements.



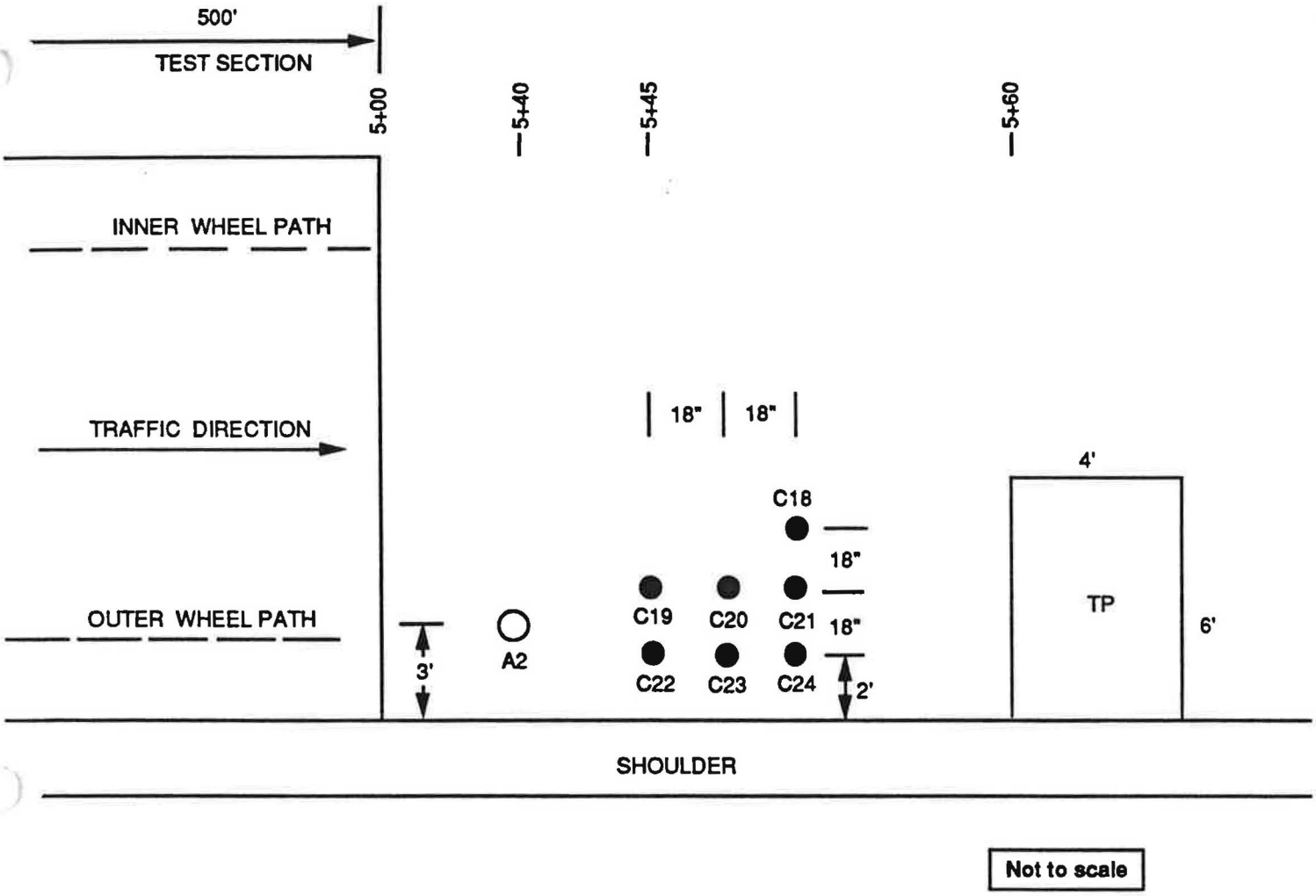
● 4" OD core of AC pavement surface: C6 - C12

○ 6" OD core of AC pavement surface; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC pavement surface; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

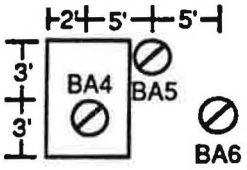
Figure B.1. Sampling Point Locations Before Test Section, GPS-1 Asphalt Concrete over Granular Base



● 4" OD core of AC pavement surface: C18-C24

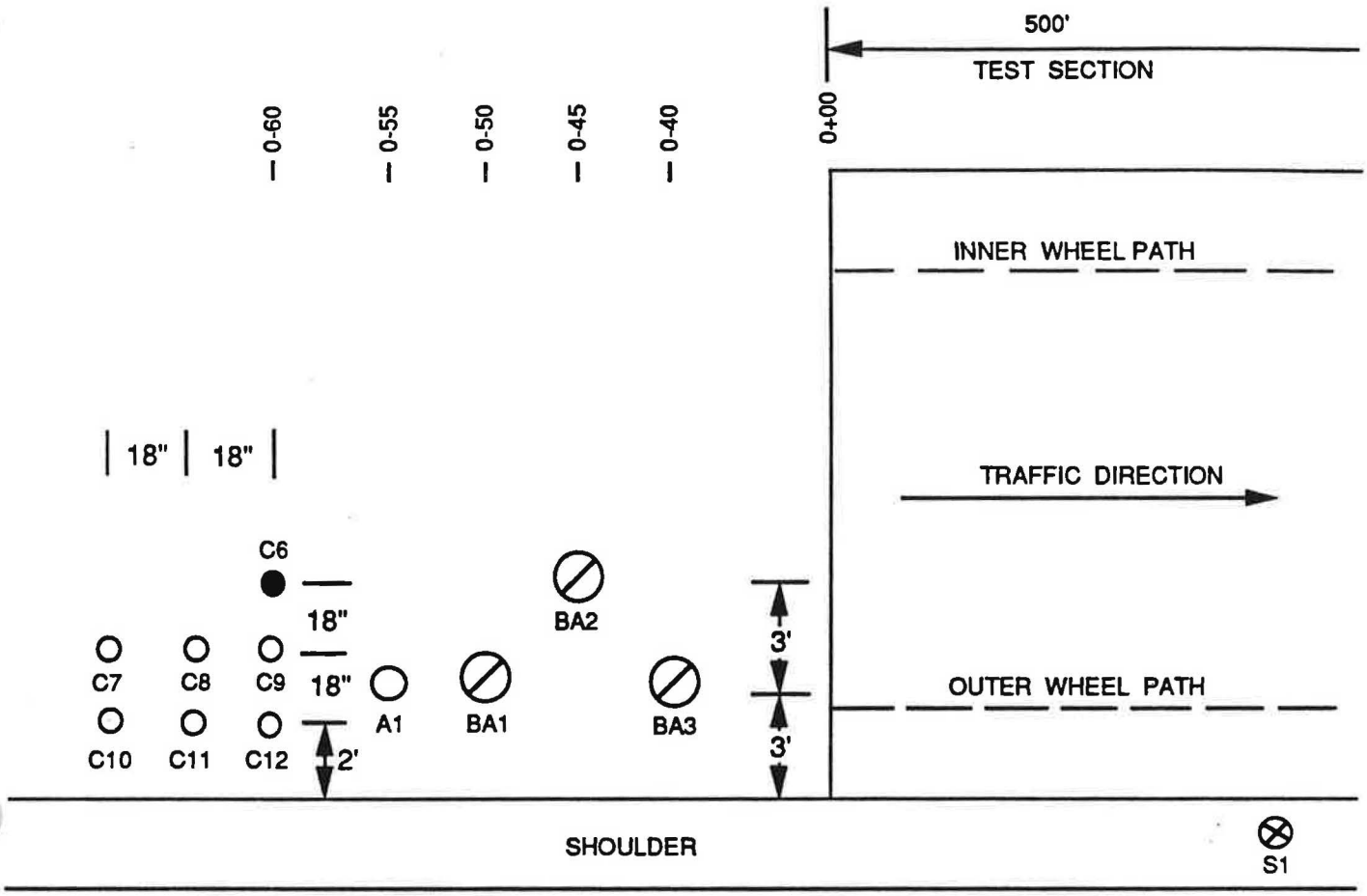
○ 6" OD core of AC pavement surface; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of AC pavement block; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples of unbound granular base and subbase layers and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.2. Sampling Point Locations After Test Section, GPS-1 Asphalt Concrete over Granular Base



● 4" OD core of AC pavement surface: C6

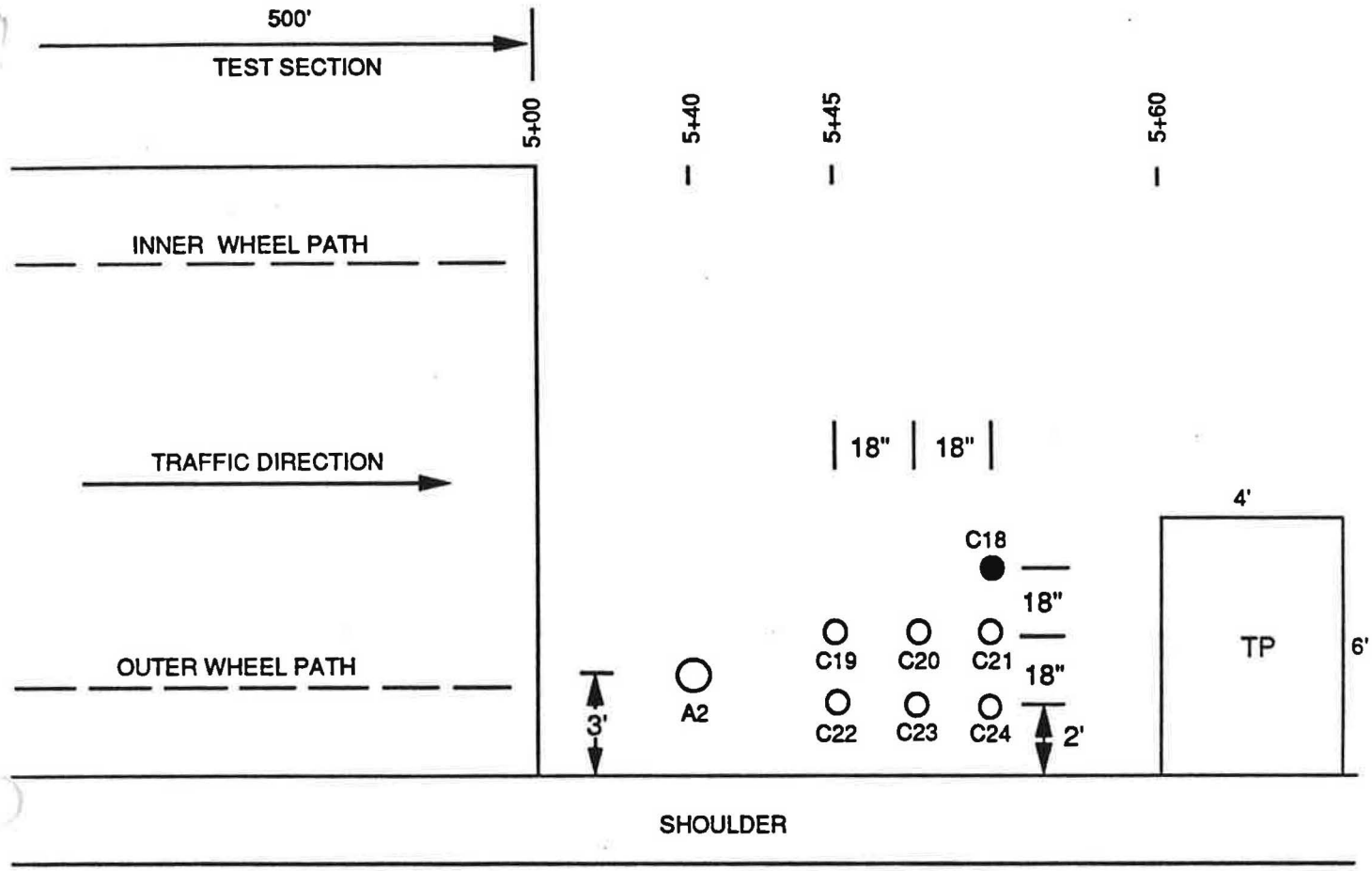
○ 4" OD core of AC pavement surface and treated layers: C7-C12

○ 6" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

Figure B.3. Sampling Point Locations Before Test Section, GPS-2 Asphalt Concrete over Bound Base

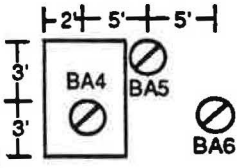


● 4" OD core of AC pavement surface : C18

○ 4" OD core of AC pavement surface and treated layers: C19-C24

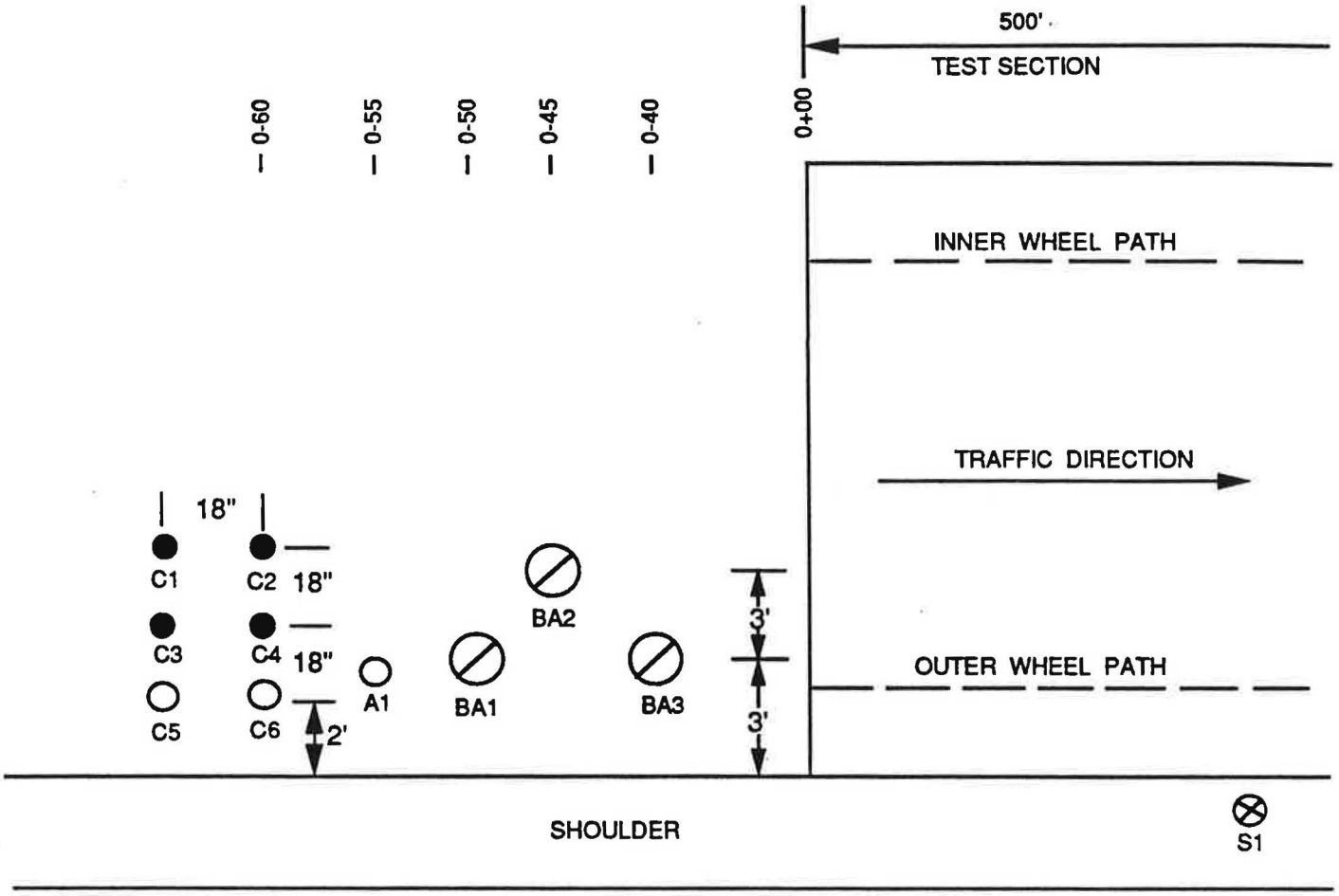
○ 6" OD core of AC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of AC pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples of unbound granular base and subbase layers and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.4. Sampling Point Locations After Test Section, GPS-2 Asphalt Concrete over Bound Base



Not to scale

● 4" OD core of PCC pavement and treated layers: C1 - C4

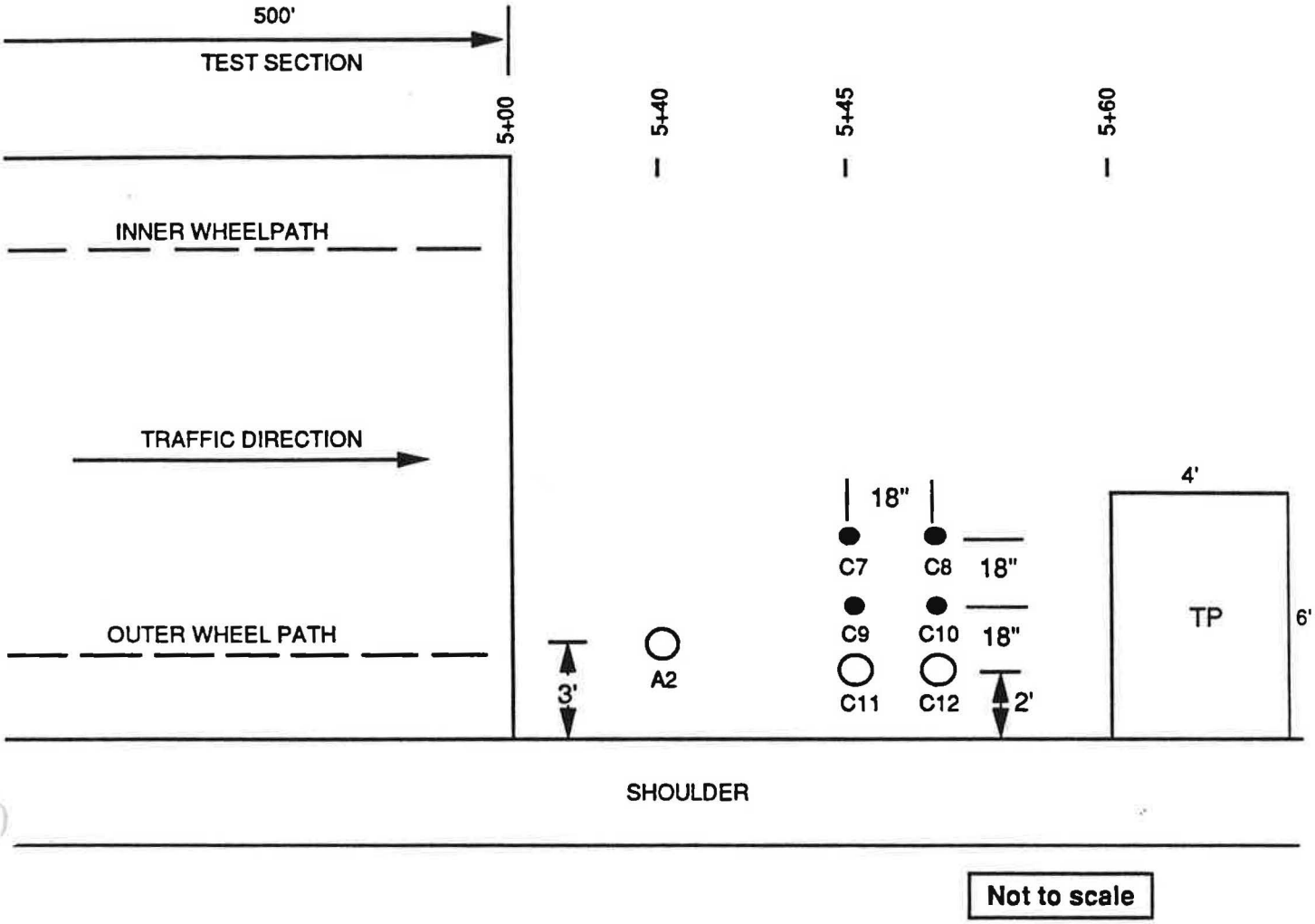
○ 6" OD core of PCC pavement and 4" OD core of treated layers: C5 - C6

○ 6" OD core of PCC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by authorized SHRP representative: S1

Figure B.5. Sampling Point Locations Before Test Section, GPS-3 Jointed Plain Concrete Pavement

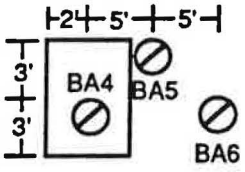


● 4" OD core of PCC pavement and treated layers: C7-C10

○ 6" OD core of PCC pavement and 4" OD cores of treated layers: C11-C12

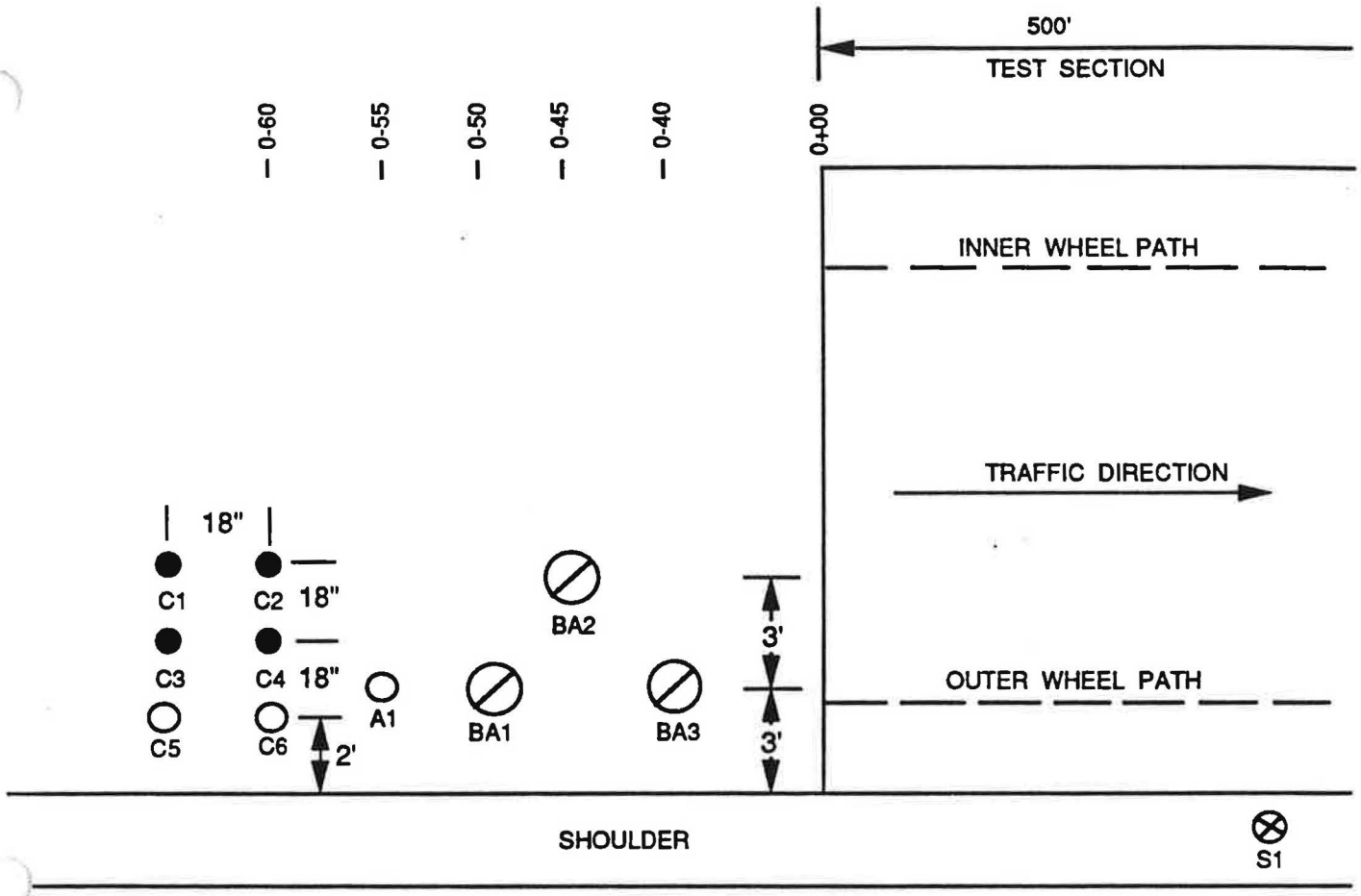
○ 6" OD core of PCC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of bulk and moisture samples of unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.6. Sampling Point Locations After Test Section, GPS-3 Jointed Plain Concrete Pavement



● 4" OD core of PCC pavement and treated layers: C1 - C4

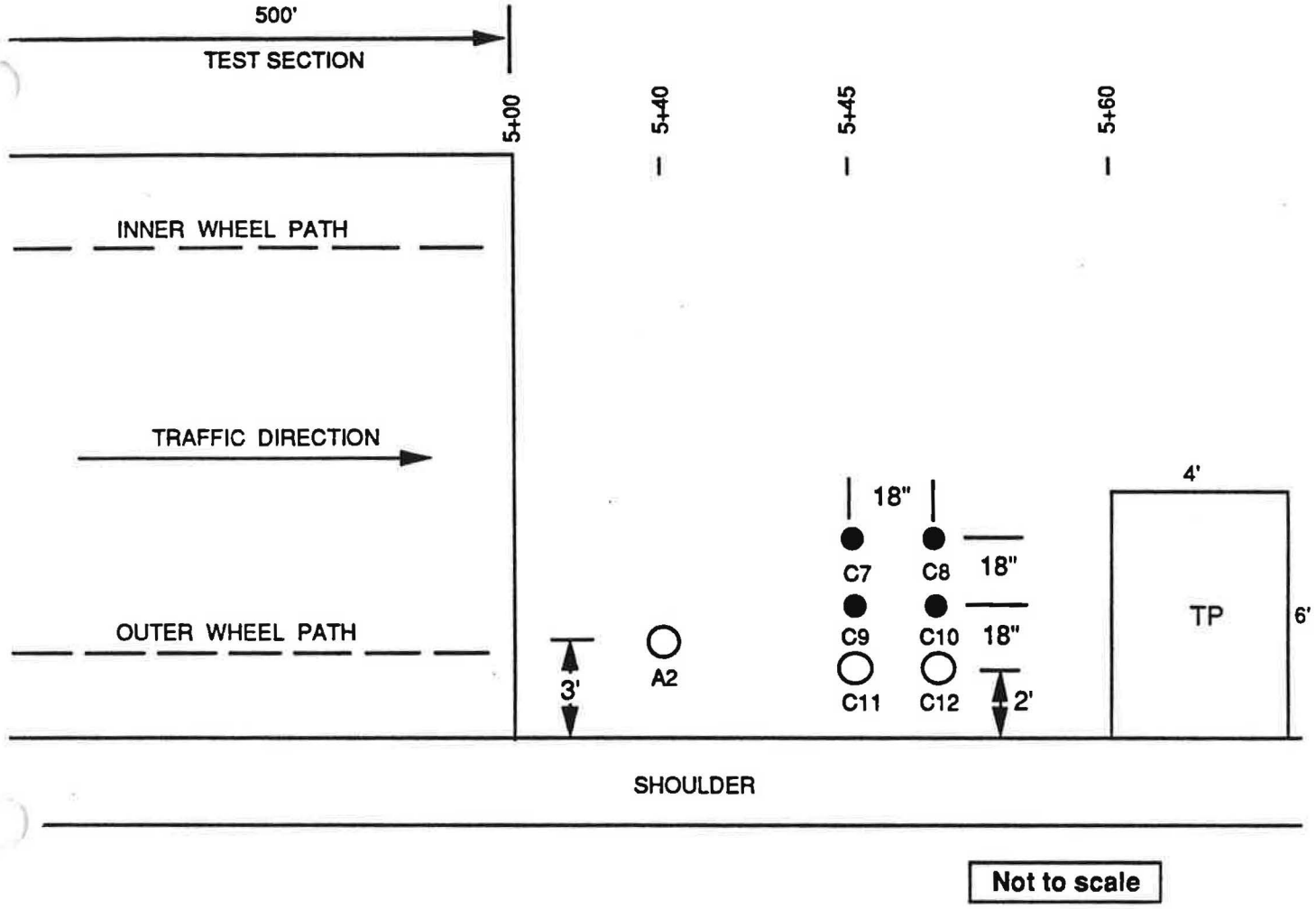
○ 6" OD core of PCC pavement and 4" OD core of treated layers: C5 - C6

○ 6" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by authorized SHRP representative: S1

Figure B.7. Sampling Point Locations Before Test Section, GPS-4 Jointed Reinforced Concrete Pavement

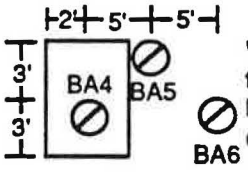


● 4" OD core of PCC pavement and treated layers: C7-C10

○ 6" OD core of PCC pavement and 4" OD cores of treated layers: C11-C12

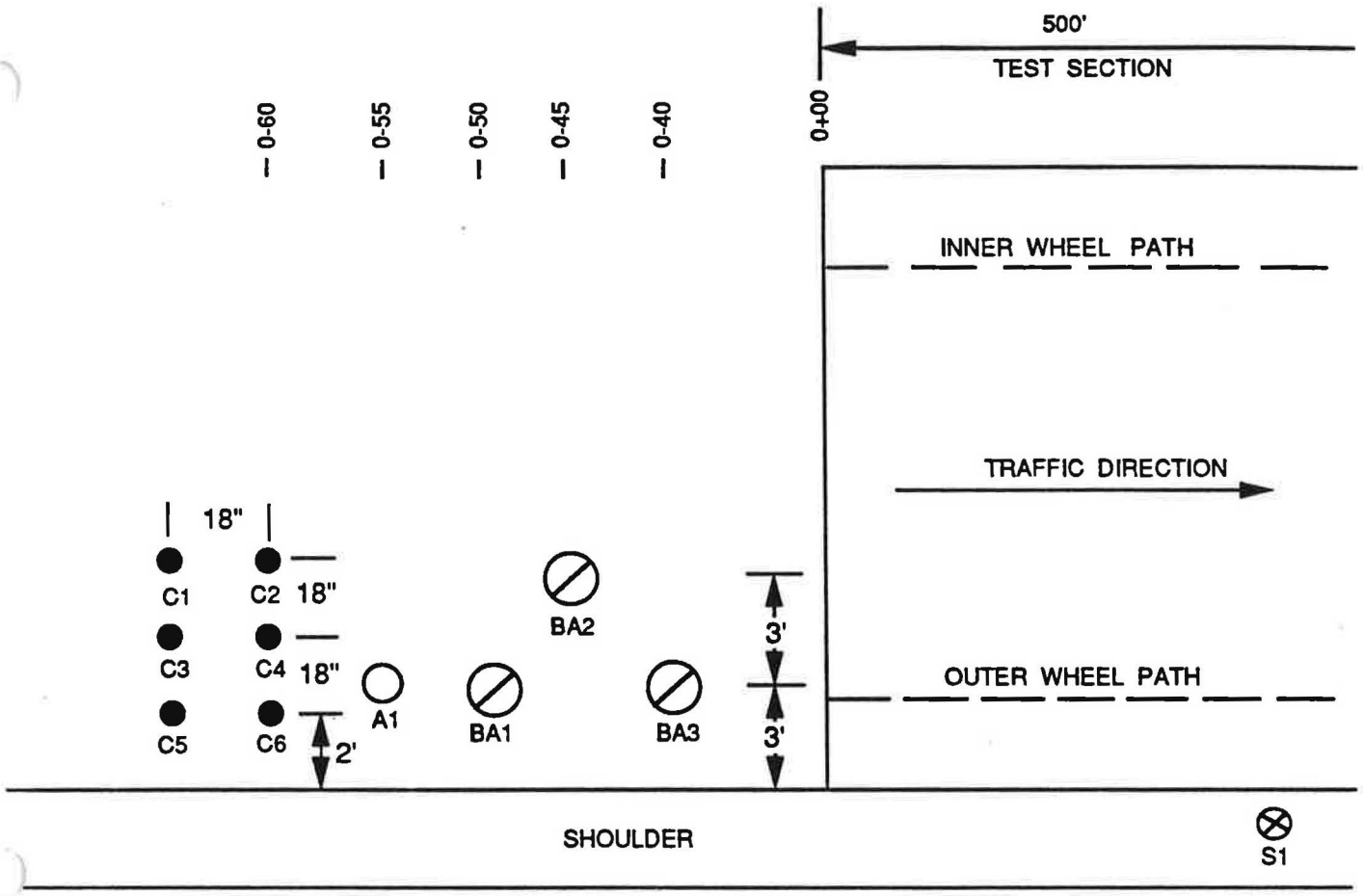
○ 6" OD core of PCC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

□ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of bulk and moisture samples of unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.8. Sampling Point Locations After Test Section , GPS-4 Jointed Reinforced Concrete Pavement



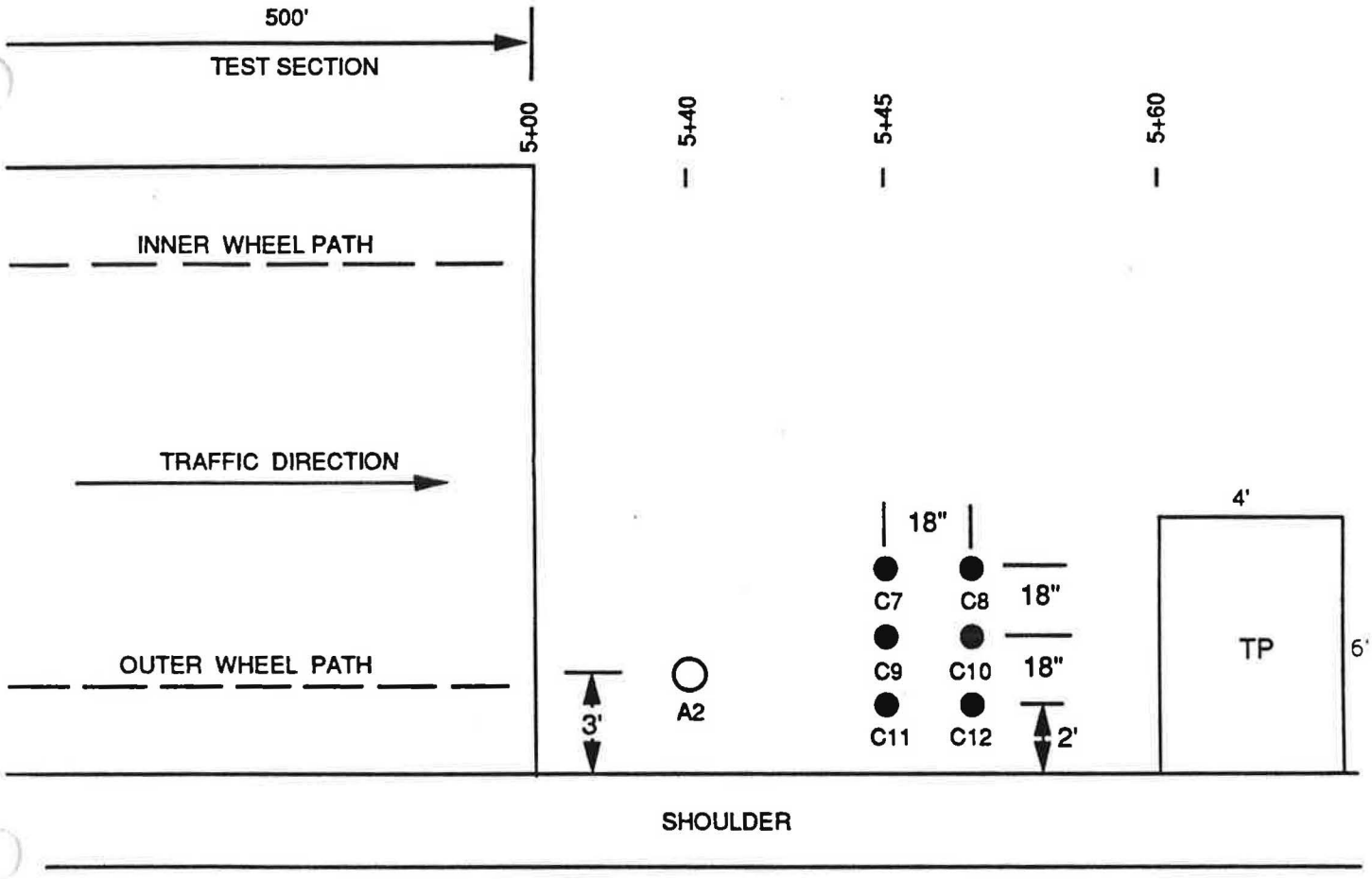
● 4" OD core of PCC pavement and treated layers: C1 - C6

○ 6" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⌀ 12" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

Figure B.9. Sampling Point Locations Before Test Section, GPS-5 Continuously Reinforced Concrete Pavement

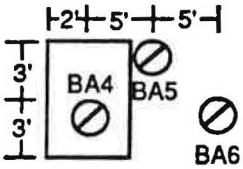


Not to scale

● 4" OD core of PCC pavement and treated layers: C7-C12

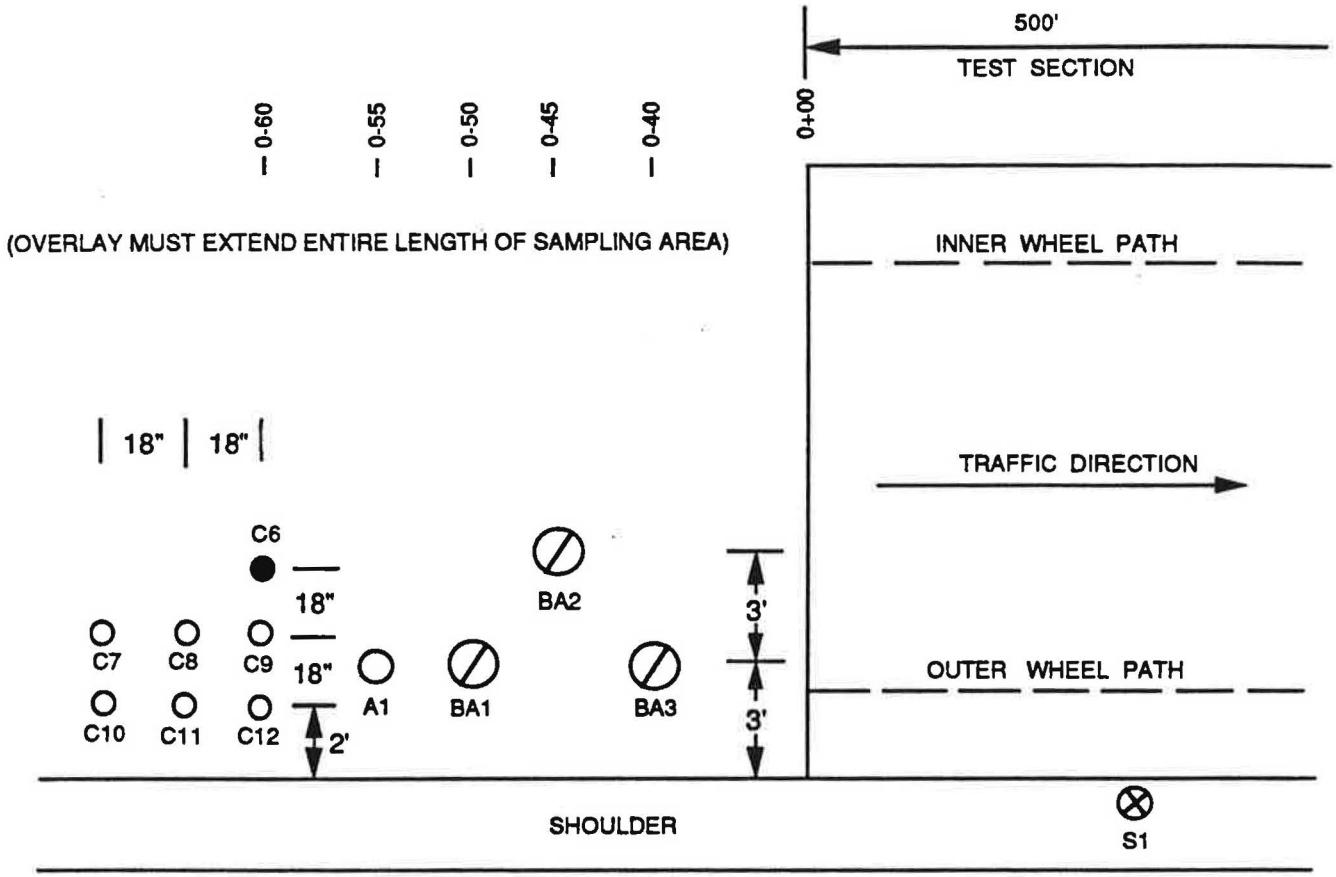
○ 6" OD core of PCC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of bulk and moisture samples of unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.10. Sampling Point Locations After Test Section, GPS-5 Continuously Reinforced Concrete Pavement



● 4" OD core of AC pavement surface (overlay and original AC surface): C6

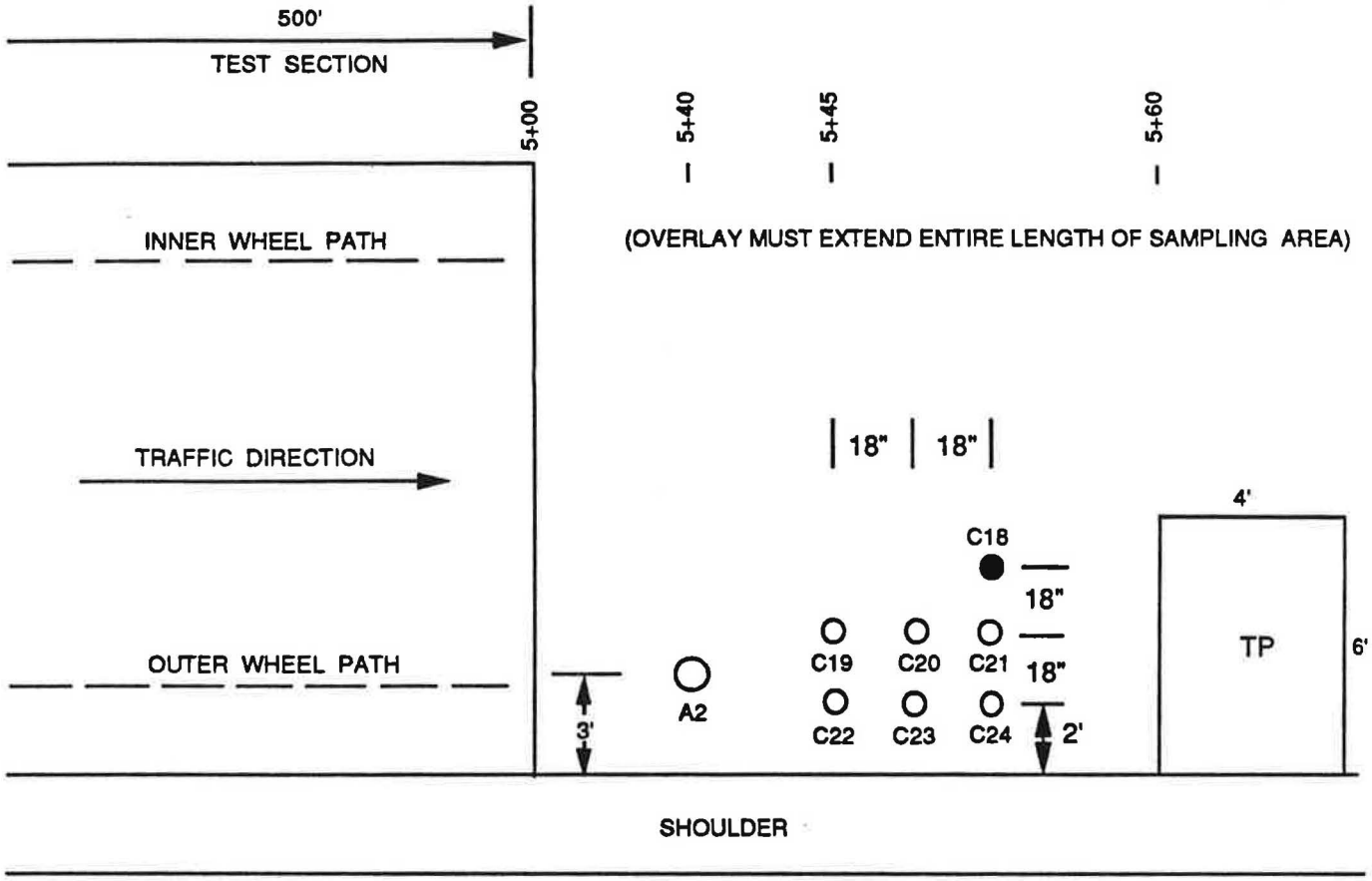
○ 4" OD core of AC pavement surface (overlay and original AC surface) and treated layers: C7-C12

○ 6" OD core of AC pavement overlay, original surface and any treated layers; augering of unbound base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC pavement overlay, original surface, and any treated layers; augering of unbound base, subbase, and subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

Figure B.11. Sampling Point Locations Before Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Preferred Sampling Plan; Only After Overlay, No Sampling Before Overlay) - Case 1



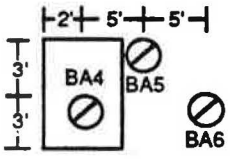
Not to scale

● 4" OD core of AC pavement surface (overlay and original AC surface): C18

○ 4" OD core of AC pavement surface (overlay and original AC surface) and any treated layers: C19-C24

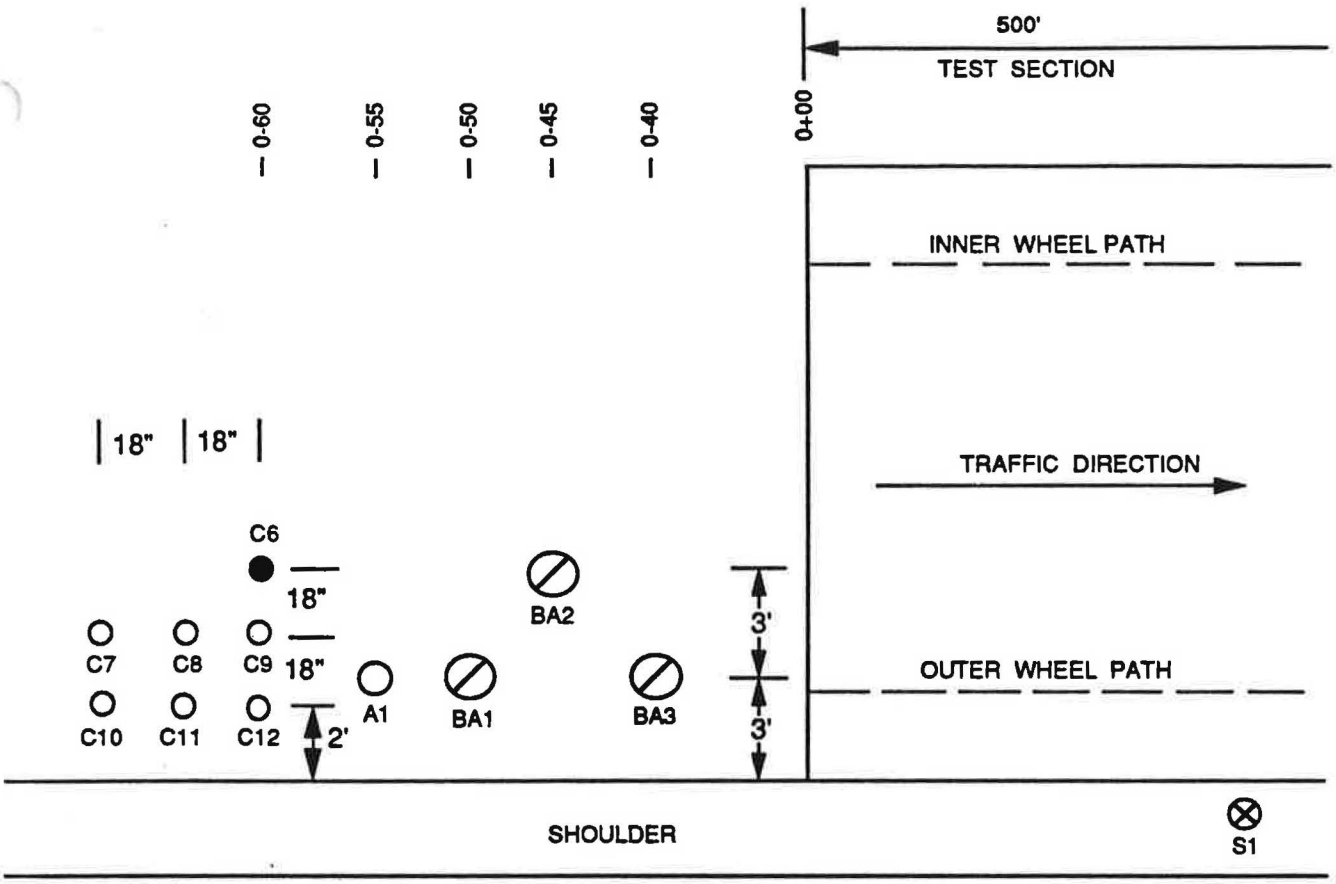
○ 6" OD core of AC pavement overlay, original surface, any treated layers; augering of base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below subgrade). Removal of pavement layers; collection of AC pavement block; nuclear density and moisture measurements on unstabilized layers and subgrade; bulk sampling of unbound layers and subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples from unbound base, subbase and subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.12. Sampling Point Locations After Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Preferred Sampling Plan; Only After Overlay, No Sampling Before Overlay) - Case 1



● 4" OD core of AC pavement surface (original surface): C6

Not to scale

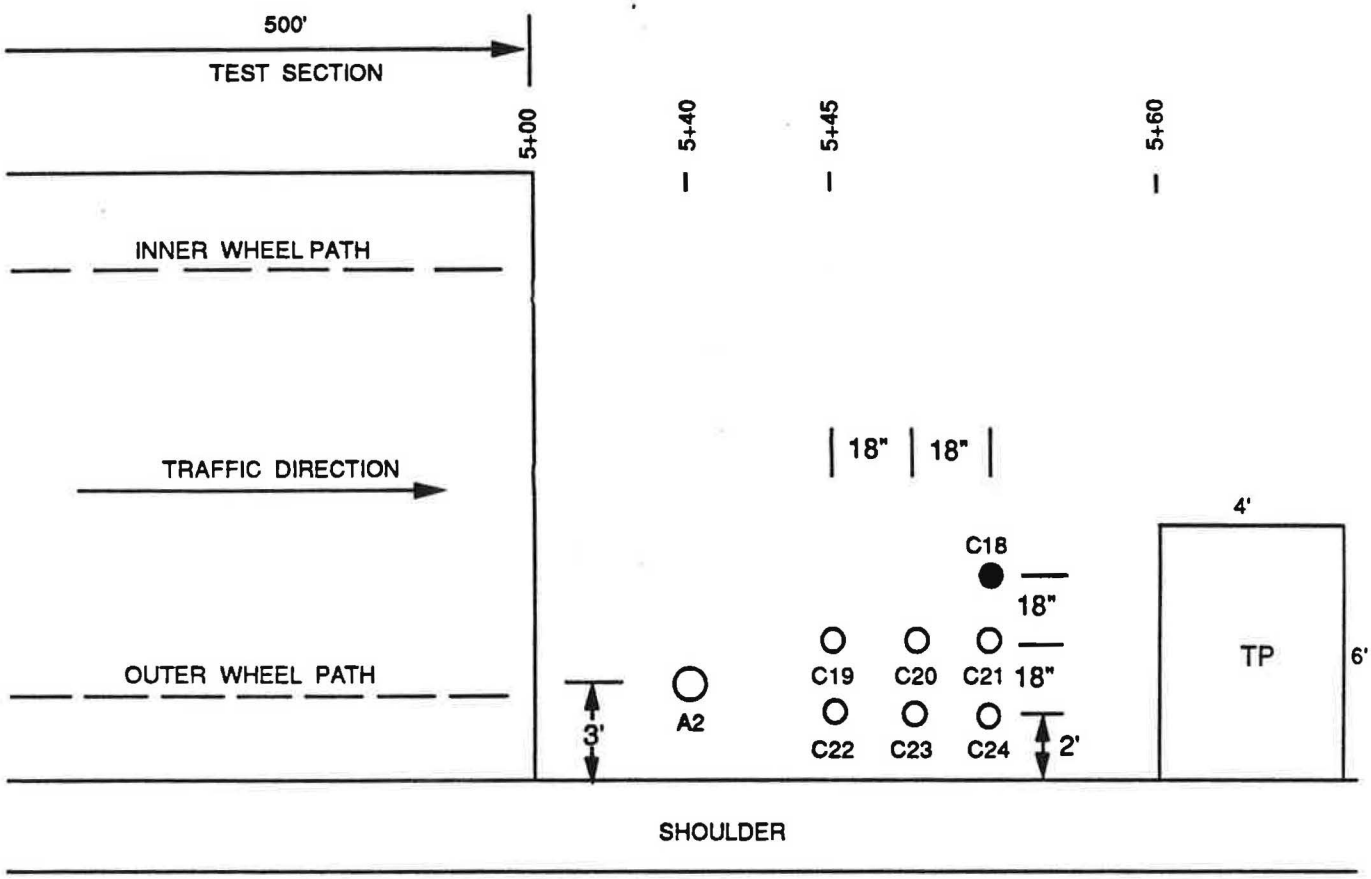
○ 4" OD core of AC pavement surface (original AC surface) and treated layers: C7-C12

◯ 6" OD core of AC pavement, original surface and any treated layers; augering of unbound base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC pavement original surface, and any treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

Figure B.13. **Before Overlay Sampling Point Locations Before Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Alternative Sampling Plans) - Case 2**



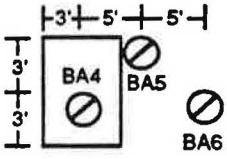
Not to scale

● 4" OD core of AC pavement surface (original AC surface): C18

○ 4" OD core of AC pavement surface (original AC surface) and any treated layers: C19-C24

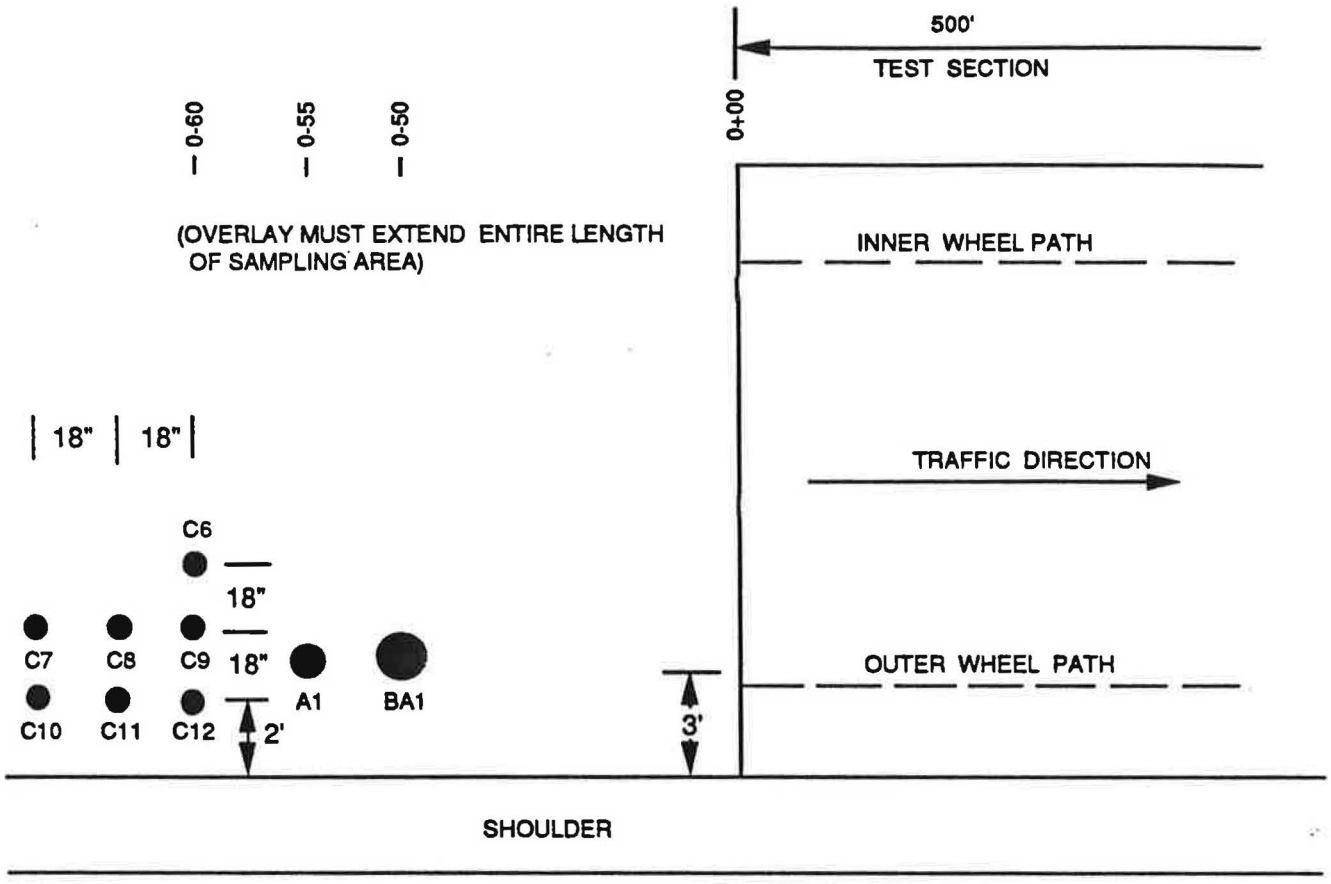
○ 6" OD core of AC pavement original surface, any treated layers; augering of unbound granular base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of AC pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples of unbound granular base and subbase layers and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.14. Before Overlay Sampling Point Locations After Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Alternative Sampling Plan) - Case 2



● 4" OD core of AC pavement overlay: C6 - C12

Not to scale

● 6" OD core of AC pavement overlay: A1

● One 12" OD core of AC pavement overlay: BA1
(This 12" OD core of AC overlay is not required if about 30 to 50 lbs. of asphaltic concrete mix used in the construction of AC overlay was sampled during construction and shipped to the Regional Laboratory Material Testing Contractor).

Figure B.15. **<u>After Overlay</u> Sampling Point Locations Before Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Alternative Sampling Plan) - Case 2**

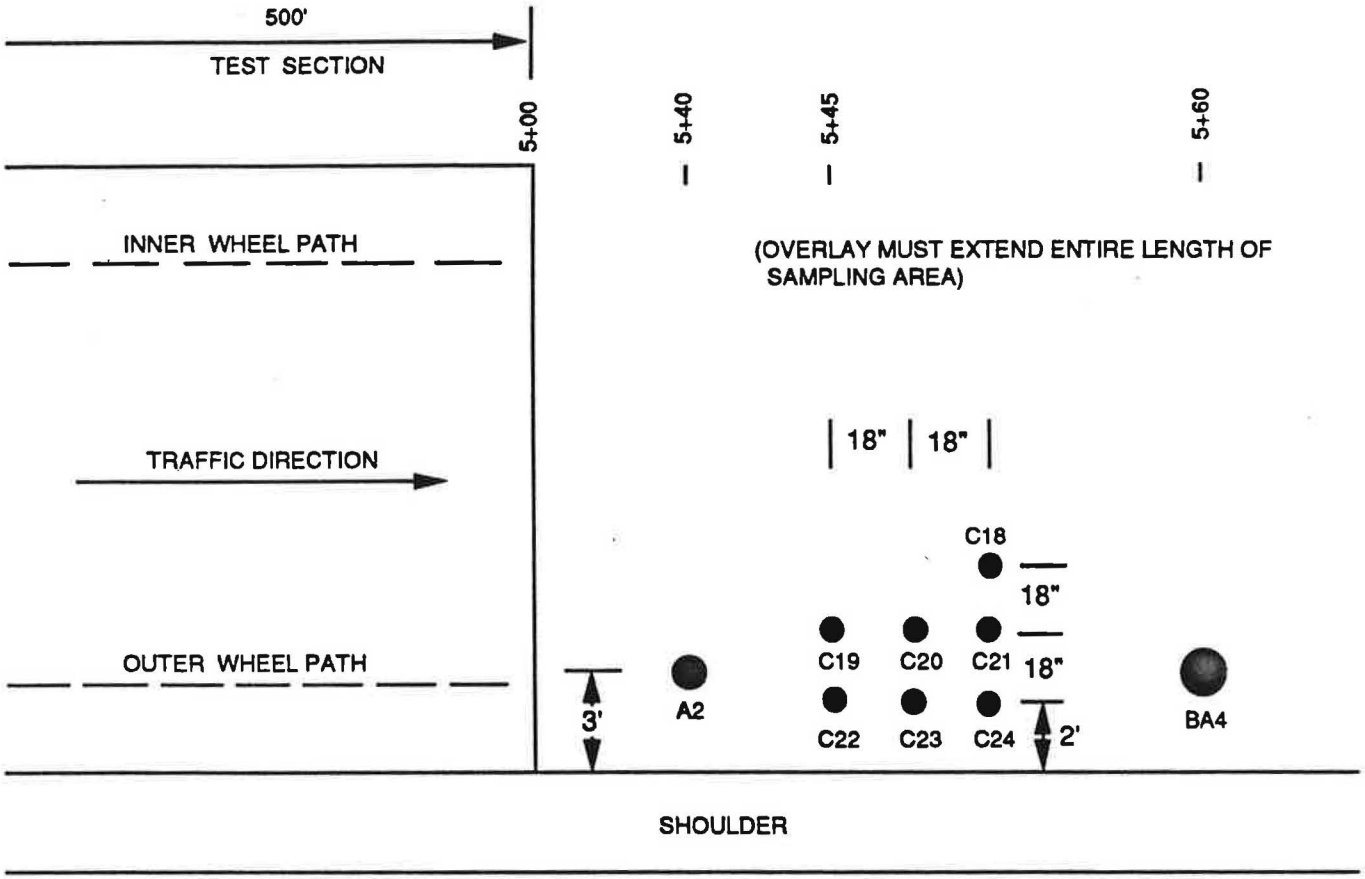
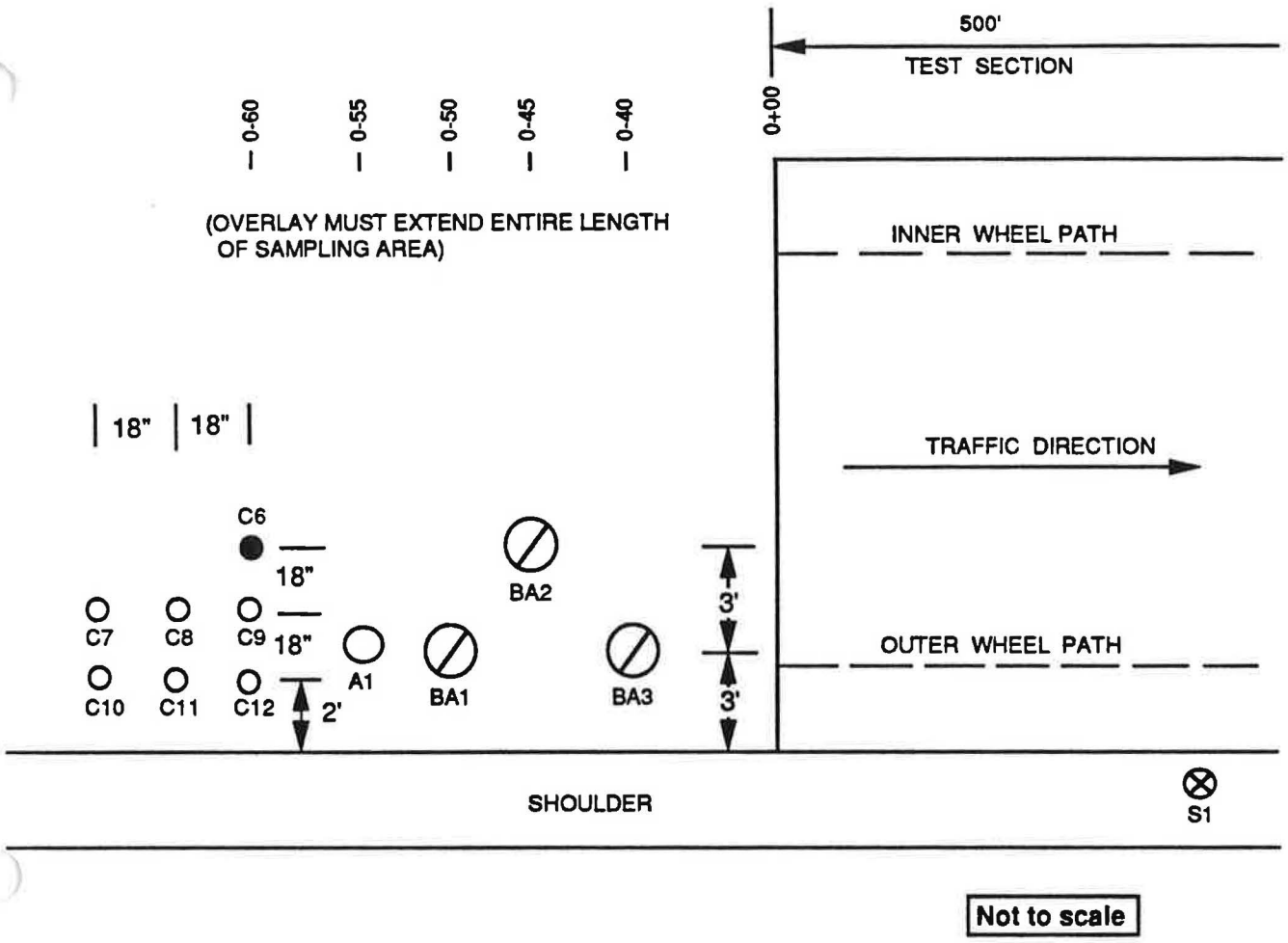


Figure B.16. **<u>After Overlay</u> Sampling Point Locations After Test Section, GPS-6 Asphalt Concrete Overlay Over Asphalt Concrete (Alternative Sampling Plan) - Case 2**



● 4" OD core of AC overlay: C6

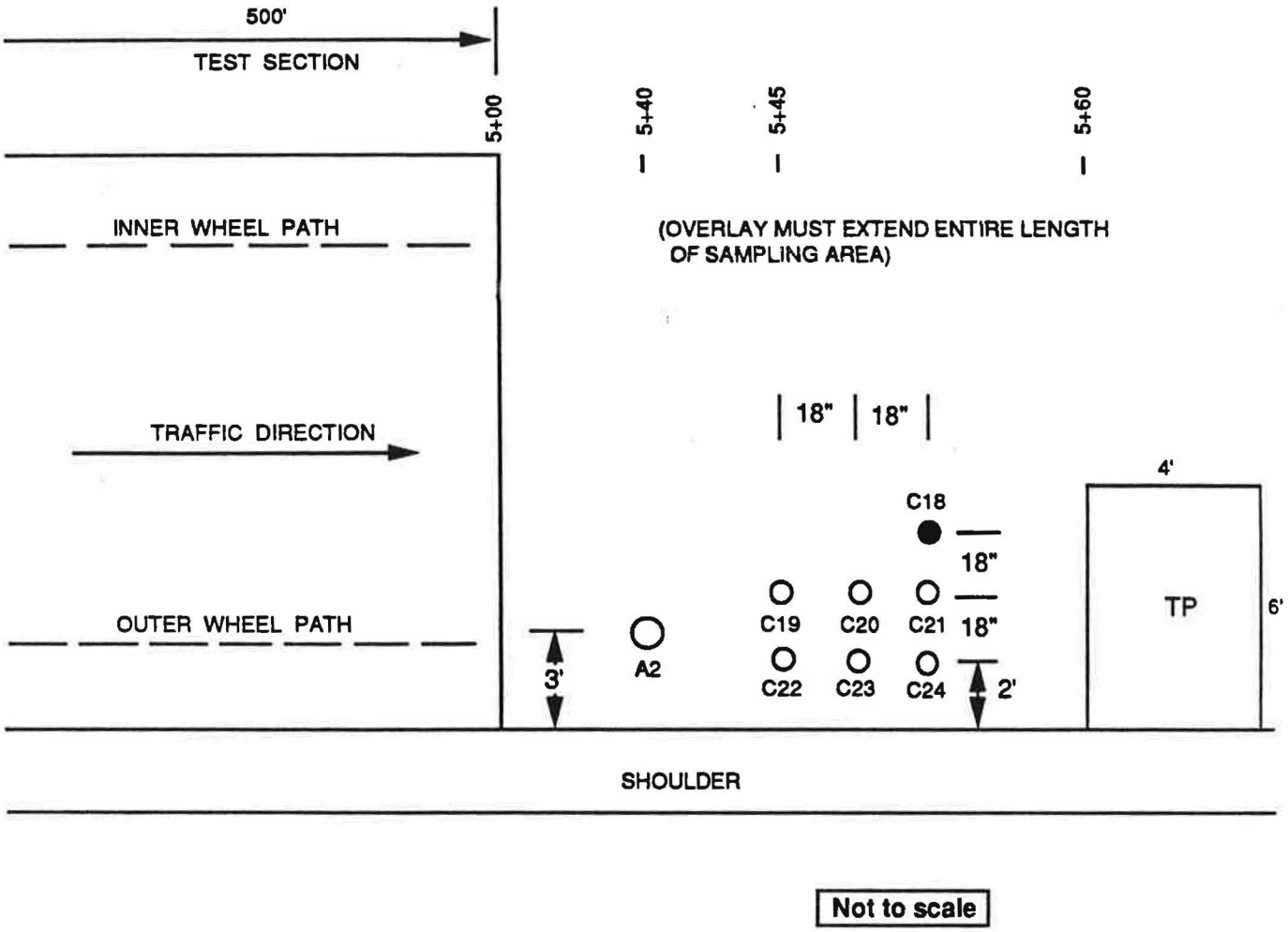
○ 4" OD core of AC overlay, PCC and treated layer: C7-C10
6" OD core of AC overlay and PCC, and 4" OD Core of treated layers: C11-C12

○ 6" OD core of AC overlay, PCC pavement, and treated layers; augering of unbound granular base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC overlay, PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe- optional as directed by SHRP Authorized Representative: S1

Figure B.17. Sampling Point Locations Before Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Preferred Sampling Plan Only After Overlay; No Sampling Before Overlay) - Case 1

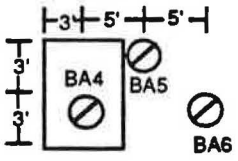


● 4" OD core of AC overlay: C18

○ 4" OD core of AC overlay, PCC and treated layers: C19-C22
6" OD core of AC overlay and PCC, and 4" OD Core of treated layers: C23-C24

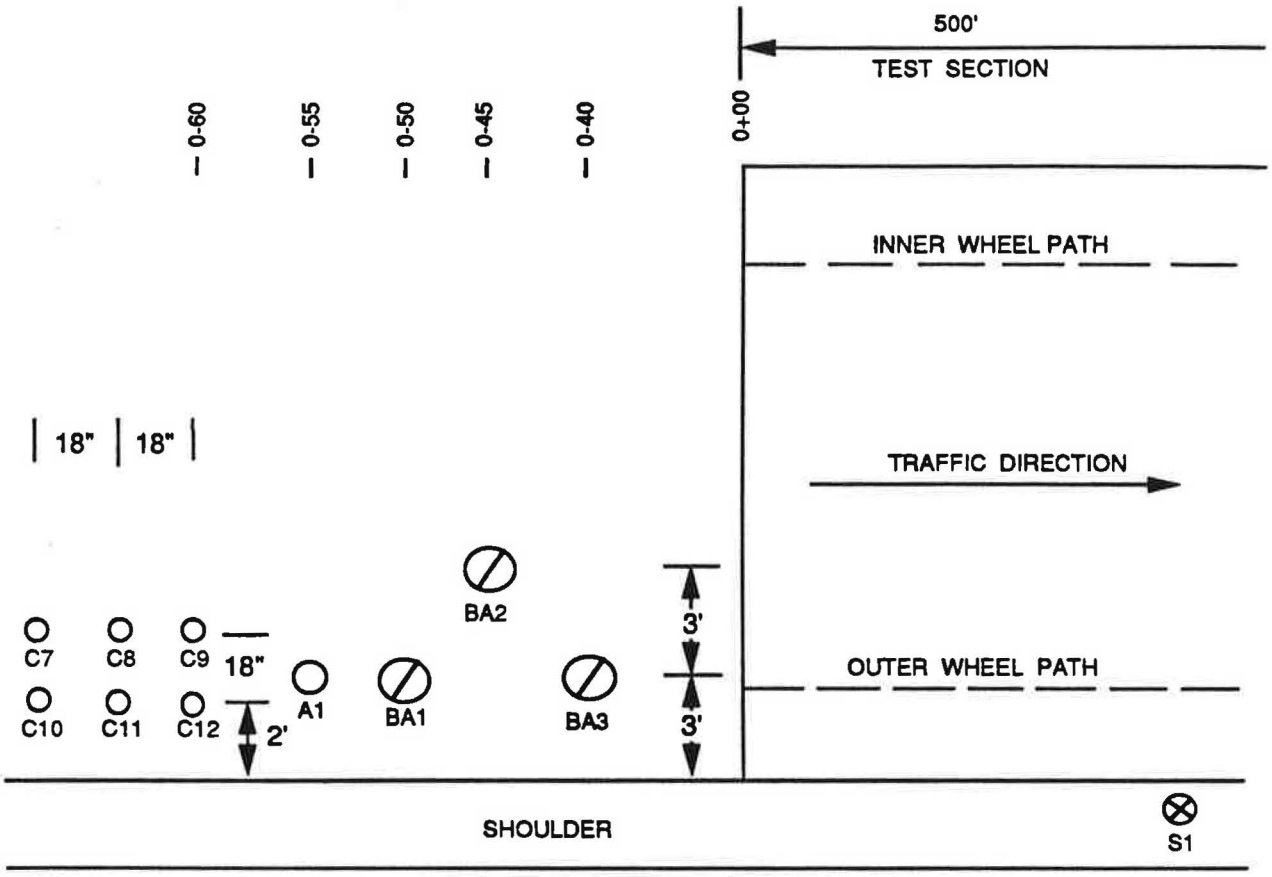
◯ 6" OD core of AC overlay, augering of unbound granular base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; nuclear density and moisture measurements on unbound granular base and subbase layers and subgrade; bulk sampling of unbound layers and subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples from unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.18. Sampling Point Locations After Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Preferred Sampling Plan Only <u>After</u> Overlay; No Sampling Before Overlay) - Case 1



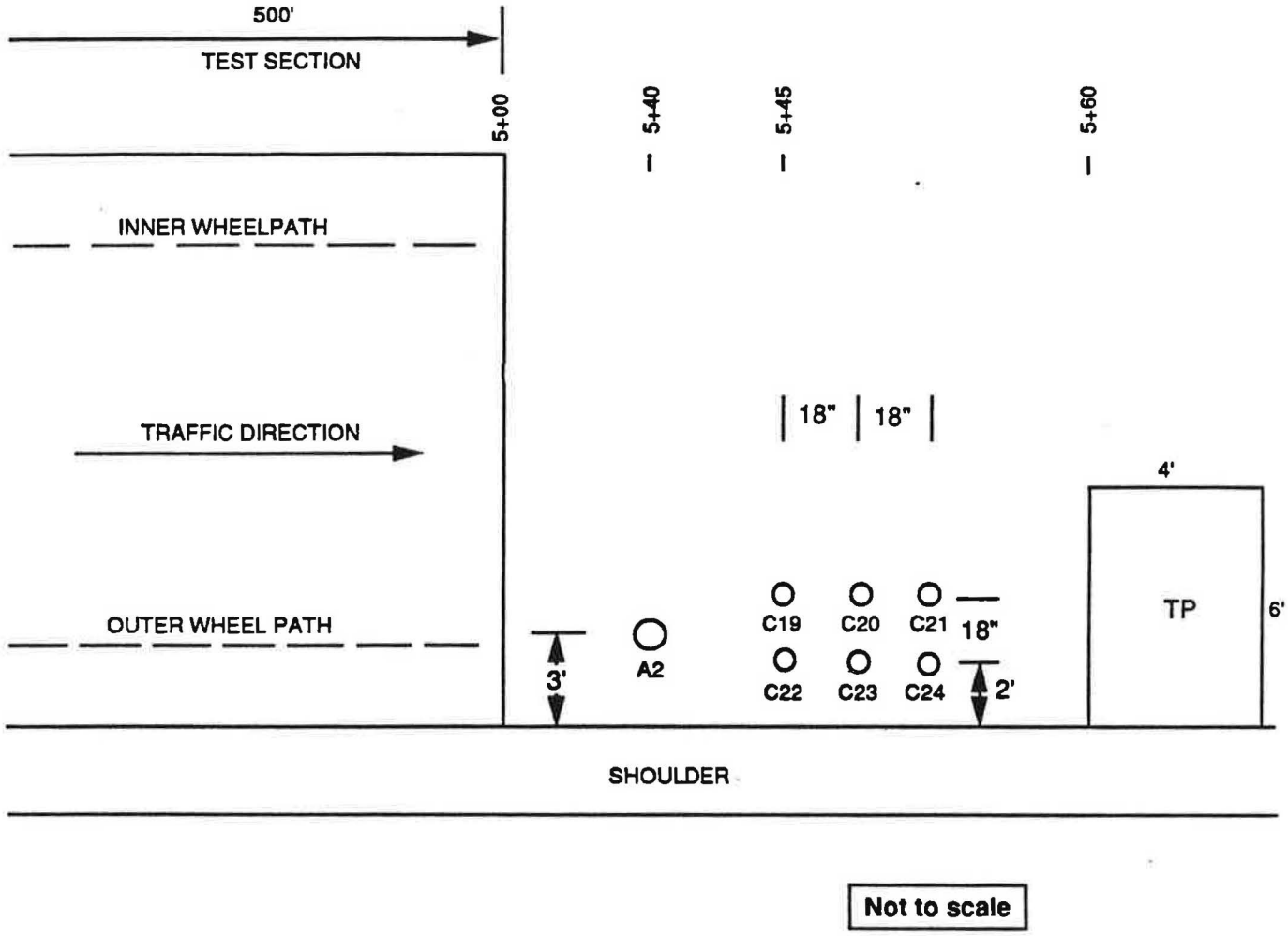
○ 4" OD core of PCC and treated layers: C7-C10
6" OD core of PCC, and 4" OD Core of treated layers: C11-C12

○ 6" OD core of PCC pavement, and treated layers; augering of unbound granular base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe- optional as directed by SHRP Authorized Representative: S1

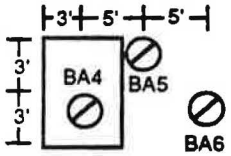
Figure B.19. Before Overlay Sampling Point Locations Before Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Alternative Sampling Plans) - Case 2



○ 4" OD core of PCC and treated layer: C19-C22
6" OD core of PCC, and 4" OD Core of treated layers: C23-C24

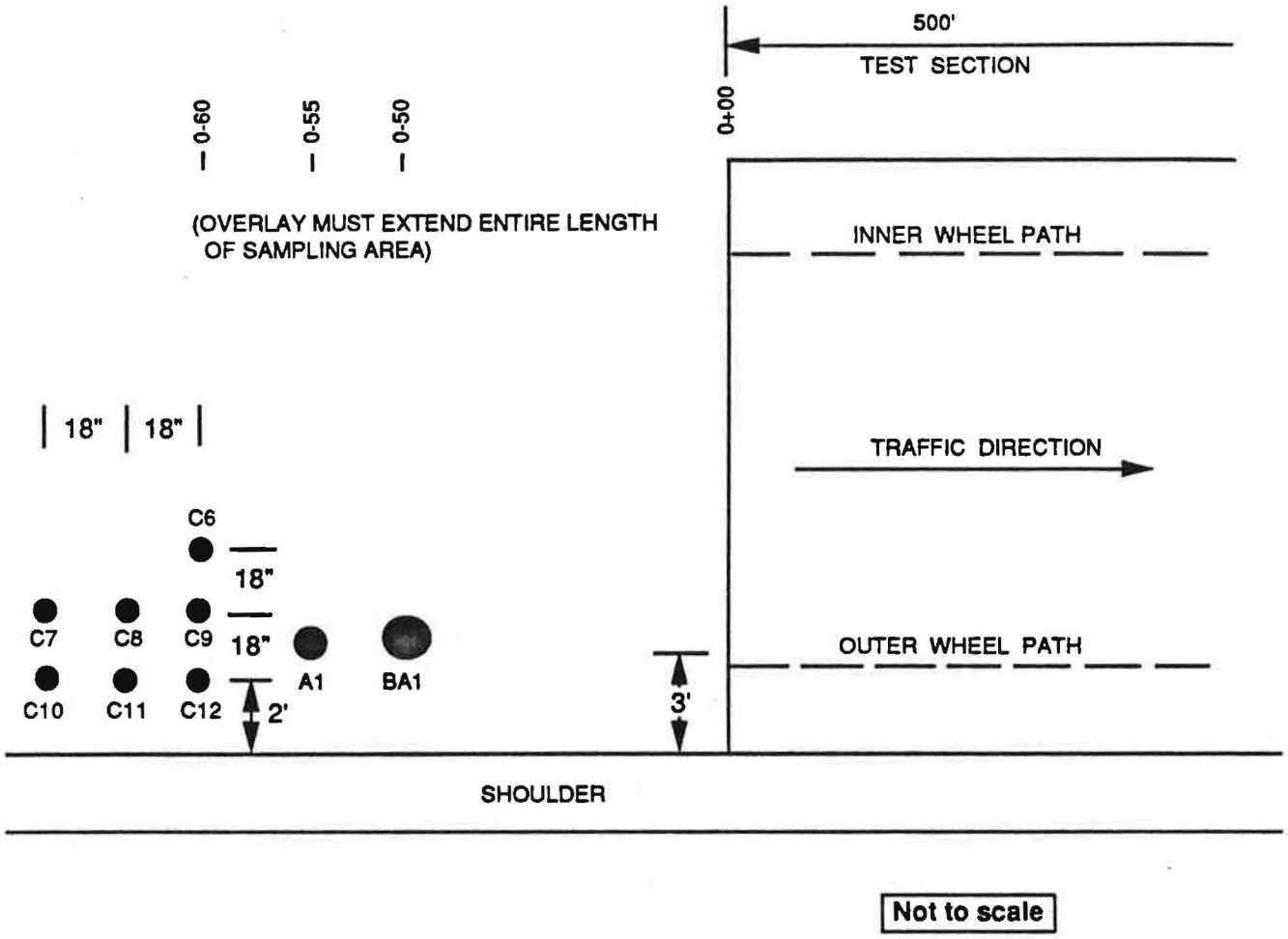
○ 6" OD core of augering of unbound granular base and subbase; thin-walled tube sampling and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; nuclear density and moisture measurements on unbound granular base and subbase layers and subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP



When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of bulk and moisture samples of unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.20. **Before Overlay Sampling Point Locations After Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Alternative Sampling Plans) - Case 2**

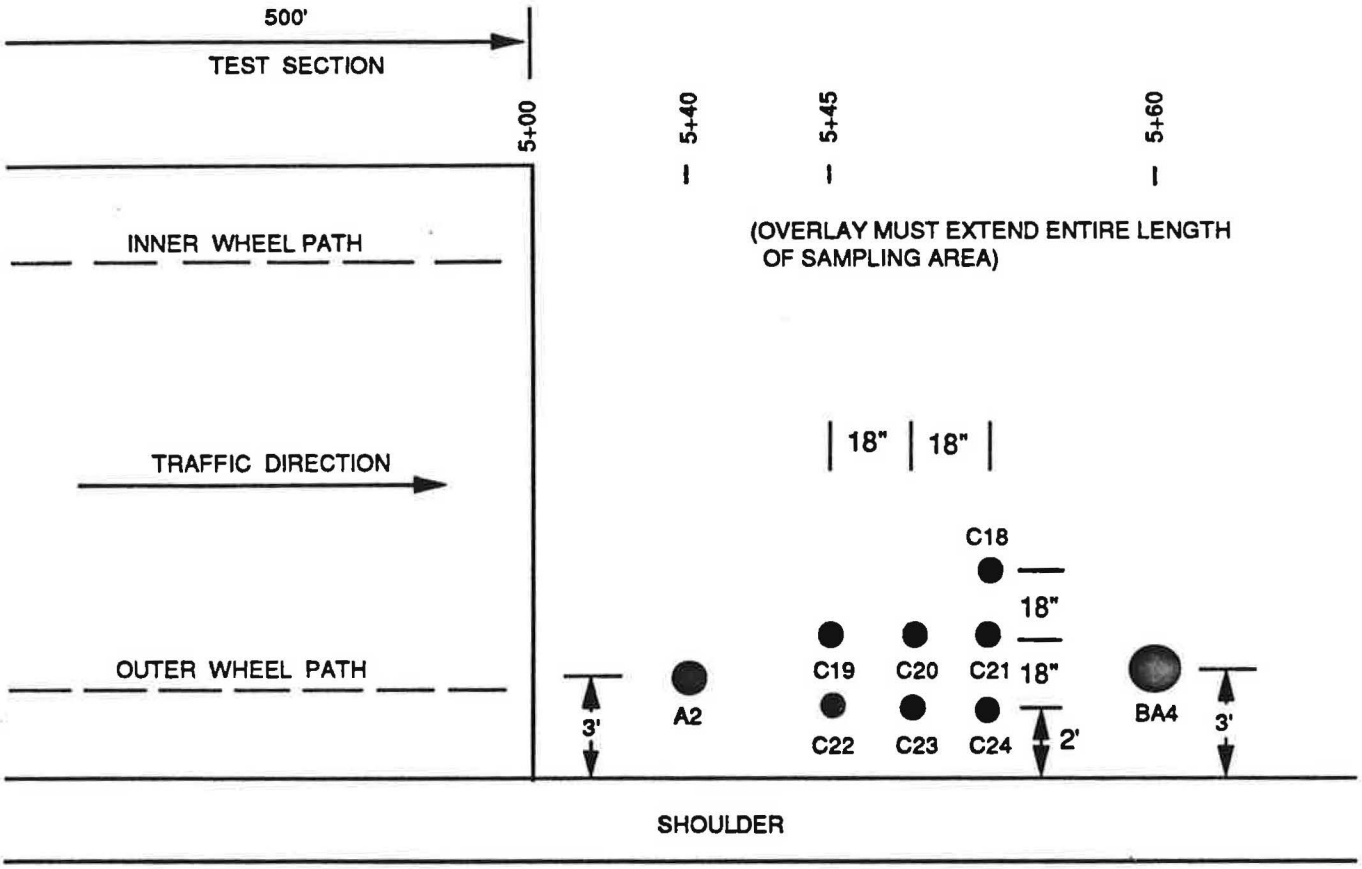


● 4" OD core of AC overlay: C6 - C12

● 6" OD core of AC overlay: A1

● 12" OD core of AC overlay: BA1
(This 12"OD core of AC overlay is not required if about 30 to 50 lbs. of asphaltic concrete mix used in the construction of AC overlay was sampled during construction and shipped to the Regional Laboratory Material Testing Contractor)

Figure B.21. **<u>After Overlay</u> Sampling Point Locations Before Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Alternative Sampling Plans) - Case 2**



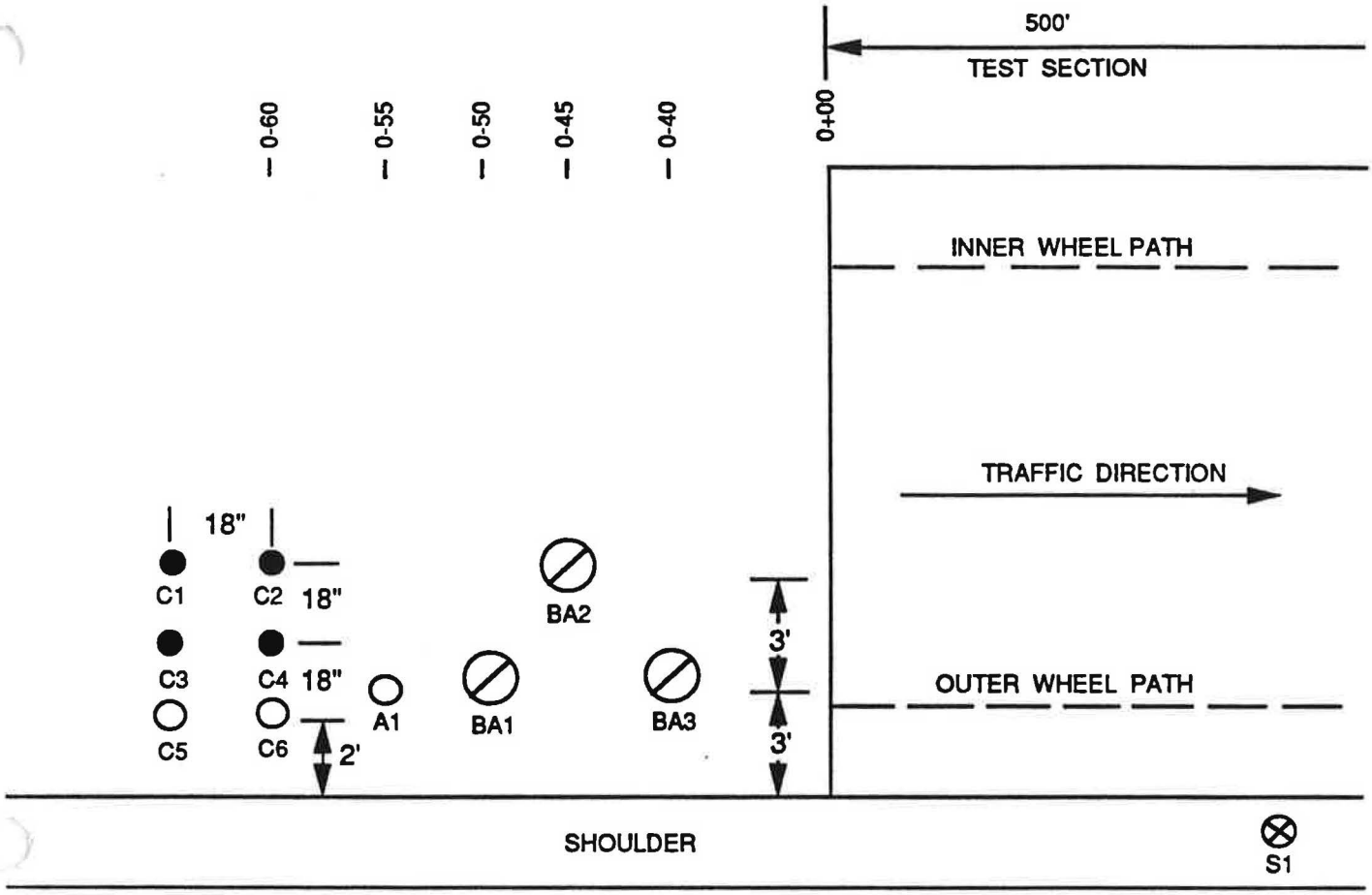
Not to scale

● 4" OD core of AC overlay: C18 - C24

● 6" OD core of AC overlay: A2

● 12" cores of AC overlay: BA4
(This 12" OD core of AC overlay is not required if about 30 to 50 lbs. of asphaltic concrete mix used in the construction of AC overlay was sampled during construction and shipped to the Regional Laboratory Material Testing Contractor).

Figure B.22. <u>After Overlay</u> **Sampling Point Locations After Test Section, GPS-7 Asphalt Concrete Overlay Over Jointed Concrete Pavement (Alternative Sampling Plans) - Case 2**



● 4" OD core of PCC overlay, PCC pavement and treated layers: C1 - C4

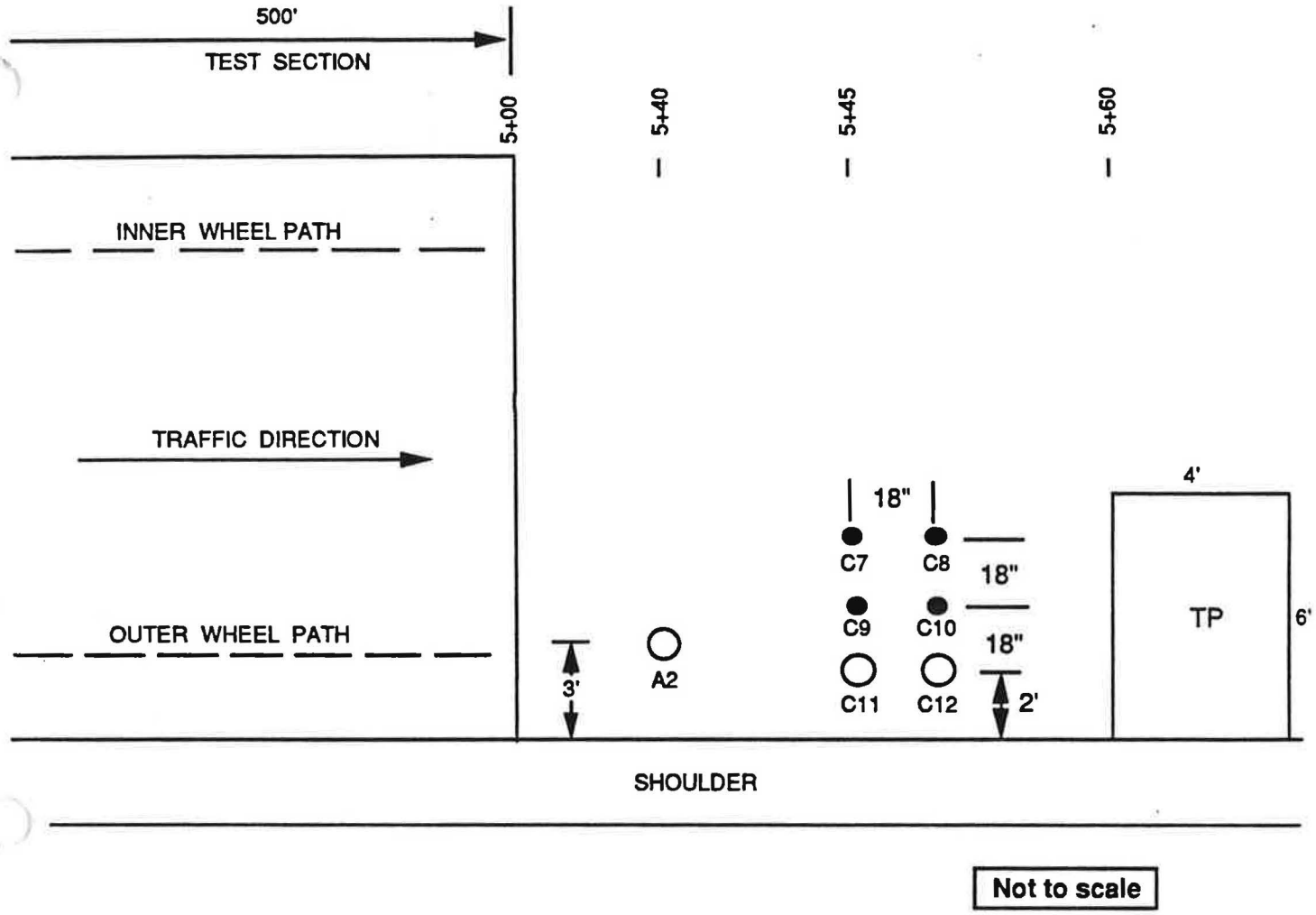
○ 6" OD core of PCC overlay, PCC pavement and treated layers: C5 - C6

○ 6" OD core of PCC overlay, PCC pavement and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of PCC pavement and treated layers; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by authorized SHRP representative: S1

Figure B.23. Sampling Point Locations Before Test Section, GPS-9 Unbonded Jointed Plain Concrete Pavement Overlay Over Concrete Pavement

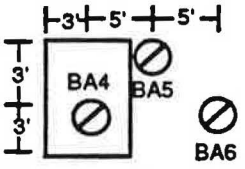


● 4" OD core of PCC overlay, PCC pavement, and treated layers: C7-C10

○ 6" OD core of PCC overlay, PCC pavement, and treated layers: C11-C12

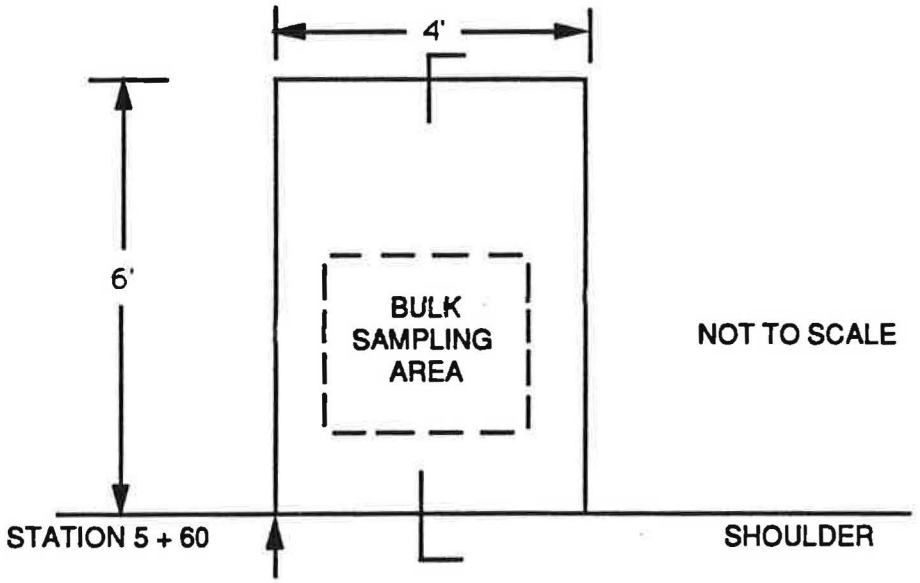
○ 6" OD core of PCC pavement surface and treated layers; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of pavement blocks; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP

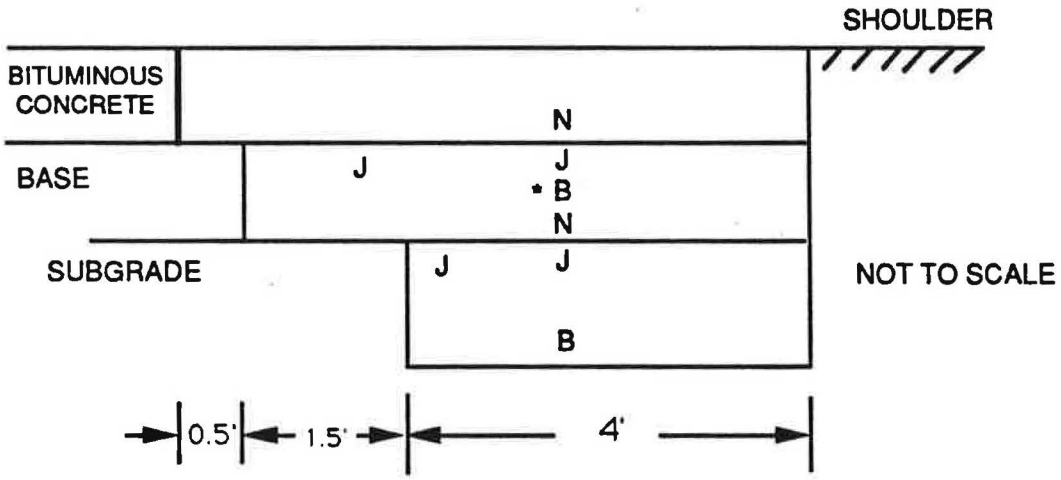


When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples of unbound granular base and subbase and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

Figure B.24. Sampling Point Locations After Test Section, GPS-9 Unbonded Jointed Plain Concrete Pavement Overlay Over Concrete Pavement



PLAN



SECTION

LEGEND

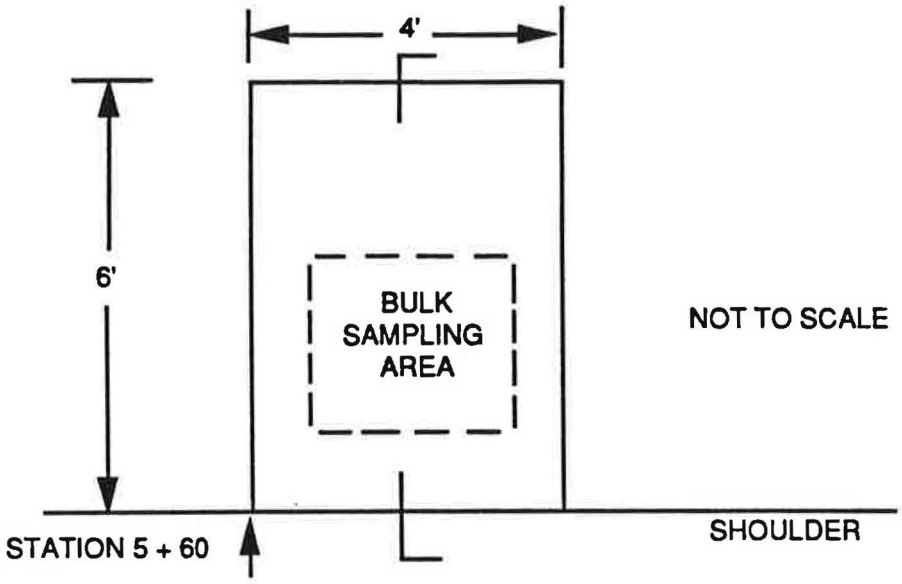
N Nuclear Density and Moisture Measurement (on unbound granular base and subbase and untreated subgrade)

J Jar Moisture Sample

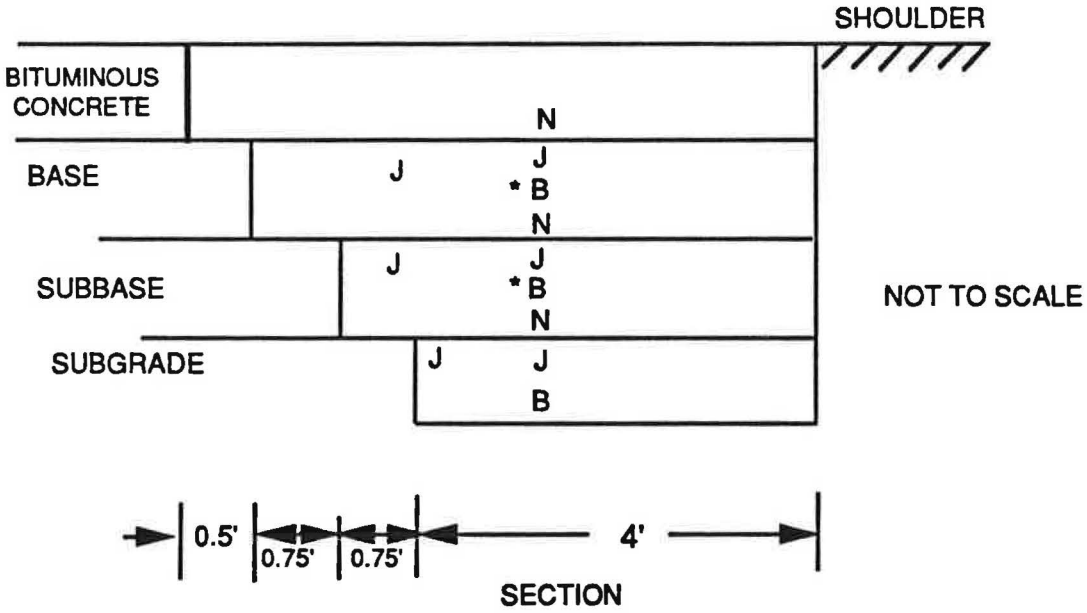
B Bulk Sample

* No Bulk Sample or Moisture Sample required for treated base and subbase (chunks and/or pieces should be retrieved if good intact cores could not be obtained from C-type coreholes.)

Figure B.25. Typical Test Pit Details for GPS-1, GPS-2 and GPS-6 Pavements (No Subbase)



PLAN

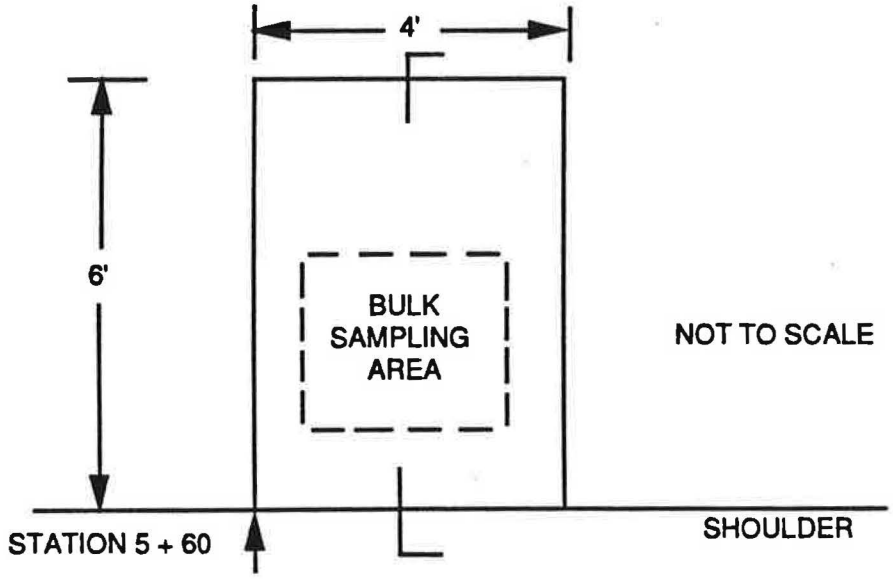


SECTION

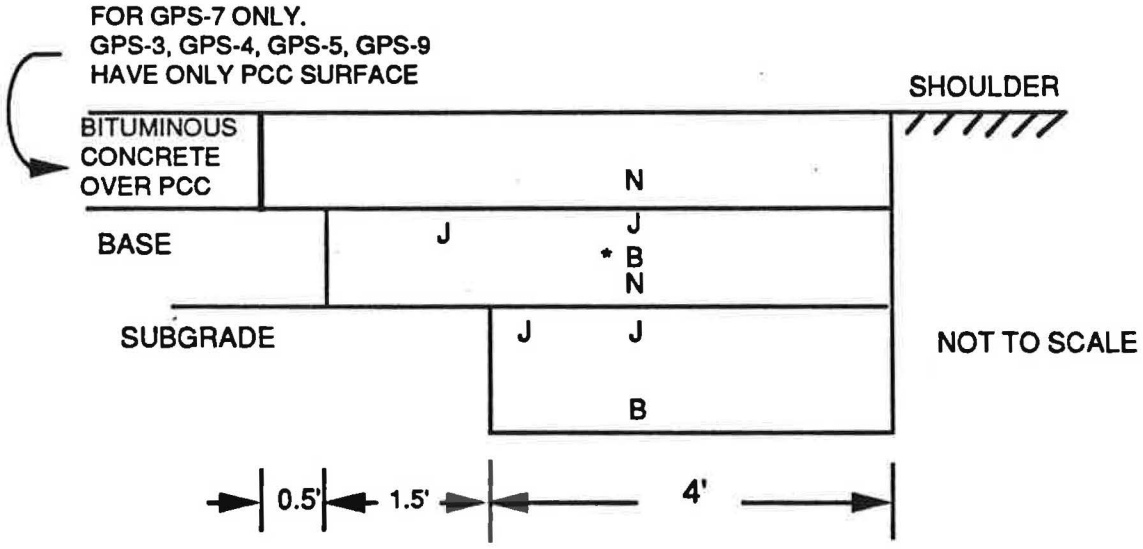
LEGEND

N	Nuclear Density and Moisture Measurement (on unbound granular base and subbase and untreated subgrade)
J	Jar Moisture Sample
B	Bulk Sample
*	No Bulk Sample or Moisture Sample required for treated base and subbase (chunks and/or pieces should be retrieved if good intact cores could not be obtained from C-type coreholes.)

Figure B.26. Typical Test Pit Details for GPS-1, GPS-2 and GPS-6 Pavements - (With Subbase)



PLAN

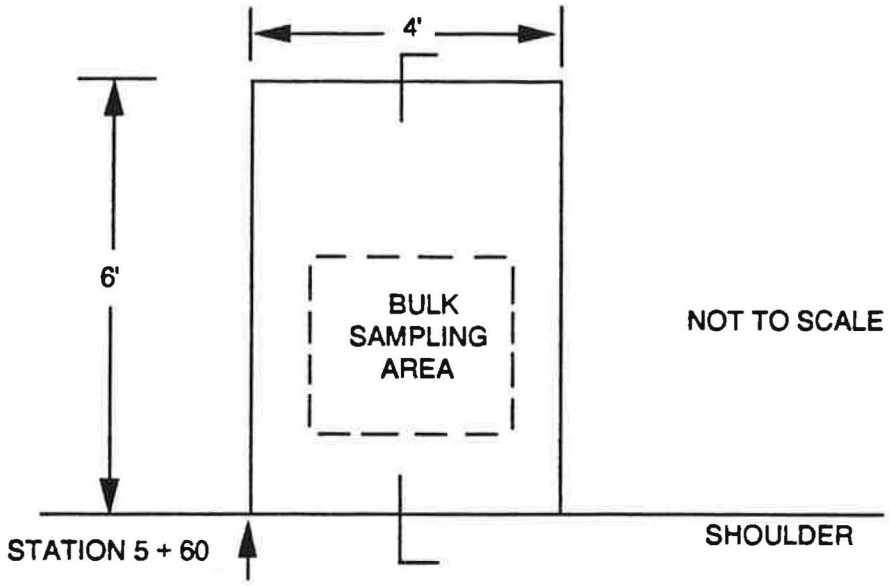


SECTION

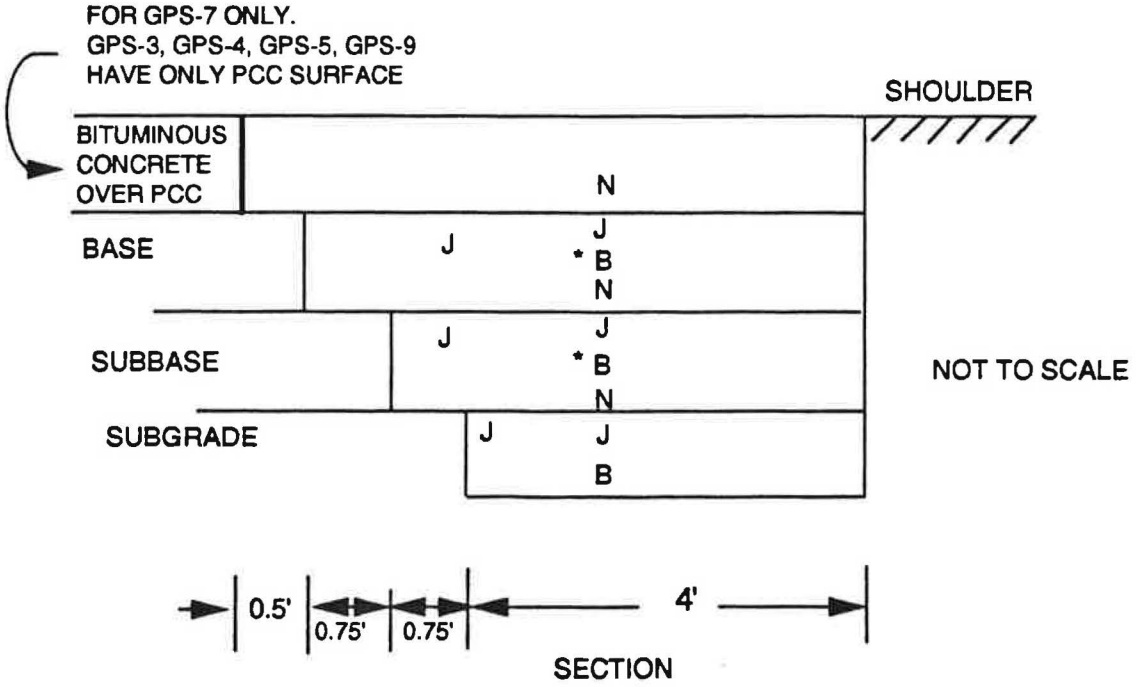
LEGEND

N	Nuclear Density and Moisture Measurement (on unbound granular base and subbase and untreated subgrade)
J	Jar Moisture Sample
B	Bulk Sample
*	No Bulk Sample or Moisture Sample required for treated base and subbase (chunks and/or pieces should be retrieved if good intact cores could not be obtained from C-type coreholes.)

Figure B.27. Typical Test Pit Details for GPS-3, GPS-4, GPS-5, GPS-7 and GPS-9 - (No Subbase)



PLAN



SECTION

LEGEND

N	Nuclear Density and Moisture Measurement (on unbound granular base and subbase and subgrade)
J	Jar Moisture Sample
B	Bulk Sample
*	No Bulk Sample or Moisture Sample required for treated base and subbase (chunks and/or pieces should be retrieved if good intact cores could not be obtained from C-type coreholes.)

Figure B.28. Typical Test Pit Details for GPS-3, GPS-4, GPS-5, GPS-7 and GPS-9 - (With Subbase)

APPENDIX C

SHRP STANDARD FORMS

APPENDIX C: SHRP STANDARD FORMS

This Appendix contains SHRP standard forms required to be used in the field sampling and field testing work. An explanation of various items on these forms is discussed in the following sections.

GENERAL

The SHRP standard forms for field sampling and testing work include; Forms S01 to S07 (required for every pavement section), Forms S08 and S09 (required to accompany NAS invoice voucher), Forms S10 and S11 (required for monitoring work schedule and progress), and Forms S12 to S16 (required attachments to the NAS invoice voucher). Forms S01 to S05 for use in the field work are each assigned a unique sheet number (DCG Sheet No. 01 to 08).

General information about the pavement section contained in Forms S01 to S11 includes:

SHRP REGION: Show one of the four SHRP regions in which the pavement section is located.

STATE: Two letter abbreviation of the state, District of Columbia, Puerto Rico, or the Canadian Province (shown in Table C.1).

STATE CODE: Two-digit code as shown in Table C.1.

SHRP ASSIGNED ID: Six-digit code of the LTPP section.

LTPP EXPERIMENT: One of the eight experiments for GPS pavement sections (or LTPP EXPT) (GPS1, GPS2, GPS3, GPS4, GPS5, GPS6, GPS7, GPS9), as shown in Appendix B.

Table C.1. Table of Standard Codes for States, District of Columbia, Puerto Rico, and Canadian Provinces.
(Based on Table A.1 of the June 13, 1988 revision of the LTPP Data Collection Guide.)

STATE	ABBREVIATION	CODE
Alabama	AL	01
Alaska	AK	02
Arizona	AZ	04
Arkansas	AR	05
California	CA	06
Colorado	CO	08
Connecticut	CT	09
Delaware	DE	10
District of Columbia	DC	11
Florida	FL	12
Georgia	GA	13
Hawaii	HI	15
Idaho	ID	16
Illinois	IL	17
Indiana	IN	18
Iowa	IA	19
Kansas	KS	20
Kentucky	KY	21
Louisiana	LA	22
Maine	ME	23
Maryland	MD	24
Massachusetts	MA	25
Michigan	MI	26
Minnesota	MN	27
Mississippi	MS	28
Missouri	MO	29
Montana	MT	30
Nebraska	NE	31
Nevada	NV	32
New Hampshire	NH	33
New Jersey	NJ	34
New Mexico	NM	35
New York	NY	36
North Carolina	NC	37
North Dakota	ND	38
Ohio	OH	39
Oklahoma	OK	40
Oregon	OR	41
Pennsylvania	PA	42
Rhode Island	RI	44
South Carolina	SC	45
South Dakota	SD	46
Tennessee	TN	47
Texas	TX	48
Utah	UT	49
Vermont	VT	50
Virginia	VA	51
Washington	WA	53
West Virginia	WV	54
Wisconsin	WI	55
Wyoming	WY	56
Puerto Rico	PR	72
Alberta	AB	81
British Columbia	BC	82
Manitoba	MB	83
New Brunswick	NB	84
Newfoundland	NF	85
Nova Scotia	NS	86
Ontario	ON	87
Prince Edward Island	PE	88
Quebec	PQ	89
Saskatchewan	SK	90

Note: The U.S. Codes are consistent with the Federal Information Processing Standards (FIPS) and HPMS

ROUTE/HIGHWAY: Record the proper designation for the route or highway on which drilling and sampling is taking place.

Lane: Record a "1" if sampling occurs on the outside lane and a "2" if sampling occurs on the inside lane. Drilling and sampling shall always occur on the outside lane for the GPS program.

Direction: Record the traffic direction on the route/highway. Use:

E for eastbound traffic direction
W for westbound traffic direction
N for northbound traffic direction
S for southbound traffic direction
NE for a northeastern bound traffic direction
SE for a southeastern bound traffic direction
SW for a southwestern bound traffic direction
NW for a northwestern bound traffic direction.

SAMPLE/TEST: Check (a) if the location is before the beginning of the section (station 0-); check (b) if the location is after the end of the section (station 5+).

FIELD SET NO: Enter 1 for the first round of field sampling and field testing (including Basic GPS Work, extra or deleted during GPS work); enter 2 for the second round of field sampling and testing (after Basic GPS Work).

DRILLER (OPERATOR, ETC.): Record driller's name.

EQUIPMENT: Record the equipment used for the sampling operations.

SHEET NO: All data sheets from the field work on a pavement section should be assigned sequential numbers starting from 1 for the pavement cores at C-type core locations (Form S01A); followed by pavement core logs for A1, A2... and BA1, BA2, BA3... type cores (Form S01); borehole logs for A1, A2... type boreholes (Form S02A) and borehole logs for BA1, BA2, BA3... type boreholes (Form S02B); test pit log (Form S03); test pit log-sketch (Form S03A); in

situ density and moisture test summary (Form S04); shoulder auger probe log (Form S05); material samples inventory (Form S06); summary material samples inventory (Form S06A); project site report (Form S07); and As-Sampled Layout Plans.

If there is too much information for a single sheet for one type of data form, then multiple sheets can be used. The instructions for assembling the completed data sheets for a pavement section are provided in a later section of this Appendix.

DATE: All dates should be recorded as mm-dd-yy. The CORING DATE, BORING DATE, EXPLORATION DATE, TEST DATE, and AUGERING DATE will be used in the LTPP data base. These should be the actual dates of field work.

LOCATION: Location should show "station" as well as the "offset," the distance from the outside shoulder (°/s) in feet. Enter "station" as shown in Appendix B of this Guide (Figures B.1 through B.24). For example: station 0 - 55 for samples from borehole A1 and station 5 + 45 for core samples from core locations C19 and C22. It should also show the distance from the outside shoulder; for example, 3 feet from °/s on the bore log for A2 indicates that A2 was 3 feet from the outside shoulder.

CORE HOLE NUMBER,

BORE HOLE NUMBER,

AUGER PROBE NUMBER: Explanation pertains to all three items above. Enter on Forms S01, S01A, S02A, S02B and S05 as appropriate. These numbers relate to sample locations, as shown in Appendix B of this Guide (Figures B.1 to B.24). These numbers are important to record on these data sheets and on Form S06, along with the sample code for appropriate sample identification.

TEST PIT NUMBER: Enter on Forms S03, S03A and S04. "TP" will generally be entered as shown in Appendix B of this Guide (Figures B.1 to B.24). If a second test pit is excavated, then that should be recorded as "TP2."

SCALE: Use inches, to the nearest tenth of an inch, on Forms S01 to S04. On Form S05, use feet to the nearest tenth of a foot.

MATERIAL CODE,

MATERIAL DESCRIPTION: Table C.2 has been prepared to record material descriptions and codes in the field. For use in the field, Table C.2 has been deliberately condensed from the detailed SHRP terminology for pavements, pavement materials and soils described in Appendix D of the SHRP-LTPP Guide for Laboratory Material Handling and Testing. Table C.2 contains: (a) codes for pavement surface material types, (b) codes for unbound base/subbase material types, (c) codes for bound base/subbase material types, and (d) codes for subgrade soil types.

General categories for subgrade soils and selected soil types in some of these categories are provided in (d) of Table C.2. For example, the code for the general category of treated soil (treated or stabilized subgrade) is 180. If the field technician/driller is reasonably sure that he has encountered bituminous treated soil then he should use code 183 instead of using 180. Similarly, the overall code for clay is 101. In addition to code 101, five more codes are included in this category. The driller would record code 101 on the borehole log for a clay soil. However, if he is reasonably certain that the soil can be classified in more detail such as silty clay (code 131) or sandy clay (code 113), he should use these codes in place of code 101.

Detailed material descriptions and codes for pavement materials and soils will be assigned in the regional material testing laboratories using Appendix D of the SHRP-LTPP Guide for Laboratory Materials Handling and Testing in conjunction with appropriate laboratory tests and detailed observations.

Further instructions specific to various forms are given in the following sections.

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field.

DESCRIPTION	CODE
(a) Pavement Surface Material Type	
Asphaltic Concrete (AC)	700
HMAC (hot-mix, hot laid asphaltic concrete is a mixture of heated coarse and fine aggregate or fine aggregate alone, with or without mineral filler, uniformly mixed with asphalt cement. Typically HMAC material is produced in an asphalt plant or drum mixer and laid hot at the paving site for asphaltic concrete surface, wearing, binder and bituminous base courses.	
Portland Cement Concrete (PCC)	730
A general term that describes portland cement concrete layers. Code 730 should be used for all PCC surface types (JPCP, JRCP or CRCP).	
(b) Unbound Base/Subbase Material Type	
Gravel (Uncrushed)	302
The product resulting from screening and blending of material from a natural deposit, consisting of mainly gravel and sand size particles with little or no fines. The product may include some fractured particles resulting from crushing oversize material. The material should have less than 70 percent passing the #10 sieve and less than 15 percent passing the #200 sieve as determined by field inspection and judgement.	
Crushed Stone	303
A product consisting of mainly gravel and sand size particles resulting from the artificial crushing of rock, boulders or large cobbles. All or most of the gravel and larger sand size particles should have fractured faces. The material should have less than 70 percent passing the #10 sieve and less than 15 percent passing the #200 sieve as determined by field inspection and judgement.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(b) Unbound Base/Subbase Material Type (continued)	
Crushed Gravel	304
A product consisting of mainly gravel and sand size particles resulting from the crushing of gravel with a requirement that at least a prescribed percentage of the resulting particles have fractured faces. Some uncrushed particles may be present. The material should have less than 70 percent passing the #10 sieve and less than 15 percent passing the #200 sieve as determined by field inspection and judgement.	
Sand Base	306
A product consisting of mainly sand size aggregates with little or no gravel or fines. The material should have more than 70 percent passing the #10 sieve and less than 15 percent passing the #200 sieve as determined by field inspection and judgement.	
Soil-Aggregate Mixture (Predominantly Fine-Grained)	307
Natural or prepared mixture of fine-grained soil with a percentage of aggregates included in the mixture. The material meets the criteria if, by field inspection and judgement, less than 70 percent passes the No. 10 sieve and more than 35 percent passes the #200 sieve. If by field judgement, more than 70 percent passes the No. 10 sieve, the material should be classified as a soil, not a soil-aggregate mixture.	
Soil-Aggregate Mixture (Predominately Coarse-Grained)	308
Natural or prepared mixtures of coarse-grained soils with a percentage of aggregates included in the mixture. The material meets the criteria if, by field inspection and judgement, less than 70 percent passes the No. 10 sieve and less than 35 percent passes the #200 sieve. If, by field judgement, more than 70 percent passes the No. 10 sieve, the material should be classified as a soil, not a soil-aggregate material.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(c) Bound Base/Subbase Material Type	
Asphalt Treated Mixture	321
Also called Asphalt Treated Base (ATB or Black Base), this is a general term used for all types of bituminous treated material with the exception of HMAC material code 700.	
Cement Aggregate Mixture	331
Also called Cement-Treated Base (CTB), this is a mixture of aggregate and soil binder treated with portland cement and is used as base or subbase to increase the stability of the pavement structure. Typically, approximately 4 percent to 8 percent portland cement is used to achieve a specified minimum value of compressive strength.	
Econocrete	332
A portland cement concrete mixture made with marginal aggregate and a relatively low cement content.	
Lean Concrete	334
Also called Lean-Concrete Base (LCB), this is a portland cement concrete mixture with a relatively low cement content.	
Sand-shell Mixture	336
A mixture of sandy material and shell fragment or material used in the subbase or base course or a mixture of processed shell blended with predominantly coarse-grained soil.	
Lime-Treated Soil	338
The addition of lime to soil (usually fine-grained) which results in decreased soil density, changes in the plasticity properties of the soil and increased soil strength.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(c) Bound Base/Subbase Material Type (continued)	
Soil Cement	339
Soil (generally granular soil) bound by portland cement to produce a hardened soil-cement mixture with a requirement for minimum compressive strength. Soil cement usually has a higher cement content than that used in cement-treated soil.	
Other	350
Specify if possible or use the term unknown.	
(d) Subgrade Soil Type	
Clay	101
A fine grained soil with more than 85 percent passing the #200 (0.075 mm) sieve as determined by field inspection and judgement that can be made to exhibit plasticity (putty like properties) within a range of water contents, and that exhibits considerable strength when air-dry.	
Clay may be further classified according to the percent of sand and or gravel in the test sample.	
Clay with Gravel	104
A predominantly fine-grained soil with less than 30 percent but more than 15 percent retained on the #200 sieve as determined by field inspection and judgement. The material retained on the #200 sieve is predominantly gravel.	
Clay with Sand	107
A predominantly fine-grained soil with less than 30 percent but more than 15 percent retained on the #200 sieve as determined by field inspection and judgement. The material retained on the #200 sieve is predominantly sand.	
Gravelly Clay	110
A predominantly fine-grained soil with more than 30 percent retained on the #200 sieve as determined by field inspection and judgement. The material retained on the #200 sieve is predominantly gravel.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(d) Subgrade Soil Type (continued)	
Sandy Clay	113
A predominantly fine-grained soil with more than 30 percent retained on the #200 sieve as determined by field inspection and judgement. The material retained on the #200 sieve is predominantly sand.	
Silty Clay	131
Combined silt and clay. For material passing approximately 85 percent or more on the 0.075 mm (#200) sieve as determined by field inspection and judgement.	
Silt	141
A predominantly fine-grained soil passing the #200 sieve (0.075 mm) sieve that is non-plastic or very slightly plastic and that exhibits little or no strength when air dry.	
Silt may be further classified according to the percent of sand and/or gravel in the test sample.	
Silt with Gravel	142
Approximately less than 30 percent but more than 15 percent retained on the #200 sieve and which is predominantly gravel as determined by field inspection and judgement.	
Gravelly Silt	143
Gravel is predominant in the fraction of 30 percent or more of the test sample retained on the #200 sieve as determined by field inspection and judgement.	
Sandy Silt	144
Sand is predominant in the fraction of 30 percent or more of the test sample retained on the #200 sieve as determined by field inspection and judgement.	
Clayey Silt	148
A silt soil containing some clay material with slight plasticity.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(d) Subgrade Soil Type (continued)	
Peat	151
A sample that is primarily composed of organic material that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as a peat.	
Treated Soil	180
For the LTPP-GPS Study, a treated subgrade soil is considered a treated subbase layer. Material code 180 indicates a general term for treated subgrade soils.	
Lime-Treated Soil	181
The addition of lime to the soil which results in decreased soil density, changes in plasticity properties of the soil and increased soil strength.	
Cement-Treated Soil	182
The addition of cement to the soil to improve the plasticity properties of the soil and its load carrying capacity.	
Bituminous Treated Subgrade Soil	183
The soil treated with bituminous materials to improve the soil strength. This does not include HMAC layers.	
Sand	201
Granular material resulting from the disintegration, grinding, or crushing of rock which will pass the #10 sieve and be retained on the #200 sieve.	
Poorly Graded Sand	202
Predominantly one size or a range of sizes of sand with some intermediate sizes missing and 5 percent or less fines.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(d) Subgrade Soil Type (continued)	
Silty Sand	214
Sands with approximately 15 percent or more fines passing the #200 sieve having low or no plasticity and less than 15 percent gravel as determined by field inspection and judgement.	
Clayey Sand	216
Sands with approximately less than 15 percent gravel and 15 percent or more fines passing the #200 sieve that are more clay-like and that range in plasticity from low to high as determined by field inspection and judgement.	
Gravel	251
Rounded particles of rock which will approximately pass the 3 inch sieve and be retained on a No. 10 sieve as determined by field inspection and judgement.	
Poorly Graded Gravel	252
Poorly graded gravels, gravel-sand mixtures, little or no fines. Predominantly one size or a range of sizes with some intermediate sizes missing.	
Silty Gravel	264
Gravel with 15 percent or more fines passing the #200 sieve having low or no plasticity and less than 15 percent sand.	
Clayey Gravel	266
Gravelly soils with approximately 15 percent more fines passing the #200 sieve that are more clay-like and that range in plasticity from low to high and less than 15 percent sand.	

Table C.2. Summary of SHRP Terminology for Describing Pavements, Pavement Materials and Soils in the Field (continued).

DESCRIPTION	CODE
(d) Subgrade Soil Type (continued)	
Shale	281
Gray, black, reddish or green rock which in fine-grained and composed of, or derived by erosion of sedimentary silts or clays, or of any type of rock that contains clay. The cleavage surfaces of shales are generally dull and earthy. Shale may convert to soil after field and/or laboratory processing (crushing, slaking, etc.).	
Rock	282
Natural solid mineral matter occurring in large masses or fragments. The same code may be used for materials used in rock fill.	
Boulder	284
Particles of rock that will not pass a 12-in. square opening as determined by field inspection.	

FORM S01- LOG OF PAVEMENT CORE (ONLY FOR USE AT BOREHOLE LOCATIONS)

Use Form S01 to log pavement cores taken at the borehole locations. Use the core sample coding system given in Section 3 of the Guide for numbering cores. The core hole number as shown in Appendix B of this Guide (Figures B.1 to B.24) and size (inch, diameter) are also important data elements. Depth should be measured from the pavement surface to the bottom of the core of each layer and recorded to the nearest tenth of an inch. Core thickness, to the nearest tenth of an inch, should be shown in either the "Core Drilled" or "Core Recovered" columns.

FORM S01A - LOG OF PAVEMENT CORES (ONLY FOR USE AT C-TYPE CORE LOCATIONS)

Use Form S01A to log 4 inch and 6 inch diameter pavement cores extracted from C-type core locations. Use the core sample coding system given in Section 3 of this Guide for numbering cores. Each sheet can be used to record cores taken from six different core hole locations. Multiple sheets should be used to record all 4 and 6 inch cores from a pavement section.

Each of the six data columns should be used to record information for all cores extracted from one core hole. The first left hand column of the first sheet of S01A should always start with the lowest numbered core hole location (either C1 or C6 depending on the GPS experiment). Other information related to the core hole number includes; Location (enter (a) "station" and (b) "offset" for the location of each core hole) and Core Drilled and Recovered (cross out the "no" if the core was successfully drilled and recovered). If "Yes" is deleted (i.e., the core was <u>not</u> recovered), then enter the replacement core number. In this case, any core taken from the first location (for example C1) should be discarded and related information under the first location column crossed-out. Only the replacement core location (C1A) and all cores taken from C1A should be recorded in the next column.

Space is provided to record cores for 4 layers from one core hole. The pavement surface layer core should be recorded first, followed by other layers in the column.

Enter the following information for each core taken from a single core hole.

CORE SIZE (Inch Diameter): Delete either 4 or 6 as appropriate.

CORE SAMPLE NO.: Enter the correct sample code following the sample coding system described in Section 3 of this Guide.

DEPTH (Inches): "Depth" should be measured from the pavement surface to the bottom of the core and recorded to the nearest tenth of an inch.

MATERIAL DESCRIPTION: Enter the appropriate material description based on Table C.2 in this Appendix.

MATERIAL CODE: Enter the appropriate code from Table C.2 for the described material type.

FORM S02A - LOG OF BOREHOLE (A-TYPE)

This form (Form S02A) is designed to record logs of boreholes A1 and A2 and any other similar type sampling areas. The following data is to be recorded on this form.

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

STRATA CHANGED: 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. A line shall be drawn across the form which indicates the strata changes.

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 42 inches, a line should be drawn at the 18 inch mark and the 42 inch mark along with the appropriate sample code number, material description, etc. See example data sheets for further understanding.

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

NOTE: 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.

BLOWS-LEFT COLUMN: Record the blow count from the first 6 inches of seating penetration by the splitspoon sampler ("A" from above example of blow count record).

If the splitspoon sampler is "refused" (advances less than one inch with 100 blows or the test is aborted at the discretion of the SHRP Authorized Representative to avoid damage to the splitspoon sampler), indicate the blow count to refusal in this 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 a blow count of 100 is reached on or before penetrating this 6 inch depth, the sampling may be stopped and the distance penetrated, measured to the nearest tenth of an inch, recorded in the *IOP* column.

BLOWS-MIDDLE COLUMN: Record the blow count from the second 6 inches of penetration by the splitspoon sampler ("B" from above example of blow count record).

If the splitspoon is refused during the second 6 inches of penetration, indicate the blow count to refusal in this 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 this 6 inch increment is reached, the splitspoon sampling procedure should be stopped and the blow count for this 6 inch increment should be recorded in this 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.)

BLOWS-RIGHT COLUMN: Record the blow count from the third 6 inches of penetration by the splitspoon sampler ("C" from above example of blow count record).

In the case of refusal during this 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 blow count ("B" + "C" only) reaches 100 before this 6 inch increment is reached, the splitspoon sampling procedure should be stopped and the blow count for this 6 inch increment recorded in this column. 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).

The *# Blows* column is only used if a splitspoon sampler is utilized.

REFUSAL: Record a "Y" if splitspoon sampler is refused (see ***# Blows*** column for further explanation and examples). 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 occurs when the splitspoon sampler advances less than one inch with 100 blows or when the test is aborted at the discretion of the SHRP Authorized 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"). This column is only used if a splitspoon sampler is utilized.

FORM S02B - LOG OF BOREHOLE (BA-TYPE)

This form (S02B) is designed to record logs of boreholes BA1, BA2 and BA3 and any other similar type sampling areas. The following information is to be recorded on this form:

STRATA CHANGED: 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. A line shall be drawn across the form which indicates the strata changes.

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

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

FORM S03 - LOG OF TEST PIT

This form (Form S03) is designed to record data from the field sampling and field testing of test pit TP1 and any other similar test pits. The following data is to be recorded on this form:

TEST PIT SIZE: Record the size of the test pit in feet to the nearest half of a foot.

STRATA CHANGED: 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. A line shall be drawn across the form which indicates the 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 different unbound pavement layers and the subgrade.

FORM S03A - LOG OF TEST PIT (SKETCH)

Form S03A is designed to allow the field sampling personnel a proper form to record any sketches of the excavation of the test pit that may be appropriate. This sketch should at least include: (a) dimensions of the test pit; (b) depth of each layer in the test pit; (c) material type of each layer and (d) the direction of traffic marked with an arrow in the direction of traffic. See the example completed field data packet contained in Appendix E of this Guide for an example of how to complete this form.

FORM S04 - IN SITU DENSITY AND MOISTURE TESTS

This form (Form S04) is designed to record data from the in situ density and moisture tests performed on all unbound layers in the test pit, TP1, and other similar test pits. The following data is to be recorded on this form.

OPERATOR: Record nuclear density gauge operators name.

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

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 this Guide. 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 Form S03 for each unbound granular layer. Record to the nearest tenth of an inch and measure from the top of the pavement surface.

TEST TYPE: These columns are used to designate unbound layers. If there are more than three unbound layers, use two or more data sheets. In this case, cross out the "SUBGRADE" designation and write over the "BASE" or "SUBBASE" as needed. The data for the subgrade should be the last entry recorded on the form. If there are less than three unbound layers, cross out the column which does not contain any information.

MATERIAL TYPE: Report a "G" if the material is unbound; record "T" if the material is other than unbound. Theoretically, all entries should be a "G".

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

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

AASHTO T238-86 METHOD (A,B,C): Record the method which was used to perform the in situ density test as per AASHTO T238-86 as follows:

"A" - Backscatter
"B" - Direct Transmission
"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, INCHES: Record the depth of the nuclear density gauge probe to the nearest tenth of an inch.

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

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

FORM S05 - LOG OF SHOULDER PROBE

The following results of the shoulder auger probe should be entered on Form S05.

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, record the type of observation.

DEPTH FROM SURFACE (FEET): Record the depths of strata changes to the nearest tenth of a foot.

REFUSAL WITHIN 20 FEET (Y/N): Record a "yes" or a "no" as appropriate.

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

FORM S06 - MATERIAL SAMPLES INVENTORY FOR SHIPMENT TO LABORATORY

A detailed inventory of material samples for shipment to the regional laboratory and PCC testing laboratory is made on this form. The inventory should be made in the following sequence of sample location numbers (starting from pavement surface layer in each case).

1. Samples from C-type locations, starting from cores of pavement surface layers.
2. Samples from boreholes A1, A2, and any additional similar boreholes.
3. Samples from boreholes BA1, BA2, BA3, and any additional similar boreholes.
4. Samples from the test pit.

Sample location numbers and sample numbers should be obtained from Forms S01A, S01, S02A, S02B and S03. "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." In the case of cores, only diameter is shown in inches in the "Sample size" column.

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. Typically, samples will include:

- o All AC cores from C-type locations, A1 and A2, and BA1.
- o All PCC cores from C-type location, A1 and A2.
- o All treated base/subbase cores (including ATB, CTB and econocrete) of 4 inch diameter from C-type locations.
- o Block samples of AC layer and treated material as applicable.
- o Bulk samples and jar samples of granular (untreated) layers and subgrade from BA1, BA2, BA3 and the test pit, TP.
- o Thin-walled tube samples and splitspoon samples from the subgrade.

FORM S06A - SUMMARY MATERIAL SAMPLES INVENTORY FOR SHIPMENT TO LABORATORY

This form provides a summary using information from Form S06 for all samples collected from the pavement section for shipment to the regional material testing laboratory and national PCC testing laboratory. A layer number is assigned from bottom to top. Enter layer number in the left hand column, starting with layer number 1 for the subgrade and increasing layer number with the next layer. The last layer number should be assigned to the pavement surface layer. A description of the pavement layer material and sample type is provided in the next column on the right, followed by total number of samples, as indicated on the form.

The total number of AC cores for shipment should includes two 12-inch diameter and two 6-inch diameter cores from the borehole locations, and other cores of 4-inch diameter. PCC cores include 4-inch and 6-inch diameter cores only. Enter total number of bound base and subbase cores of 4-inch diameter on the form. Enter total number of bags of bulk samples and jar samples for moisture content testing for unbound base layer, unbound subbase layer, and the

subgrade. The total number of thin-walled tubes and splitspoon jar samples should also be entered for the subgrade.

FORM S07 - PROJECT SITE REPORT

This is an important data sheet that documents many items for verification by the SHRP Authorized Representative and it is also required to support the invoice. Enter the crew size and the names of the Crew Chief, Head Driller, SHA Representative, and SHRP Authorized Representative on the spaces provided on the form. Record weather conditions and equipment breakdowns as shown on the form and other incidences in the "General Remarks." Enter special work hours (night and weekend work, holiday work, "extra" regular hours, standby time and overtime) as authorized by the SHRP Authorized Representative, in appropriate places.

A summary of the work is entered in the "Work Program" portion of this form. Enter a check mark in (a) with a list of optional items if Basic GPS work is performed on the section. Indicate any extra items during Basic GPS in (b). List any deleted items during Basic GPS in (c). Use (d) to enter those items related to After Basic GPS work in accordance with Schedule C. All other types of SHRP work should be indicated in (e). Name the organization, subcontract or other arrangement that provided test pit excavation, patching, traffic control, etc. in appropriate places. Enter the name of the laboratory where samples will be shipped along with the sample material type(s), and approximate shipping weight. Enter "unknown" if the sample shipping weight can not be estimated.

FORM S08 - SUMMARY OF APPROVED WORK

All approved work performed by the contractor is summarized on this form. It must accompany the NAS invoice voucher. Enter a summary of all approved work (including Basic GPS work and other categories, as indicated) on this form during the period for which an invoice will be prepared by the Drilling and Sampling Contractor. A summary of work performed on each of the pavement sections is provided on this form. A summary of special work items from Form S07 for a given site (regular "extra" hours if any, standby time, overtime, night and weekend

hours, and holiday hours) should also be entered for each SHRP pavement section. Total sample shipping weight is also entered for each pavement section.

FORM S09 - SUMMARY OF APPROVED TRAVEL

All approved travel during the period of work that is documented in Form S08 must also accompany the NAS invoice voucher. For an approved schedule of work, one or more of the following travel mileage items are entered on this form: (a) travel from the contractor's headquarters to the first site (mobilization), (b) travel from the first site to the second site, from the second site to the third site, and so on..., (c) travel from the last site to the headquarters of the Contractor (demobilization).

In each case, the travel mileage should be based on the mileage registered by the drill rig truck, (or other arrangements made between the drilling and sampling contractor and the SHRP Regional Engineer) and verified and approved by the SHRP Authorized Representative.

FORM S10 - Four Week Schedule

The four week schedule must be submitted to the SHRP Authorized Representative/SHRP Regional Engineer and approved before commencing travel to the designated sites. The information required on this form is self-explanatory. This schedule should be resubmitted every week. It will be a weekly update of the planned four week schedule.

FORM S11 - WEEKLY PROGRESS REPORT

This is the weekly progress report form which must be submitted to the SHRP Regional Engineer/RCOC. It is used for monitoring the Regional Drilling and Sampling Contractor's work and progress with respect to the scheduled work. The information required on this form is self-explanatory.

FORMS S12 - S16 (ATTACHMENTS TO NAS INVOICE VOUCHER)

Use these forms to record the quantities of field material sampling and field testing work performed during the period for which an invoice is prepared by the Regional Drilling and Sampling Contractor. These forms are based on the contract fee schedules as described below.

- Form S12 NAS Invoice Voucher Attachment A (Based on Fee Schedule A - Basic GPS Work)
- Form S13 NAS Invoice Voucher Attachment B1 (Based on Fee Schedule B - Extra During Basic GPS Work)
- Form S14A NAS Invoice Voucher Attachment B2 (Based on Fee Schedule B - Extra During Basic GPS Work
- Form S14B NAS Invoice Voucher Attachment B3 (Based on Fee Schedule B - Extra During GPS Work)
- Form S15A NAS Invoice Voucher Attachment B4 (Based on Fee Schedule B - Deleted During Basic GPS Work)
- Form S15B NAS Invoice Voucher Attachment B5 (Based on Fee Schedule B - Deleted During Basic GPS Work)
- Form S16A NAS Invoice Voucher Attachment C1 (Based on Fee Schedule C - Extra After Basic GPS)
- Form S16B NAS Invoice Voucher Attachment C2 (Based on Fee Schedule C - Extra After Basic GPS Work)
- Form XXX - NAS Invoice Voucher Attachment X (To be developed by SRE for other work, such as SPS work).

These forms are included in this Appendix for information purposes. The forms are to be used by the Contractor's office for preparing invoices to SHRP of completed and approved work.

ASSEMBLY OF DATA SHEETS FROM EACH SITE AND TRANSMITTAL

Assembly

The following is an explanation of the standard format that will be used for the assembly of the data sheets from one SHRP pavement test section. The order in which the forms appear below will be their position from bottom to top of the final assembled packet with Form S01A as the bottom page, as illustrated in Figure C.1.

- Form S01A is used to log C-type core samples with up to six cores per page. These forms will be arranged so that the core numbers will increase from last page to the next page. For example, for GPS 3, the core numbers range from C1 to C12 and, therefore, the last page would be cores C1 - C6, the next to the last page would contain cores C7 - C12 and so on.

- Form S01 is used to log pavement cores from boreholes A1, A2 and BA1, BA2, BA3 and any additional, similar boreholes. It should be directly on top of any S01A forms in the final assembled packet. All core information from one borehole should fit on one sheet. The pages should be arranged with the lower numbered boreholes placed behind the higher numbered ones (for example, in the order of BA3, BA2, BA1, and A2, A1 where BA3 is the top sheet and A1 is at the bottom).

- Form S02B is used to log BA.. type boreholes. These sheets should be placed directly on top of any S01 forms in the data packet. If more than one S02B form is needed, the lower numbered borehole location should be placed behind the higher numbered BA.. type forms.

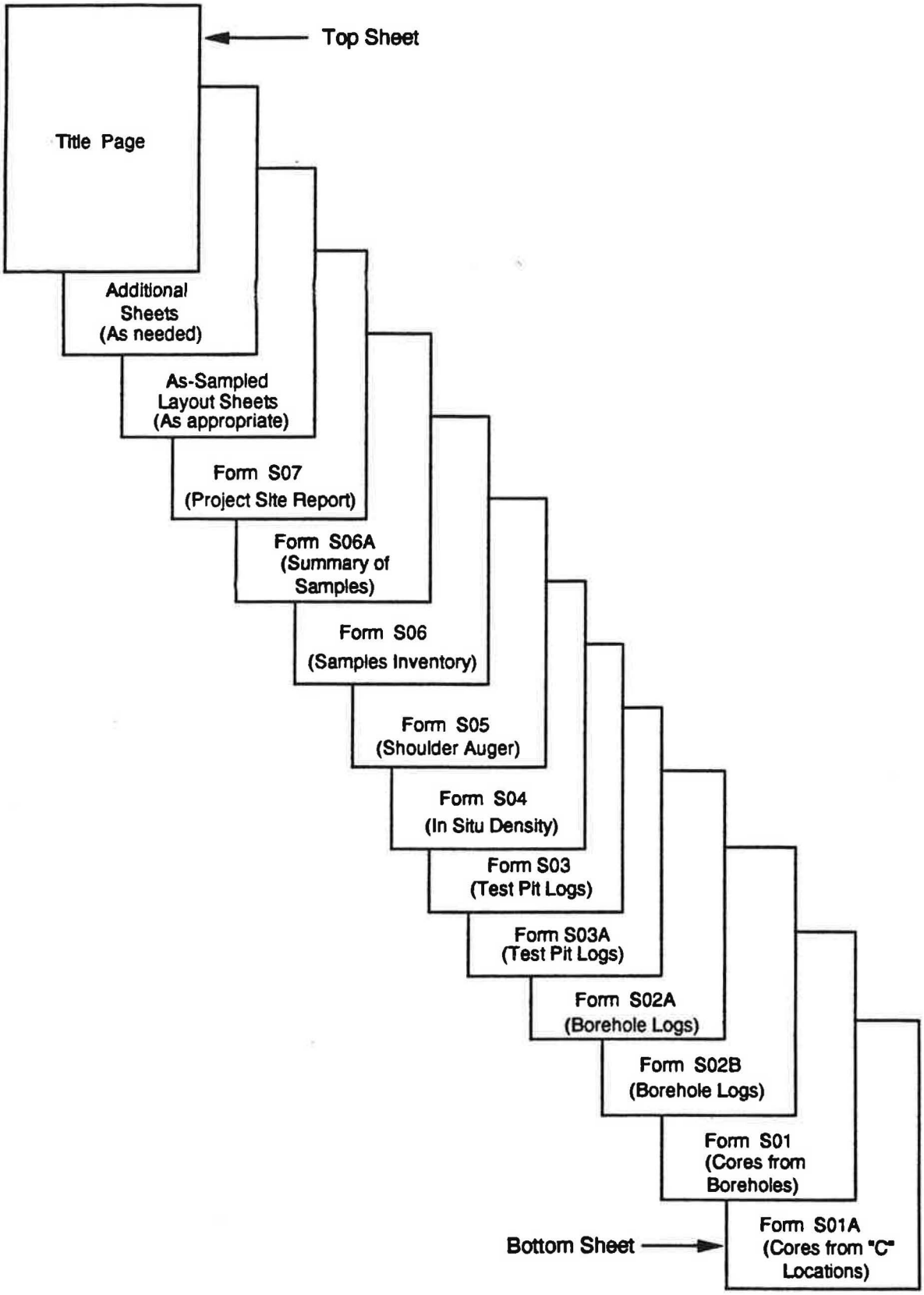


Figure C.1. Illustration of Assembly of Sampling and Testing Forms for One Site.

- Form S02A is used to log boreholes A1 and A2. It should be directly on top of any S02B forms in the final assembled packet. Also, if more than one S02A form is needed, the lower numbered borehole (A1) should be placed behind the higher numbered A-type boreholes.

- Form S03A should be placed in front of Form S02A and behind Form S03.

- Form S03 is used to log the test pit information. It should be placed in front of Form S03A and behind Form S04 in the final assembled packet.

- Form S04 is used to log the density/moisture information of the SHRP pavement test section. It should be placed in front of Form S03 and behind Form S05 in the final assembled packet.

- Form S05 is used to log the auger probe(s) for the SHRP pavement test section. This should be placed in front of Form S04 and behind Form S06. In the case of two auger probes, (i.e. S1 and S2) S2 should be placed before S1 in the packet.

- Form S06 is a material samples inventory which is used to log each individual sample that will be shipped to the laboratory. Form S06 should be placed in front of Form S05 and behind Form S07 in the final packet. In addition, because there will be more than one of these forms for each site, they should be ordered in the exact same manner as these forms are ordered. Thus the first Form S06 should start with the C1 and the last Form S06 should end with the test pit entries. These forms should then be placed with the first Form S06 (i.e. the form starting with C1) placed behind the other and so on. So the top page of these forms in the packet should have the test pit entries.

- Form S06A is the Summary of the Material Samples Inventory. Form S06A should be placed before Form S06 and behind Form S07 in the packet.

- Form S07 is the Project Site Report for the SHRP test section. It should be placed before Form S06A and behind the As-Sampled Layout Plan sheets in the final packet.

- The next sheets are the As-Sampled Layout Plan(s). Depending on the GPS experiment type, two of the figures should be selected from Figures B.1 - B.24 of this Guide (i.e. Figures B.1 and B.2 for GPS 1 or Figures B.3 and B.4 for GPS 2 etc.). These layout plans should then be placed before Form S07 and after the additional sheets in the packet. The left side of the As-Sampled Layout Plan should be placed in front of the right side (odd numbered figure before the even numbered figure). Also, any additional sheets may be placed in front of the As-Sampled Layout Plan as needed.

- The title page (to be provided by the Drilling and Sampling Contractor) will be the first top sheet of the packet and it will include the following:

  1 - SHRP Region:
  2 - State:
  3 - SHRP Section ID Number:
  4 - Experiment Name (i.e. AC over Granular Base etc.):
  5 - Highway Number:
  6 - Date(s) of Field Material Sampling and Field Testing:
  7 - Submitting Contractor:
  8 - Total Sheets, Including The Title Page:

To determine the total number of sheets (Item 8 above) all of the pages in the packet should be counted. Then the pages should be numbered starting from the last page in the packet (Form S01A). For example, if there are 37 pages in the packet, the last page would be page 1 of 37, the next to last page 2 of 37 and so forth until item 8 of the title page would read:

Total Sheets, Including This Title Page: 37

This will insure that any lost sheets can be quickly identified and found.

Transmittal

When the packet has been assembled and numbered, the original and appropriate number of duplicates should be made and one set sent to each of the following:

- Authorized SHRP Representative
- SHRP Regional Engineer (Receives Original Packet)
- Regional Testing Laboratory for Asphalt, Aggregate, and Soil Materials
- National Laboratory for PCC
- Regional Drilling and Sampling Contractor Office

SHRP-LTPP *STATE CODE*_____

SHRP REGION_____ FIELD MATERIAL SAMPLING

STATE_____ AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF PAVEMENT CORE *DCG SHEET: 01*

(ONLY FOR USE AT BOREHOLE LOCATIONS)

OPERATOR_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*CORING DATE*___-___-___ *LOCATION: STATION*_____ *CORE HOLE NUMBER*_____

CORE BARREL: *Size*_____(inch Diam.) *OFFSET*_____*feet from °/s* Cooling Medium_____

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

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

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-____-19__

Crew Chief, Contractor Affiliation:_____ SHRP Representative Affiliation:_____ Date

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____

STATE_____ FIELD MATERIAL SAMPLING AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

*FIELD SET NO.*_____

LOG OF PAVEMENT CORES
(ONLY FOR USE AT C-TYPE CORE LOCATIONS)

DCG SHEET: 02

OPERATOR_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*CORING DATE*___-___-___ CORE BARREL: Tip Type_____ Cooling Medium_____

Note: Each column shown below should be used to record information for all cores extracted from one core hole. "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 Drilled & Recovered	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*	*YES/NO*
If NO: to be replaced by						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*	*4/6*
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks						

GENERAL REMARKS:_____

_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-_____-19__

Crew Chief, Contractor SHRP Representative Date

Affiliation:_____ Affiliation:_____

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____

STATE_____ FIELD MATERIAL SAMPLING AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF BORE HOLE (A-Type) *DCG SHEET: 03*

DRILLER_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*BORING DATE*___-___-___ *LOCATION: STATION*_____ *BORE HOLE NUMBER:*_____

*BORE HOLE SIZE:*_____ (inch Diam.) *OFFSET*_____ *feet from °/s*

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

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

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-_____-19__

Crew Chief, Contractor SHRP Representative Date

Affiliation:_____ Affiliation:_____

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____

STATE_____ FIELD MATERIAL SAMPLING AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF BORE HOLE (BA..-Type) *DCG SHEET: 04*

DRILLER_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*BORING DATE*___-___-___ *LOCATION: STATION*_____ *BORE HOLE NUMBER*_____

*BORE HOLE SIZE:*_____ (inch Diam.) *OFFSET*_____ *feet from °/s*

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

1. Record sample numbers for bulk samples taken from unbound layers and the subgrade.

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

GENERAL REMARKS:_____

CERTIFIED

_____

Crew Chief, Contractor Affiliation:_____

VERIFIED AND APPROVED

_____

SHRP Representative Affiliation:_____

MONTH-DAY-YEAR

_____-____-19__

Date

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____
TATE_____ FIELD MATERIAL SAMPLING
AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane _____ Direction_____
SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF TEST PIT *DCG SHEET: 05*

TECHNICIAN_____ EQUIPMENT _____ SHEET NUMBER_____OF_____
*EXPLORATION DATE*___-___-___ *LOCATION: STATION*_____ *TEST PIT NUMBER*_____
PIT SIZE: (a) *Length*_____feet *OFFSET*_____*feet from °/s*
(b) *Width*_____feet

Scale (Inches)	*Strata Changed (Inches)*	*Moisture Sample No.*	*Bulk Sample No.*	*Material Description*	*Material Code*
4					
8					
12					
16					
20					
24					
28					
32					
36					
40					
44					
48					

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-____-19__

rew Chief, Contractor SHRP Representative Date

Affiliation:_____ Affiliation:_____

Form S03/April 1990

SHRP-LTPP *STATE CODE*_____

SHRP REGION_____ FIELD MATERIAL SAMPLING

STATE_____ AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane _____ Direction_____

SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF TEST PIT (SKETCH) *DCG SHEET: 06*

TECHNICIAN_____ EQUIPMENT _____ SHEET NUMBER_____OF_____

EXPLORATION DATE___-___-___ LOCATION: STATION_____ TEST PIT NUMBER_____

PIT SIZE: (a) Length_____feet OFFSET_____feet from °/*s*

(b) Width_____feet

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

GENERAL REMARKS:_____

CERTIFIED

_____

Crew Chief, Contractor

Affiliation:_____

VERIFIED AND APPROVED

_____

SHRP Representative

Affiliation:_____

MONTH-DAY-YEAR

_____-_____-19__

Date

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____
STATE_____ FIELD MATERIAL SAMPLING AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____
SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

IN SITU DENSITY AND MOISTURE TESTS

DCG SHEET: 07

OPERATOR_____ *NUCLEAR DENSITY GAUGE I.D.*_____ SHEET NUMBER____OF____
*TEST DATE*__-__-____ *LOCATION: STATION*_____ *TEST PIT NUMBER*_____
DATE OF LAST MAJOR CALIBRATION__-__-__ *OFFSET*_____*feet from °/s*
Note: Use additional sheets if necessary

DEPTH FROM SURFACE TO THE TOP OF THE LAYER, INCHES (SEE S03)						
TEST TYPE	*BASE COURSE TOP Result, pcf*		*SUBBASE TOP Result, pcf*		*SUBGRADE TOP Result, pcf*	
	Wet	*Dry*	*Wet*	*Dry*	*Wet*	*Dry*
MATERIAL TYPE: (Unbound-G Other-T)						
IN SITU DENSITY, pcf 1						
2						
3						
(AASHTO T238-86) 4						
AVERAGE						
Method (A,B,or C)						
Rod Depth, inches						
IN SITU MOISTURE CONTENT, % 1						
2						
3						
(AASHTO T239-86) 4						
AVERAGE						

GENERAL REMARKS:_____

CERTIFIED
_____
Crew Chief, Contractor
Affiliation:_____

VERIFIED AND APPROVED
_____
SHRP Representative
Affiliation:_____

MONTH-DAY-YEAR
____-____-19__
Date

SHRP-LTPP *STATE CODE* _____

SHRP REGION_____ FIELD MATERIAL SAMPLING

STATE_____ AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

SAMPLE/TEST: (a) Before Section_____ (b) After Section_____ *FIELD SET NO.*_____

LOG OF SHOULDER PROBE *DCG SHEET: 08*

OPERATOR_____ EQUIPMENT USED_____ SHEET NUMBER_____OF_____

*AUGERING DATE*___-___-___ *LOCATION STATION*:_____ *AUGER PROBE NUMBER*_____

TOP OF ROCK BASED ON:_____ *OFFSET*:_____*feet from °/s*

NOTE: SHOULDER AUGER PROBE IS AN OPTIONAL ITEM, AS DIRECTED BY SAR.

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)*

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ _____-_____-19__

Crew Chief, Contractor SHRP Representative Date

Affiliation:_____ Affiliation:_____

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____

STATE_____ FIELD MATERIAL SAMPLING AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____

*FIELD SET NO.*_____

MATERIAL SAMPLES INVENTORY
FOR SHIPMENT TO LABORATORY

WORK COMPLETED ON ____-____-____ SHEET NUMBER_____OF_____

Note: Use additional sheets if necessary. Include Form S06A for summary information and "as actual" sampling location plan sheets with this material samples inventory.

SAMPLE LOCATION	SAMPLE NUMBER	SAMPLE SIZE	SAMPLE TYPE	SAMPLE MATERIAL	SAMPLE CONDITION	PROGRAM OF WORK *

* Enter "Basic GPS" or "Extra GPS" or "Deleted GPS" or "After Basic GPS" or "Other."

GENERAL REMARKS:_____

_____

CERTIFIED

_____
Crew Chief, Contractor
Affiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation:_____

PREPARED ON:
MONTH-DAY-YEAR

____-____-19__
Date

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____
STATE_____ FIELD MATERIAL SAMPLING
AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane _____ Direction_____
*FIELD SET NO.*_____

SUMMARY
MATERIAL SAMPLES INVENTORY
FOR SHIPMENT TO LABORATORY

WORK COMPLETED ON ____-____-____ SHEET NUMBER____OF____

NOTE: This summary is based on the material samples inventory information provided on Form S06.

LAYER NO. (From Subgrade)	MATERIAL/SAMPLE TYPE	TOTAL NUMBER OF SAMPLES
_____	AC CORES: 4" Diameter___ 6" Diameter___ 12" Diameter___ AC Cores with Bound Base/Subbase _____ AC Cores with PCC_____ AC Cores with PCC and Bound Base/Subbase_____ PCC Cores with Bound Base/Subbase_____	
_____	PCC CORES: 4" Diameter___ 6" Diameter___	
_____	BOUND BASE CORES: 4" Diameter___	
_____	UNBOUND BASE SAMPLES: (a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
_____	BOUND SUBBASE CORES: 4" Diameter___	
_____	UNBOUND SUBBASE SAMPLES: (a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____	
___1__	SUBGRADE SAMPLES: (a) BAGS (BULK)_____ (b) JARS (MOISTURE)_____ (c) THIN-WALLED TUBES_____ (d) SPLITSPOON _____JARS	

PCC CORES TO BE SHIPPED TO:_____

ALL OTHER SAMPLES TO BE SHIPPED TO:_____
(Including combined cores of two or more layers)

GENERAL REMARKS:_____

_____

CERTIFIED

_____
Crew Chief, Contractor
ffiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation:_____

PREPARED ON:
MONTH-DAY-YEAR

_____-____-19__
Date

SHRP REGION_____ SHRP-LTPP *STATE CODE*_____
STATE_____ FIELD MATERIAL SAMPLING
AND FIELD TESTING *SHRP ASSIGNED ID*_____

LTPP EXPERIMENT_____ ROUTE/HIGHWAY_____ Lane_____ Direction_____
*FIELD SET NO.*_____

PROJECT SITE REPORT

SHEET NO._____OF_____

DATE____-____-____ ARRIVAL ON SITE_____AM/PM WORK COMPLETED_____AM/PM

CREW CHIEF_____ HEAD DRILLER_____ CREW SIZE_____

SHA REPRESENTATIVE_____ SHRP REPRESENTATIVE_____

WEATHER_____NIGHT AND WEEKEND WORK_____HOURS

BREAKDOWN_____HOLIDAY WORK_____HOURS

REGULAR HOURS (EXTRA)_____HOURS STANDBY TIME_____HOURS OVERTIME_____HOURS

WORK PROGRAM: (a) BASIC GPS (SCHEDULE A)_____
OPTIONAL ITEMS:_____
(b) EXTRA GPS (SCHEDULE B)_____
(c) DELETED GPS (SCHEDULE B)_____
(d) AFTER BASIC GPS (SCHEDULE C)_____
(e) OTHER SHRP WORK_____

TEST PIT EXCAVATION (Provided by):_____ PATCHING (Provided by):_____

TRAFFIC CONTROL (Provided by):_____

SAMPLES TO BE SHIPPED TO:	MATERIALS TYPE(S):	SHIPPING WEIGHT(lbs.)

GENERAL REMARKS:_____

CERTIFIED VERIFIED AND APPROVED MONTH-DAY-YEAR

_____ _____ ____-____-19__
Crew Chief, Contractor SHRP Representative Date
Affiliation:_____ Affiliation:_____

SHRP REGION_____
SHRP RCOC_____

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

DRILLING & SAMPLING
CONTRACTOR_____

SUMMARY OF APPROVED WORK

PERIOD COVERED FROM : (a) From ____-____-____ (b) To ____-____-____ SHEET NO._____OF____

SHRP ASSIGNED ID	STATE	LTPP EXPT	PROGRAM OF WORK**	REGULAR TIME (HRS)	STANDBY TIME EXTRA (HRS)	OVER TIME (HRS)	NIGHT AND WKND (HRS)	HOLIDAY WORK (HRS)	SAMPLE SHIPPING WEIGHT (LBS)

** Enter "Basic GPS" (Schedule A) or "Extra GPS" (Schedule B) or "Deleted GPS" (Schedule B) or "After Basic GPS" (Schedule C) or "Other".

GENERAL REMARKS:_____

A COPY OF FORMS S08 AND S09 MUST ACCOMPANY NAS INVOICE VOUCHER

CERTIFIED
_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED
_____
SHRP Representative
Affiliation:_____

MONTH-DAY-YEAR
_____-_____-19___
DATE

SHRP REGION _____
SHRP RCOC _____

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

DRILLING & SAMPLING
CONTRACTOR _____

SUMMARY OF APPROVED TRAVEL

PERIOD COVERED FROM: (a) From ____-____-____ (b) To ____-____-____ SHEET NO.____OF___

DATE MM-DD-YY	TRAVEL DESCRIPTION AND PURPOSE	MILES

TOTAL APPROVED MILEAGE: _____

GENERAL REMARKS: _____

_____

A COPY OF FORMS SO8 AND SO9 MUST ACCOMPANY NAS INVOICE VOUCHER

CERTIFIED

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation:_____

MONTH-DAY-YEAR

____-____-19___
DATE

Form SO9/April 1990

SHRP REGION_____
SHRP RCOC_____

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

DRILLING & SAMPLING
CONTRACTOR_____

FOUR WEEK SCHEDULE

PERIOD COVERED: (a) From ____-____-____ (b) To ____-____-____ SHEET NO.____OF_____

DATE	SHRP SECTION ID	LTPP EXPT	STATE	PROGRAM OF WORK **	TEST PIT EXCAV. BY	PATCHING BY	TRAFFIC CONTROL BY	REMARKS

** ENTER "BASIC GPS" (SCHEDULE A) OR "EXTRA GPS" (SCHEDULE B) OR "DELETED GPS" (SCHEDULE B) OR "AFTER BASIC GPS" (SCHEDULE C) OR "OTHER".

GENERAL REMARKS:_____

_____

NOTE: To be submitted every week for the next four weeks, as directed by SHRP.

CERTIFIED

_____
Contractor Representative
Affiliation: _____

VERIFIED AND APPROVED

_____
SHRP Representative
Affiliation: _____

PREPARED ON:
MONTH-DAY-YEAR
_____-____-19____
DATE

Form S10/April 1990

SHRP REGION________________
SHRP RCOC________________

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING
WEEKLY PROGRESS REPORT

DRILLING & SAMPLING
CONTRACTOR________________

PERIOD COVERED: (a) From ____-____-____ (b) To ____-____-____ SHEET NO._____OF_____

DATE	STATUS	SHRP SECTION ID	LTPP EXPT	STATE	PROGRAM OF WORK **	TEST PIT EXCAV. BY	PATCHING BY	TRAFFIC CONTROL BY	REMARKS
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								
	SCHEDULED								
	ACTUAL								

** ENTER "BASIC GPS" (SCHUDULE A) OR "EXTRA GPS" (SCHEDULE B) OR "DELETED GPS"(SCHEDULE B) OR "AFTER BASIC GPS" (SCHEDULE C) OR "OTHER".

GENERAL REMARKS: ____

'ERTIFIED

____
Contractor Representative
Affiliation:____________

VERIFIED AND APPROVED

____
SHRP Representative
Affiliation:____________

MONTH-DAY-YEAR
____-____-19____
DATE

Form S11/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS1 ROUTE/HIGHWAY US311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section _____ (b) After Section ✓ *FIELD SET NO.* 1

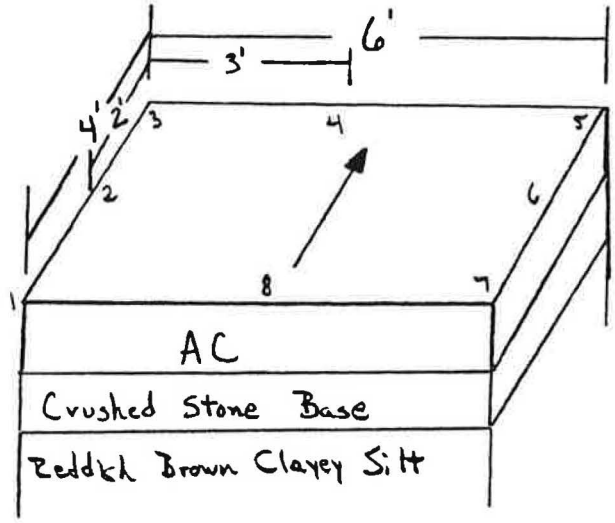
LOG OF TEST PIT (SKETCH)

DCG SHEET: 06

TECHNICIAN P. McKenna EQUIPMENT Backhoe SHEET NUMBER 15 OF 25
EXPLORATION DATE 3 - 30 - 90 LOCATION: STATION 5+62 TEST PIT NUMBER TP1
PIT SIZE: (a) Length 6 feet OFFSET 3 feet from °/s
(b) Width 4 feet

1. 4.6" AC, 16.6" CSB
2. 4.6" AC, 16.6" CSB
3. 4.5" AC, 16.5" CSB
4. 4.6" AC, 16.6" CSB
5. 4.6" AC, 16.6" CSB
6. 4.6" AC, 16.5" CSB
7. 4.5" AC, 16.6" CSB
8. 4.6" AC, 16.6" CSB

AC = Asphaltic Concrete
CSB = Crushed Stone Base
↗ = Direction of traffic



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

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3 - 30 - 1990
Date

EXAMPLE

Form S03A/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section ____ (b) After Section ✓ *FIELD SET NO.* 1

LOG OF BORE HOLE (A-Type)

DCG SHEET: 03

DRILLER M. Masley EQUIPMENT USED Mobile B-55 SHEET NUMBER 14 OF 25
BORING DATE 3-30-90 *LOCATION: STATION* 5+40 *BORE HOLE NUMBER:* A2
BORE HOLE SIZE: 6 (inch Diam.) *OFFSET* 3 *feet from °/s*

Scale (Inches)	*Strata Changed (Inches)*	*Sample Number* (1)	*# Blows* (2) 6"	6"	6"	*Ref? Y/N* (3)	*DLR (Inches)* (4)	*IOP* (5)	*Material Description*	*Material Code*
10.0	16.8								Crushed Stone Base	303
20.0	26.9	JS03	45	55	-	N	—	10.1	Gray medium coarse sand with gravel	201
30.0										
40.0	40.0	—							Gray medium coarse sand with gravel	201
50.0		JS04	100	-	-	Y	41.0	1	Gray medium coarse sand with gravel	201
60.0										
70.0										
80.0										
90.0										
100.0										

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

GENERAL REMARKS: JS04 refused at 41.0 inches

CERTIFIED
Signature
w Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3 - 30 - 1990
Date

Form S02A/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section ✓ (b) After Section _____ *FIELD SET NO.* 1

LOG OF BORE HOLE (A-Type)

DCG SHEET: 03

DRILLER M. Masley EQUIPMENT USED Mobile B-55 SHEET NUMBER 13 OF 25
BORING DATE 3-30-90 *LOCATION: STATION* 0-55 *BORE HOLE NUMBER:* A1
BORE HOLE SIZE: 6 (inch Diam.) *OFFSET* 3 *feet from* °/s

Scale (Inches)	*Strata Changed (Inches)*	*Sample Number* (1)	*# Blows* (2) 6"	6"	6"	*Ref? Y/N* (3)	*DLR (Inches)* (4)	*IOP* (5)	*Material Description*	*Material Code*
10.0	16.6								Crushed Stone Base	303
20.0 / 30.0	31.8	JS01	25	40	60	N	—	9.2	Gray medium coarse sand with gravel	201
40.0	40.0	—							Gray medium coarse sand with gravel	201
50.0 / 60.0	58.0	JS02	20	25	50	N	—	—	Gray medium coarse sand with gravel	201
70.0										
80.0										
90.0										
100.0										

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

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section ✓ (b) After Section _____ *FIELD SET NO.* 1

LOG OF BORE HOLE (BA..-Type)

DCG SHEET: 04

DRILLER M. Mosley
EQUIPMENT USED Mobile B-55
SHEET NUMBER 12 OF 25
BORING DATE 3-30-90
LOCATION: STATION 0-40
BORE HOLE NUMBER BA3
BORE HOLE SIZE: 12 (inch Diam.) *OFFSET* 3 *feet from °/s*

Scale (Inches)	*Strata Changed (Inches)*	*Sample Number* (1)	*Moisture Sample Number* (2)	*Material Description*	*Material Code*
10.0	16.6	BG03 (2 bags)	MG03	Crushed Stone Base	303
20.0		BS03 (2 bags)	MS03	Reddish Brown Clayey Soil (micaceous)	216
30.0					
40.0					
50.0					
60.0					
70.0					
80.0					
90.0					
100.0					

1. Record sample numbers for bulk samples taken from unbound layers and the subgrade.

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

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section ✓ (b) After Section _____ *FIELD SET NO.* 1

LOG OF BORE HOLE (BA..-Type)

DCG SHEET: 04

DRILLER M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 11 OF 25
BORING DATE 3-30-90 *LOCATION: STATION* 0-45 *BORE HOLE NUMBER* BA2
BORE HOLE SIZE: 12 (inch Diam.) *OFFSET* 6 *feet from °/s*

Scale (Inches)	Strata Changed (Inches)	Sample Number (1)	Moisture Sample Number (2)	Material Description	Material Code
10.0	16.6	BG02 (2 bags)	MG02	Crushed Stone Base	303
20.0					
30.0					
40.0					
50.0					
60.0					
70.0					
80.0					
90.0					
100.0					

1. Record sample numbers for bulk samples taken from unbound layers and the subgrade.

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

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ FIELD SET NO. 1

LOG OF BORE HOLE (BA..-Type)

DCG SHEET: 04

DRILLER M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 10 OF 25
BORING DATE 3-30-90 LOCATION: STATION 0-55 BORE HOLE NUMBER BA1
BORE HOLE SIZE: 12 (inch Diam.) OFFSET 3 feet from °/s

Scale (Inches)	Strata Changed (Inches)	Sample Number (1)	Moisture Sample Number (2)	Material Description	Material Code
10.0	16.6	BG01 (2 bags)	MG01	Crushed Stone Base	303
20.0		BS01 (2 bags)	MS01	Reddish Brown Clayey Silty Sand (micaceous)	216
30.0					
40.0					
50.0					
60.0					
70.0					
80.0					
90.0					
100.0					

1. Record sample numbers for bulk samples taken from unbound layers and the subgrade.

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

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ FIELD SET NO. 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 9 OF 25

CORING DATE 3-30-90 LOCATION: STATION 0-40 CORE HOLE NUMBER BA3

CORE BARREL: Size 12 (inch Diam.) OFFSET 3 feet from °/s Cooling Medium Water

Scale (Inches)	Depth (Inches)	Core Drilled (Inches)	Core Recov. (Inches)	Core Sample No.	Material Description	Material Code
0	4.5	4.5	4.5	CA63	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: _____

CERTIFIED

Signature

Crew Chief, Contractor

Affiliation: XYZ

VERIFIED AND APPROVED

Signature

SHRP Representative

Affiliation: ABC

MONTH-DAY-YEAR

3 - 30 - 1990

Date

EXAMPLE

Form SO1/April 1990

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ FIELD SET NO. 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 8 OF 25

CORING DATE 3-30-90 LOCATION: STATION 0-45 CORE HOLE NUMBER BA2

CORE BARREL: Size 12 (inch Diam.) OFFSET 6 feet from °/s Cooling Medium Water

Scale (Inches)	Depth (Inches)	Core Drilled (Inches)	Core Recov. (Inches)	Core Sample No.	Material Description	Material Code
0	4.5	4.5	4.5	CA62	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: _____

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3 - 30 - 1990
Date

EXAMPLE

Form S01/April 1990

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ FIELD SET NO. 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 7 OF 25

CORING DATE 3-30-90 LOCATION: STATION 0-55 CORE HOLE NUMBER BA1

CORE BARREL: Size 12 (inch Diam.) OFFSET 6 feet from °/s Cooling Medium Water

Scale (Inches)	Depth (Inches)	Core Drilled (Inches)	Core Recov. (Inches)	Core Sample No.	Material Description	Material Code
0	4.5	4.5	4.5	CAG1	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: _____

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3-30-1990
Date

EXAMPLE

Form SO1/April 1990

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ____ (b) After Section ✓ FIELD SET NO. 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 6 OF 25

CORING DATE 3-30-90 LOCATION: STATION 5+40 CORE HOLE NUMBER A2

CORE BARREL: Size 6 (inch Diam.) OFFSET 3 feet from °/s Cooling Medium Water

Scale (Inches)	Depth (Inches)	Core Drilled (Inches)	Core Recov. (Inches)	Core Sample No.	Material Description	Material Code
0	4.5	4.5	4.5	CA52	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: _____

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3 - 30 - 1990
Date

EXAMPLE

Form SO1/April 1990

SHRP REGION NA | SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING | STATE CODE 37

STATE NC | SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ FIELD SET NO. 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 5 OF 25

CORING DATE 3-30-90 LOCATION: STATION 0-54 CORE HOLE NUMBER A1A

CORE BARREL: Size 6 (inch Diam.) OFFSET 3 feet from °/s Cooling Medium Water

Scale (Inches)	Depth (Inches)	Core Drilled (Inches)	Core Recov. (Inches)	Core Sample No.	Material Description	Material Code
0	4.5	4.5	4.5	CA51	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: Replacement for A1.

CERTIFIED	VERIFIED AND APPROVED	MONTH-DAY-YEAR
Signature	Signature	3-30-1990
Crew Chief, Contractor	SHRP Representative	Date
Affiliation: XYZ	Affiliation: ABC	

EXAMPLE

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US-311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section ✓ (b) After Section ____ *FIELD SET NO.* 1

LOG OF PAVEMENT CORE
(ONLY FOR USE AT BOREHOLE LOCATIONS)

DCG SHEET: 01

OPERATOR M. Mosley EQUIPMENT USED Mobile B-55 SHEET NUMBER 4 OF 25

CORING DATE 3-30-90 *LOCATION: STATION* 0-55 *CORE HOLE NUMBER* A1

CORE BARREL: *Size* 6 (inch Diam.) *OFFSET* 3 *feet from* °/s Cooling Medium Water

Scale (Inches)	*Depth (Inches)*	Core Drilled (Inches)	Core Recov. (Inches)	*Core Sample No.*	*Material Description*	*Material Code*
0						
	4.5	4.5	4.5	~~CA51~~	AC	700
5						
10						
15						
20						
25						

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

GENERAL REMARKS: A replacement borehole is needed.

CERTIFIED	VERIFIED AND APPROVED	MONTH-DAY-YEAR
Signature	Signature	3-30-1990
Crew Chief, Contractor	SHRP Representative	Date
Affiliation: XYZ	Affiliation: ABC	

EXAMPLE

Form S01/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS 1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
FIELD SET NO. 1

LOG OF PAVEMENT CORES
(ONLY FOR USE AT C-TYPE CORE LOCATIONS)

DCG SHEET: 02

OPERATOR D. Harris EQUIPMENT USED Tractor SHEET NUMBER 3 OF 25

CORING DATE 3-30-90 CORE BARREL: Tip Type Thinwall Cooling Medium Water

Note: Each column shown below should be used to record information for all cores extracted from one core hole. "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	C22	C23	C24			
LOCATION: (a) STATION	5+45	5+46.5	5+48			
(b) OFFSET (Feet, O/S)	2	2	2			
Core Drilled & Recovered	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO	YES/NO
If NO: to be replaced by						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.	CA22	CA23	CA24			
Depth (Inches)	4.5	4.25	4.25			
Material Description	AC	AC	AC			
Material Code	700	700	700			
Core Size (inch Diam)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks						

GENERAL REMARKS:

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3-30-1990
Date

Form S01A/April 1990

EXAMPLE

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS 1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
FIELD SET NO. 1

LOG OF PAVEMENT CORES
(ONLY FOR USE AT C-TYPE CORE LOCATIONS)

DCG SHEET: 02

OPERATOR D. Harris EQUIPMENT USED Tractor SHEET NUMBER 2 OF 25

CORING DATE 3-30-90 CORE BARREL: Tip Type Thinwall Cooling Medium Water

Note: Each column shown below should be used to record information for all cores extracted from one core hole. "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	C12	C18	C19	C19A	C20	C21
LOCATION: (a) STATION	0-60	5+48	5+45	5+45.5	5+46.5	5+48
(b) OFFSET (Feet, O/S)	2	5	3.5	3.5	3.5	3.5
Core Drilled & Recovered	YES/~~NO~~	YES/~~NO~~	~~YES~~/NO	YES/~~NO~~	YES/~~NO~~	YES/~~NO~~
If NO: to be replaced by			C19A			
Core Size (inch Diam.)	4/~~6~~	4/~~6~~	4/6	4/~~6~~	4/~~6~~	4/~~6~~
Core Sample No.	CA12	CA18		CA19	CA20	CA21
Depth (Inches)	4.5	4.25		4	4	4.3
Material Description	AC	AC		AC	AC	AC
Material Code	700	700		700	700	700
Core Size (inch Diam)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks			Core not Acceptable			

GENERAL REMARKS:

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3-30-1990
Date

Form S01A/April 1990

EXAMPLE

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS 1 ROUTE/HIGHWAY US-311 Lane 1 Direction S
FIELD SET NO. 1

LOG OF PAVEMENT CORES
(ONLY FOR USE AT C-TYPE CORE LOCATIONS)

DCG SHEET: 02

OPERATOR D. Harris EQUIPMENT USED Tractor SHEET NUMBER 1 OF 25

CORING DATE 3-30-90 CORE BARREL: Tip Type Thinwall Cooling Medium Water

Note: Each column shown below should be used to record information for all cores extracted from one core hole. "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	C6	C7	C8	C9	C10	C11
LOCATION: (a) STATION	0-60	0-63	0-61.5	0-60	0-63	0-61.5
(b) OFFSET (Feet, O/S)	5	3.5	3.5	3.5	2	2
Core Drilled & Recovered	YES/~~NO~~	YES/~~NO~~	YES/~~NO~~	YES/~~NO~~	YES/~~NO~~	YES/~~NO~~
If NO: to be replaced by						
Core Size (inch Diam.)	4/~~6~~	4/~~6~~	4/~~6~~	4/~~6~~	4/~~6~~	4/~~6~~
Core Sample No.	CA06	CA07	CA08	CA09	CA10	CA11
Depth (Inches)	4.3	4.3	4.0	4.5	4.3	4.5
Material Description	AC	AC	AC	AC	AC	AC
Material Code	700	700	700	700	700	700
Core Size (inch Diam)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Core Size (inch Diam.)	4/6	4/6	4/6	4/6	4/6	4/6
Core Sample No.						
Depth (Inches)						
Material Description						
Material Code						
Remarks						

GENERAL REMARKS:

CERTIFIED

Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED

Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR

3-30-1990
Date

Form SO1A/April 1990

EXAMPLE

April 1990

APPENDIX F

QUARTERLY REPORTING REQUIREMENTS

DRILLING AND SAMPLING CONTRACTOR

APPENDIX F: QUARTERLY REPORTING REQUIREMENTS - DRILLING AND SAMPLING CONTRACTOR

The following section is currently under review by SHRP personnel. If any changes to the quarterly reporting procedures occur, a LTPP Materials Directive will be issued to all interested parties containing the revised quarterly reporting procedures.

A quarterly progress report is required to be submitted to the SHRP Regional Engineer by each drilling and sampling contractor. The purpose of the quarterly report is to allow SHRP management to monitor progress and to provide early recognition of potential problem areas. The quarterly report should consist of three sections: an executive summary, a detailed cumulative financial summary, and a detailed statement of work performed during the reporting quarter.

Executive Summary - Attachments A and B

The executive summary should consist of two pages: a one page project director's narrative highlighting progress during the reporting quarter (See Attachment A, guide format) and a one page cumulative financial summary (See Attachment B, guide format).

The executive summary may be used along with the SHRP manager's assessment of progress as part of their report to the SHRP Executive Committee.

Financial Attachment B

1. Under the heading "Amount" is the total contract amount. "Amount Authorized To-Date," is the cumulative to date authorized amount. For a one-year contract these two amounts would be equal.

2. The heading, "Quarter _____ of __4__ of Contract Year ____" is used in an attempt to make clear the quarter and year of the multi-year contract the quarterly report is summarizing. (It is intended to stay with the four-quarter reporting system to the year of authorized expenditure.) Contract quarters start and end coincident with a

calendar quarter. (January - March, April - June, July - September, and October - December.)

3. The line graph of expenditure status should, as the title implies, reflect cumulative expenditures including previous years if applicable. The scale on the expenditures axis should span the current year's authorized amount. Thus, at the lower end of the scale will be the cumulative authorized amount for previous years and at the upper end of the scale will be the cumulative authorized amount through the current contract year.

Detailed Prosecution and Progress

The quarterly statement of work performed should be a comprehensive assessment of the progress made during the reporting quarter. This section of the quarterly report should address as appropriate, but not necessarily be limited to, the following considerations.

1. Accomplishment this quarter - a comparison should be made between what was planned and what was actually accomplished with respect both to task completion and expenditures. Any outstanding features, financial concerns, problems, etc. should be cited. For Drilling and Sampling Contracts, data should be reported in the format shown in Attachment C of this Appendix.

2. Next Milestone or Deliverable - Assess progress toward meeting the next decision point, interim milestone or deliverable called for in the contract.

3. Progress Toward Products or Deliverables - Comment on the progress toward fulfilling the deliverables called for in the contracts.

4. Changes in Contract Management/Staff - Changes in principal contract staff should be reported and the plans to maintain level and continuity of effort in response to any such changes.

5. Variance from Contract Proposal - Significant deviation in level of effort, expenditure, technical approach, etc., from the contract proposal should be explained along with action planned to correct the situation or reasons why a substantive change is requested should be detailed.

6. Work Planned Next Quarter - Summarize activities planned and identify any corrective actions to be taken regarding previously encountered problems (See No. 8).

7. Subcontractor(s) Performance - A general assessment of subcontractor performance. What is being done by whom and what will be done and by whom with respect to the accomplishment of work scheduled in relation to meeting overall project requirements.

8. Problem Areas - Factors that are, or have the potential of, affecting progress toward contract objectives should be stated, along with steps to correct the problem. Items such as delays in obtaining direction, materials or equipment, shipping problems, staffing and relationships with other SHRP Contractors and State Highway Agencies are examples.

Quarterly Report Review

Quarterly reports may be provided to expert advisors to assist SHRP staff in evaluating contract progress. Therefore, any privileged or sensitive information should be reported on a separate page or section so that SHRP staff can readily keep the information confidential. Arbitrary and unwarranted use of this restriction should be avoided.

Quarterly Report Due Date

Quarterly reports are to coincide with Calendar quarters and are due within ten working days following the end of the quarter. For contracts that start with less than 30 days left in a calendar quarter, the first quarterly report may be delayed until the end of the next full calendar quarter.

Period Covered

Quarterly accomplishment is to be reported with reference to the budget period for which funds are authorized, generally one year.

Finally, send fifteen (15) copies of the quarterly report to the attention of the appropriate SHRP Regional Engineer who will forward the report to the Washington D.C. SHRP Office. Also, please number the pages of the quarterly report. (Invoices on the other hand, should be sent to the attention of the SHRP Director of Finance and Administration).

ATTACHMENT A
EXECUTIVE SUMMARY

Date:_____

STRATEGIC HIGHWAY RESEARCH PROGRAM
QUARTERLY PROGRESS SUMMARY

Contract No._____ Title:_____

Start Date:_____ Completion Date:_____ Amount:_____

Quarter _____ of __4__

Project Director's Progress Summary

This Quarter

Work Planned Next Quarter

SIGNED:_____
Project Director

ATTACHMENT B

Date:_____

STRATEGIC HIGHWAY RESEARCH PROGRAM
QUARTERLY PROGRESS SUMMARY

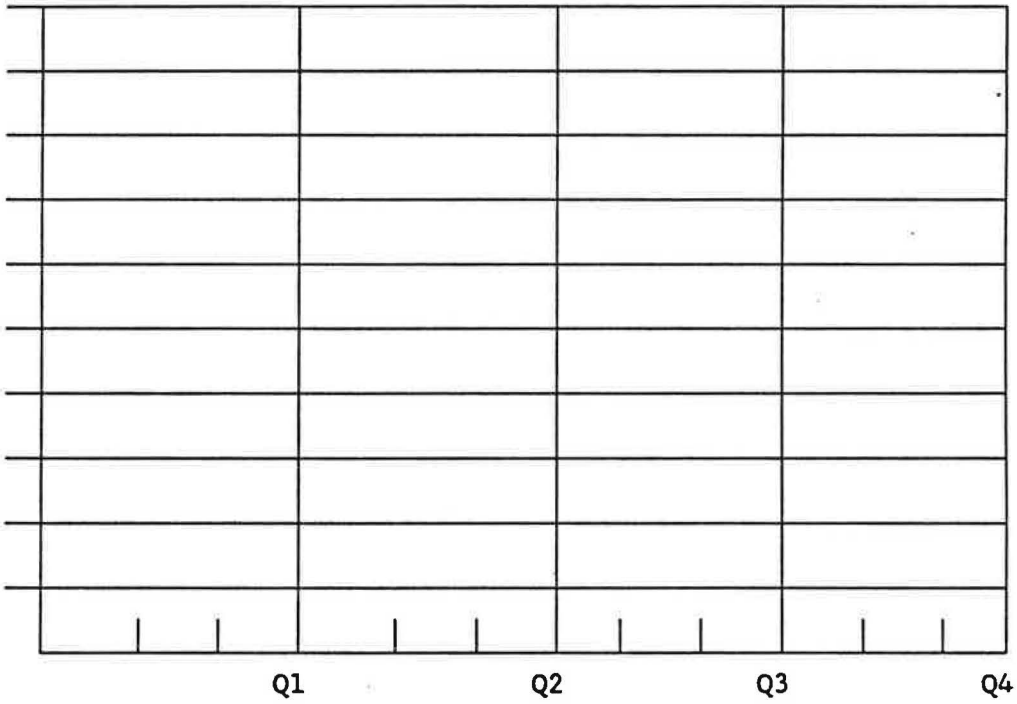
Contract No._____ Title:_____

Start Date:_____ Completion Date:_____ Amount:_____

Amount Authorized to Date:_____

Quarter _____ of 4

CUMULATIVE TOTAL EXPENDITURES



OVERALL TECHNICAL PROGRESS, CUMULATIVE PERCENT COMPLETE

PLANNED				
ACTUAL				

Q1 Q2 Q3 Q4

CONTRACT QUARTER

ATTACHMENT B1
Field Sampling and Testing Financial

	EXPENDITURE		VARIANCE	
	PLANNED	ACTUAL $	AMOUNT $	PERCENT%
SCHEDULE A				
(1) Lump Sum Sampling				
(2) Travel				
(3) Standby				
(4) Overtime				
(5) Night/Weekend/Holiday				
(6) Shipping				
(7) Other				
SCHEDULE B				
(1) Test Pit Excavation				
(2) Travel				
(3) Standby				
(4) Overtime				
(5) Night/Weekend/Holiday				
(6) Extra or Deleted Work (List Under or Attach Extra Sheet)				
(7) Shipping				
(8) Other				
TOTAL Schedule A + B				

ATTACHMENT C - ACCOMPLISHMENTS THIS QUARTER
(Drilling and Sampling Contracts)

SHRP Region:_____

SHRP CONTRACT:_____

Quarter _____ of __4___

STATE	LTPP GPS Experiment Number								Total No of Sections this Qtr by State
	1	2	3	4	5	6	7	9	
Total this Quarter									
Cumulative Previous Total									
Cumulative Total to Date									

SHRP-LTPP

SHRP REGION_____ FIELD MATERIAL SAMPLING DRILLING & SAMPLING

SHRP RCOC_____ AND FIELD TESTING CONTRACTOR_____

NAS INVOICE VOUCHER ATTACHMENT A

(Based on Fee Schedule A - Basic GPS Work)

PERIOD COVERED: (a) From ____-____-____ (b) To____-____-____ SHEET NO._____OF_____

ITEM A1: SAMPLING AND TESTING - LUMP SUM WORK

	Description	Unit	Quantity	Lump Sum Price	Total Cost,$
A1a:	GPS 1	Each	_____	$_____	_____
A1b:	GPS 2	Each	_____	$_____	_____
A1c:	GPS 3	Each	_____	$_____	_____
A1d:	GPS 4	Each	_____	$_____	_____
A1e:	GPS 5	Each	_____	$_____	_____
A1f:	GPS 6	Each	_____	$_____	_____
A1g:	GPS 7	Each	_____	$_____	_____
A1h:	GPS 9	Each	_____	$_____	_____

Total Lump Sum Cost (LSC) :_____

ITEM A2 : SAMPLE SHIPPING

			Quantity,lbs.	Unit Price	Cost,$
From_____	To	_____	_____	$_____/100lbs.	_____
From_____	To	_____	_____	$_____/100lbs.	_____
From_____	To	_____	_____	$_____/100lbs.	_____

Total Sample Shipping Cost (SSC):_____

		Quantity	Unit Rate	Cost,$
ITEM A3:	TRAVEL	_____Miles	$_____/Mile	_____
ITEM A4:	REGULAR TIME (EXTRA)	_____Hours	$_____/Hour	_____
ITEM A5:	STANDBY TIME	_____Hours	$_____/Hour	_____
ITEM A6:	OVERTIME	_____Hours	$_____/Hour	_____
ITEM A7:	NIGHT AND WEEKEND WORK	_____Hours	$_____/Hour	_____
ITEM A8:	HOLIDAY WORK	_____Hours	$_____/Hour	_____

TOTAL COST OF SCHEDULE "A" WORK, $:_____
(LSC + SSC + ITEM A3 TO ITEM A8)

CERTIFIED, DATE

_____

Contractor Representative

Affiliation:_____

VERIFIED AND APPROVED, DATE

_____

SHRP Representative

Affiliation:_____

SHRP-LTPP

SHRP REGION_____ FIELD MATERIAL SAMPLING DRILLING & SAMPLING

SHRP RCOC_____ AND FIELD TESTING CONTRACTOR_____

NAS INVOICE VOUCHER ATTACHMENT B1

(Based on Fee Schedule B - Extra During Basic GPS Work)

PERIOD COVERED: (a) From ____-____-____(b) To____-____-____ SHEET NO._____OF_____

ITEM B1: TEST PIT EXCAVATION (GENERALLY ONE PER SECTION)

	Description	Unit	Quantity	Unit Price	Cost,$
B1a:	GPS 1	Each	_____	$_____	_____
B1b:	GPS 2	Each	_____	$_____	_____
B1c:	GPS 3	Each	_____	$_____	_____
B1d:	GPS 4	Each	_____	$_____	_____
B1e:	GPS 5	Each	_____	$_____	_____
B1f:	GPS 6	Each	_____	$_____	_____
B1g:	GPS 7	Each	_____	$_____	_____
B1h:	GPS 9	Each	_____	$_____	_____

Total Test Pit Cost (TPC):_____

ITEM B2: OTHER COSTS ASSOCIATED WITH TEST PIT

		Quantity		Unit Rate	Cost,$
B2a:	TRAVEL	_____	Miles	$_____/Mile	_____
B2b:	REGULAR TIME (EXTRA)	_____	Hours	$_____/Hour	_____
B2c:	STANDBY TIME	_____	Hours	$_____/Hour	_____
B2d:	OVERTIME	_____	Hours	$_____/Hour	_____
B2e:	NIGHT AND WEEKEND WORK	_____	Hours	$_____/Hour	_____
B2f:	HOLIDAY WORK	_____	Hours	$_____/Hour	_____

TOTAL OTHER COSTS ASSOCIATED WITH TEST PIT (TOC):_____

		Unit	Quantity	Unit Price	Cost,$
ITEM B3:	ADDITIONAL PERSONNEL AND EQUIPMENT	Each/Section	_____	$_____	$_____
B4a:	TRAFFIC CONTROL	Each/Section	_____	$_____	$_____
B4b:	PATCHING	Each/Section	_____	$_____	$_____

TOTAL COST OF ATTACHMENT B1, $:_____

(TPC + TOC + ITEM B3 + ITEM B4a + ITEM B4b)

CERTIFIED, DATE

_____

Contractor Representative

Affiliation:_____

VERIFIED AND APPROVED, DATE

_____

SHRP Representative

Affiliation:_____

Form S13/April 1990

SHRP REGION_____ SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING DRILLING & SAMPLING CONTRACTOR_____

SHRP RCOC_____

NAS INVOICE VOUCHER ATTACHMENT B2

(Based on Fee Schedule B - Extra During Basic GPS Work)

PERIOD COVERED: (a) From ____-____-____ (b) To ____-____-____ SHEET NO._____OF_____

Item No.	Description	Unit	Unit Price	Quantity	Cost, $
ITEM B5:	Coring, 4 or 6 in. diam, per inch of depth				
B5a:	Asphaltic Concrete Surface Binder and Base Courses	Lin. Inch			
B5b:	Treated Base, Subbase or Subgrade	Lin. Inch			
B5c:	Portland Cement Concrete	Lin. Inch			
ITEM B6:	Coring, 12 in. diam. per inch of depth				
B6a:	Asphaltic concrete	Lin. Inch			
B6b:	Portland Cement Concrete	Lin. Inch			
ITEM B7:	Auger Probes in Shoulders	Lin. Ft.			
ITEM B8:	Augering of Treated Base, Subbase or Subgrade, 12 in. diam.	Lin. Inch			
ITEM B9:	Augering and Sampling of Untreated Base, Subbase or Subgrade, 6 or 12 in. diam. holes	Lin. Inch			
ITEM B10:	Thinwall Tubes of Subgrade	Each			
ITEM B11:	Standard Penetration Test and Splitspoon Samples or Subgrade	Each			

TOTAL COST OF ATTACHMENT B2, $:_____
(ITEMS B5 TO B11)

CERTIFIED, DATE

_____
Contractor Representative

Affiliation:_____

VERIFIED AND APPROVED, DATE

_____
SHRP Representative

Affiliation:_____

SHRP REGION_____
SHRP RCOC_____

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

DRILLING & SAMPLING
CONTRACTOR_____

NAS INVOICE VOUCHER ATTACHMENT B3
(Based on Fee Schedule B - Extra During Basic GPS Work)

PERIOD COVERED: (a) From ____-____-____ (b) To____-____-____ SHEET NO._____OF_____

Item No.	Description	Unit	Unit Price	Quantity	Cost,$
ITEM B12:	Bulk Sampling in test pits, per sample				
B12a	Asphaltic Concrete Surface and Binder, 12 in. by 12 in. slabs	Each	_____	_____	_____
B12b	Untreated Base or Subbase	Each	_____	_____	_____
B12c	Subgrade	Each	_____	_____	_____
ITEM B13:	Nuclear Moisture and/or Density Tests, per test	Each	_____	_____	_____
ITEM B14:	Crew Chief	Hour	_____	_____	_____

TOTAL COST OF ATTACHMENT B3, $:_____
(ITEM B12 TO ITEM B14)

CERTIFIED, DATE

_____
Contractor Representative

Affiliation:_____

VERIFIED AND APPROVED

_____
SHRP Representative

Affiliation:_____

SHRP REGION_____ SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING DRILLING & SAMPLING CONTRACTOR_____

SHRP RCOC_____

NAS INVOICE VOUCHER ATTACHMENT B4

(Based on Fee Schedule B - Deleted During Basic GPS Work)

PERIOD COVERED: (a) From____-____-____ (b) To____-____-____ SHEET NO._____OF_____

Item No.	Description	Unit	Unit Price	Quantity	Cost,$
ITEM B5:	Coring, 4 or 6 in. diam, per inch of depth				
B5a:	Asphaltic Concrete Surface Binder and Base Courses	Lin. Inch	_____	_____	-_____
B5b:	Treated Base, Subbase or Subgrade	Lin. Inch	_____	_____	-_____
B5c:	Portland Cement Concrete	Lin. Inch	_____	_____	-_____
ITEM B6:	Coring, 12 in. diam. per inch of depth				
ITEM B6a:	Asphaltic concrete	Lin. Inch	_____	_____	-_____
ITEM B6b	Portland Cement Concrete	Lin. Inch	_____	_____	-_____
ITEM B7:	Auger Probes in Shoulders	Lin. Feet	_____	_____	-_____
ITEM B8:	Augering of Treated Base, Subbase or Subgrade, 12 in. diam.	Lin. Inch	_____	_____	-_____
ITEM B9:	Augering and Sampling of Untreated Base, Subbase or Subgrade, 6 or 12 in. diam. holes	Lin. Inch	_____	_____	-_____
ITEM B10:	Thinwall Tubes of Subgrade	Each	_____	_____	-_____
ITEM B11:	Standard Penetration Test and Splitspoon Samples of Subgrade	Each	_____	_____	-_____

TOTAL COST OF ATTACHMENT B4, $:-_____
(ITEM B5 TO ITEM B11)

CERTIFIED, DATE

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED, DATE

_____
SHRP Representative
Affiliation:_____

SHRP REGION_____ SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING DRILLING & SAMPLING CONTRACTOR_____

SHRP RCOC_____

NAS INVOICE VOUCHER ATTACHMENT B5

(Based on Fee Schedule B - Deleted During Basic GPS Work)

PERIOD COVERED: (a) From ____-____-____ (b)To____-____-____ SHEET NO._____OF_____

Item No.	Description	Unit	Unit Price	Quantity	Cost,$
ITEM B12:	Bulk Sampling in test pits, per sample				
B12a:	Asphaltic Concrete Surface and Binder, 12 in. by 12 in. slabs	Each	_____	_____	-_____
B12b:	Untreated Base or Subbase	Each	_____	_____	-_____
B12c:	Untreated Subgrade	Each	_____	_____	-_____
ITEM B13:	Nuclear Moisture and/or Density Tests, per test	Each	_____	_____	-_____
ITEM B14:	Crew Chief	Hour	_____	_____	-_____

TOTAL COST OF ATTACHMENT B5, $:-_____
(ITEM B12 TO ITEM B14)

CERTIFIED, DATE

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED, DATE

_____
SHRP Representative
Affiliation:_____

SHRP-LTPP

SHRP REGION_____ FIELD MATERIAL SAMPLING DRILLING & SAMPLING

SHRP RCOC_____ AND FIELD TESTING CONTRACTOR_____

NAS INVOICE VOUCHER ATTACHMENT C1

(Based on Fee Schedule C - Extra After Basic GPS Work)

PERIOD COVERED: (a) From___-___-___ (b) To___-___-___ SHEET NO.___OF_____

ALTERNATE 1 - Hourly Rates and Travel for any GPS Experiment

Item No.	Description	Unit	Unit Price	Quantity	Cost,$
ITEM C1:	Full Crew and Equipment for Sampling and Testing				
C1a:	Regular Time	Hour	*_____	_____	_____
C1b:	Standby Time	Hour	*_____	_____	_____
C1c:	Overtime	Hour	*_____	_____	_____
C1d:	Night and Weekend Shift Work	Hour	*_____	_____	_____
C1e:	Holiday Work	Hour	*_____	_____	_____
C1f:	Travel	Mile	*_____	_____	_____

* Same as Items A3-A8 (ATTACHMENT A) unless otherwise specified by the Proposer

ITEM C2:	Full Crew and Equipment for Test Pit Excavation				
C2a:	Regular Time	Hour	**_____	_____	_____
C2b:	Standby Time	Hour	**_____	_____	_____
C2c:	Overtime	Hour	**_____	_____	_____
C2d:	Night and Weekend Shift Work	Hour	**_____	_____	_____
C2e:	Holiday Work	Hour	**_____	_____	_____
C2f:	Travel	Mile	**_____	_____	_____

** Same as Items B2a-B2f (ATTACHMENT B1) unless otherwise specified by the Proposer.

TOTAL COST OF ATTACHMENT C1, $:_____
(ITEM C1 TO ITEM C2)

CERTIFIED, DATE

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED, DATE

_____
SHRP Representative
Affiliation:_____

SHRP REGION_____ SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING DRILLING & SAMPLING CONTRACTOR_____

SHRP RCOC_____

NAS INVOICE VOUCHER ATTACHMENT C2

(Based on Fee Schedule C - Extra After Basic GPS Work)

PERIOD COVERED: (a) From____-____-____ (b) To____-____-____ SHEET NO._____OF_____

ALTERNATE 1 - Hourly Rates and Travel for any GPS Experiment

Item No.	Description	Unit	Unit Price	Quantity	Cost,$
ITEM C3:	Crew and Drill Rig for Boring and Coring up to 12 in. diam. holes				
C3a:	Regular Time	Hour	_____	_____	_____
C3b:	Standby Time	Hour	_____	_____	_____
C3c:	Overtime	Hour	_____	_____	_____
C3d:	Night and Weekend Shift Work	Hour	_____	_____	_____
C3e:	Holiday Work	Hour	_____	_____	_____
C3f:	Travel	Mile	_____	_____	_____
ITEM C4:	Crew and Equipment for Coring only - 4 or 6 inch diam.				
C4a:	Regular Time	Hour	_____	_____	_____
C4b:	Standby Time	Hour	_____	_____	_____
C4c:	Overtime	Hour	_____	_____	_____
C4d:	Night and Weekend Shift Work	Hour	_____	_____	_____
C4e:	Holiday Work	Hour	_____	_____	_____
C4f:	Travel	Mile	_____	_____	_____
ITEM C5:	Crew and Equipment for Bulk Sampling and Nuclear Tests				
C5a:	Regular Time	Hour	_____	_____	_____
C5b:	Standby Time	Hour	_____	_____	_____
C5c:	Overtime	Hour	_____	_____	_____
C5d:	Night and Weekend Shift Work	Hour	_____	_____	_____
C5e:	Holiday Work	Hour	_____	_____	_____
C5f:	Travel	Mile	_____	_____	_____
ITEM C6:	Shipping Samples	lbs.	_____/100lbs.	_____	_____

TOTAL COST OF ATTACHMENT C, $:_____
(ITEM C3 TO C6)

CERTIFIED, DATE

_____
Contractor Representative
Affiliation:_____

VERIFIED AND APPROVED, DATE

_____
SHRP Representative
Affiliation:_____

April 1990
(Issued March 1989)

THE ROLE OF PAVEMENT TEST PITS IN SHRP/LTPP RESEARCH

This paper explains the role of test pits in the Strategic Highway Research Program (SHRP) in support of the Long-Term Pavement Performance (LTPP) studies. The way in which test pits will be opened and sampled, and the use of the data that can be obtained from them, are reviewed. Test pits will contribute vital information that will enable SHRP to relate observations of pavement performance to the in-situ properties of subsurface materials. The completeness of such information, on a national basis, will influence SHRP's ability to develop new and better models of pavement performance and improved design methods. SHRP seeks the cooperation and support of the state highway agencies in permitting test pits to be employed.

Introduction

The term "test pit" describes a hole that is cut through the surface of a roadway to provide access to the subsurface layers, including the base, subbase, and subgrade. Typically a test pit is several feet wide and several feet long -- large enough for a person to conveniently enter it. It is usually dug in stages, layer by layer, and at its greatest depth a test pit may extend a foot or more into the subgrade.

Plans that are currently under development at SHRP call for one test pit six feet wide by four feet long, (i.e., across the outer wheel path, from the shoulder line to the center line of a highway lane). A test pit will be located at one end of each of the General Pavement Sections (GPS) test sections in the LTPP research program. At the present time SHRP plans to establish more than 700 GPS test sections in the U.S. and Canada. Additional test pits may be needed for other research projects such as the highway maintenance studies, where they are not immediately adjacent to a GPS section.

Since the thicknesses of the layers in highway pavements differ from one location to another, the depth of the test pits will vary also. SHRP plans call for a test pit that will extend one foot into the subgrade. Some unusually thick

major highways have three to five feet of material above the subgrade, so a test pit may be up to six feet deep.

To make a test pit for highway research purposes requires a combination of equipment and hand labor. First a diamond saw is used to cut a rectangular hole through the surface layer. After the surface material has been removed from the hole, in-situ tests are made to determine the density of the base course in the wheelpath and adjacent to it. Hand labor is used to obtain a bulk sample from a portion of the test pit, and then a backhoe completes bulk removal of the base. This process is repeated layer by layer until the predetermined depth in the subgrade is reached.

Appendix I contains an excerpt from the SHRP Technical Provisions for field sampling and testing. These specifications provide detailed information about how SHRP plans to install, sample, log and repair the test pits. However, the procedures are subject to amendment as experience is gained. The state highway agencies will be provided with revisions as they occur.

Purposes of the Test Pit

There are a variety of reasons a test pit is useful in pavement research.

Bulk sampling. Some or all of the large quantity of material that is removed during the excavation of the layers can be saved for further testing in the laboratory. A four-by-six foot test pit will yield up to 3000 pounds (1 1/2 tons) of material per foot of depth, although SHRP does not plan to retain the entire amount.

Bulk sampling is desirable for two reasons:

- to obtain a representative sample of each layer
- to provide an adequate quantity of material for laboratory testing

SHRP OPERATIONAL GUIDELINES FOR TEST PITS

1. If the state highway agency concludes that the excavation or configuration of a test pit presents an unacceptable hazard to motorists or workers, SHRP and its contractors will proceed according to the agency instructions.

2. Prior to any sampling and field testing activities within a state, the SHRP Regional Engineer will initiate discussions with the appropriate state personnel to establish the following:

   a. Sections where test pits are excluded for safety reasons.

   b. Sections where the state prefers to control the schedule or modify test pits for safety reasons. The SHRP Regional Engineer will ultimately decide if the modified test pits will yield appropriate information, and the state will decide if test pit excavation should proceed.

   c. The ability of the state to participate in the excavation of the test pit and pavement restoration.

   d. The feasibility of using the test pit excavation and/or sampling and testing lane closure to accommodate installation of monitoring instrumentation such as automated vehicle classifiers.

3. For GPS test sites with flexible pavements, test pits are essential. Based upon experience from the National Pilot Study, excavation of and restoration of test pits does not present safety hazards beyond those of the drilling and sampling operations, and can be completed within a normal working day.

4. For GPS test sites with rigid pavements, test pits are not required.

5. The SHRP regional drilling and sampling contractor will be responsible for all in-situ testing and collection of samples from the test pit to minimize variation in the process.

6. For those projects scheduled for overlay or rehabilitation before September 1992, the excavation of the test pit can be delayed and included as part of the design and/or construction of the overlay. This will include, or course, all projects included in GPS experiments with overlay where the overlay has yet to be placed. Field testing and sampling under such circumstances must be coordinated with the SHRP Regional Coordination Office to maintain quality assurance.

7. The SHRP Regional Engineer will maintain regular contact with the state highway agencies regarding revisions to this policy and details of the sampling and field testing program.

APPENDIX D: OPERATIONAL GUIDELINES ON TEST PITS

This Appendix is reproduced from SHRP Operational Memorandum No. 004, January 1989 as revised March 17, 1989. Some of the quantities in these guidelines have been revised in the past as indicated in the text of this guide.

Introduction

The inclusion of test pits in the materials sampling and testing activities for the General Pavement Sections (GPS) portion of the Long Term Pavement Performance (LTPP) program has been a matter of great importance to the SHRP research, and great interest to the highway agencies involved in it. Inclusion of test pits offers the opportunity to optimize the LTPP testing efforts and to contribute vital information on the performance-related behavior of subsurface pavement layers and subgrades. The rationale for test pits is addressed in the paper entitled, "The Role of Pavement Test Pits in SHRP/LTPP Research" included in this Appendix. The need for and nature of the test pits as described in that document have been discussed by the SHRP Expert Task Group on LTPP Materials Sampling and Testing, and represents the general consensus of that group.

Although the advantages of test pits are widely recognized, many agencies have voiced concerns about motorist and worker safety. Others have suggested that inclusion of the test pit will present schedule difficulties for state traffic control crews, as test pit excavation and restoration may take more than a normal work day. Satisfactory restoration of the pavement, particularly rigid pavement, was a major concern expressed by almost all agencies. Discussions of the practical considerations of a test pit policy have taken place among the SHRP staff, the state highway agencies, and the SHRP advisory structures. The experience gained through the national LTPP Drilling and Sampling Pilot Study also has influenced the development of these guidelines. This study was conducted with the cooperation of the North Carolina Department of Transportation in December 1988. In this study, test pits were opened in flexible pavements, a jointed portland cement concrete pavement with treated base, and a continuously reinforced portland cement concrete pavement.

To reach a workable balance between the research contribution of test pits and the practical problems associated with them, SHRP has adopted guidelines that include both essential and desirable elements. The guidelines also acknowledge that the state and provincial highway agencies are ultimately responsible for the safety of motorists and those working at the test site. The states are provided the flexibility to prohibit or control the scheduling of specific test pit excavation for safety reasons.

This flexibility will add considerable uncertainty for contractors responsible for SHRP's drilling and sampling activities, so strong communication between the states and the SHRP regional offices prior to field sampling will be a necessity. Furthermore, because this policy will add uncertainty to SHRP's drilling and sampling budget, the availability of state crews to participate in the excavation and restoration of the test pit must be established well in advance of actual field operations. As has been stated previously, SHRP sees such participation as essential because the state will bear responsibility for the "patch" and state personnel are better qualified than the SHRP drilling and sampling contractor to complete pavement repairs.

April 1990

APPENDIX D

SHRP OPERATIONAL GUIDELINES ON TEST PITS

SHRP has estimated that approximately 400 pounds of processed material will be needed from each granular layer for the comprehensive series of tests that is currently scheduled. "Processing" generally involves removal of particles larger than three-quarters of an inch, so bulk samples weighing 800 pounds or more will be required for some base and subbase materials.

It is essential that the materials tested be representative of the pavement layer. Coring tends to cut through aggregate particles, thereby modifying the gradation and angularity, and generating fines, while bulk samples taken by hand in test pits avoid these problems. Coring generally involves the use of water to cool the bit, which can lead to an erroneous determination of the moisture content of the granular materials. Augering large-diameter holes (viz., twelve inches) to obtain bulk samples presents problems in base and subbase layers, because the auger tends to mix the materials together and blur the interfaces. Thus, it can become difficult, if not impossible, to get a representative sample of base and subbase layers using auger methods. Augering also often biases the sample toward the finer fractions.

In-Situ Properties of Materials

The current AASHTO Guide for Design of Pavement Structures and virtually every other pavement design methodology in use today holds as a basic assumption that all the unbound layers of the pavement structure have been compacted to a specific minimum relative dry density and that the key structural parameters implied by meeting the specified density are reliable for design purposes and will vary little during the life of the pavement. Any study of long-term pavement performance that does not test this basic assumption and its implications cannot be used to test the validity of the design procedures themselves.

Key structural parameters such as strength, stability, and resilient modulus apparently do change over time due to changes in moisture content, intrusion of fines, degradation and so on. In some particular cases, the assumption that a satisfactory relationship exists between relative density and the key structural parameters may be invalid. In a limited number of cases, the specified density may not have been obtained during construction or has been lost

due to mechanical action of traffic or frost. Only by determining the site-specific conditions can the real relationships between the subsurface conditions and long-term performance be established.

In the current AASHTO guide, the load-carry capacity of a specific design varies directly with resilient modulus of the subgrade. There is also a significant relationship between capacity and the modulus of subgrade reaction for rigid pavement. The guide assumes that the unbound layers are compacted to 95° relative dry density as determined by AASHTO Test Method T-180.

If adequate care is taken to avoid disturbing the materials in the test pit, in-situ tests such as density and moisture content can be made. A nuclear gage can be used to obtain these data, or the sand cone test (or similar displacement tests) can be used to determine density, and a sample can be removed to determine the moisture content by drying. Variation in density and moisture content across the wheelpath can also be measured in the test pit.

It is nearly impossible to obtain good quality, accurate, in-situ density information in an augered hole. Even a twelve-inch diameter hole would be too small and too deep. Augering disturbs the material at the bottom of the hole, and it would not be possible to properly seat the density measuring device.

For SHRP research, the importance of obtaining accurate information about the in-situ moisture content of every pavement layer, including the subgrade, cannot be over-emphasized. SHRP intends to subject the pavement materials to a battery of sophisticated laboratory tests, including the determination of resilient modulus in the repeated-load triaxial test. Such tests must be performed on representative samples of the materials, which have been carefully compacted to the appropriate density at the proper moisture content, simulating in-situ conditions. The resilient modulus of granular materials is very sensitive to the moisture content and density.

If the laboratory test results are to yield moduli that are correct for the field conditions, it is critical for the field moisture content and density to be correctly defined. These data will be needed to explain deflections, roughness, and other dependent variable measurements at the test sites, and the

accuracy of the conclusions that will be drawn about pavement performance will be compromised if the in-situ data are not provided or are inadequate.

Subsurface Observations

Test pits provide a unique opportunity to clearly view a cross-section of the pavement to its full depth across the wheelpath. A permanent photographic record can be made to document what was seen. Core holes, even twelve-inch-diameter holes, do not provide an equivalent degree of access beneath the road surface to facilitate such observations, particularly at the subgrade level.

Direct measurement of pavement layer thicknesses can be obtained in a test pit. Deficiencies such as subgrade and base-layer rutting can be observed and measured. When a road has been overlaid or built in stage construction, such rutting often goes undetected except by means of a test pit. Surface rut depths and subgrade rut depths generally differ in magnitude. The only way to accurately assess this situation is with a test pit. In a recent survey conducted by the AASHTO Joint Task Force on Rutting, thirty-two states identified base/subbase distress as a major cause of rutting.

It is sometimes possible by means of a test pit to observe the intrusion of subgrade fines into the base/subbase. Erosion of the surface of the base layer, due to pumping, can also be detected.

Drainage deficiencies, either in the base or subgrade, or both layers, can be identified by using a test pit. Because a large vertical surface is exposed in a short time period, it is possible to obtain a good sense of the flow rate in layers that are near saturation, when water runs into the test pit. In "boxed" construction, where the base and subgrade are not free to drain laterally, drainage deficiencies often go undetected prior to the development of surface distress. Unless a hydrostatic pressure exists, which is uncommon, the problem cannot usually be detected solely by means of core holes.

Degradation of materials also can be observed in test pits. In areas where ground freezing occurs beneath the pavement, the effects of frost action on aggregates can be detected, particularly where the test pit extends deeper than

the normal frost depth. Visual observations of the materials above and below the frost line usually will disclose whether degradation has progressed.

Finally, it is sometimes possible to observe certain types of distress phenomena in the cut face of the surface course. Examples might include tensile crack formation at the bottom of asphalt concrete layers, and D-cracking in portland cement concrete layers. Shrinkage cracking or heaving of swelling subgrade soils can also be observed in test pits.

The location of test pits excavated at each site is significant. Each test section will contain two sampling areas before and after a 500-foot long zone where non-destructive dependent variable measurements will be taken. So that test pit patches will not induce anomalous dynamic loads in the dependent variable measurement zone, a single test pit will be excavated in the downstream sampling zone only. Determination of materials variability through the test section will be made by core and auger samples, and deflection readings taken in close conjunction with the sampling activities.

Where conditions warrant, consideration will be given to excavation of test pits at the downstream sampling area when the test section pavement is scheduled for rehabilitation or reconstruction. Site-to-site variation also will be used to identify specific sites where the in-situ parameters are suspect.

Problems with the Test Pit

Problems with the test pit generally fall into three categories:

- Lane closures and traffic control
- Obtaining a good patch
- Expense

Disruption of the flow of traffic, the difficulty of traffic control in a work zone, and safety of the work crews are related concerns that are factors on all types of highways. Having a majority of SHRP LTPP pavement test sections on Interstate highways, some with high traffic volumes and others with high

speeds, further sharpens these concerns, which is another reason why only one pit per section is contemplated.

It can be expected that the excavation and patching of a test pit will take anywhere from four to eight hours, depending on the surface type and thickness, and on the number of layers involved. Effective signing, crash protection devices, and alert flaggers will be needed throughout the process. To minimize disruption in high-traffic locations, it is possible for the crews to work at night. For safety, it is preferable, however, to work in the daytime to enhance safety and to facilitate visibility for subsurface observations.

Patching can be a problem on both asphalt and concrete pavements. Settlements of subsurface layers, which leads to pavement roughness, and water infiltration around the perimeter of the patch, is a concern. Reestablishment of the continuity of steel reinforcing bars in CRCP surfaces is also a special concern.

The best quality patching is achieved with careful attention to detail. Highway agency crews demonstrate their knowledge and competence in this regard on a daily basis when they make permanent patches at potholes and utility cuts. Good materials comparable to those removed from the test pit, and a high degree of compaction, will overcome the settlement problem. For best results in asphalt surfaces the edge of the hole should be primed to promote bonding, and hot asphalt concrete should be properly compacted. To assure continuity on CRCP surfaces the reinforcing bars should be exposed by jackhammering around the edge of the hole, and then the bars can be welded or spliced to state specifications to assure continuity.

Although the cost of a test pit will vary somewhat with the depth and the number of layers to be sampled, the cost is not prohibitive. Bid prices received by SHRP indicate that the average cost of opening and obtaining samples from a test pit as described herein will be in the range of $1700 to $2100, depending upon the pavement type and exclusive of patching costs and work-zone traffic control costs which will vary from state to state. Although bulk samples obtained with an auger are not as truly representative as the test pit samples, the augered holes are also expensive. SHRP bid prices for twelve-inch diameter

augered holes average over $50 per foot. For a twelve-inch thick base, it would take eight to nine borings to yield 800 pounds of material, and eight five-foot deep borings would cost as much as a test pit.

Alternatives to the Use of Test Pits

The alternatives to the use of test pits are less satisfactory because the information obtained from the alternatives generally is less complete, less reliable, and less useful for research applications.

Trenching along the shoulder at the edge of the roadway may, in some cases, permit obtainment of representative samples. Because the trench is not across the wheelpath, however, the opportunity is lost to measure density variations and to observe rutting and compaction due to traffic. Furthermore, for many roadways, the base and subbase materials do not extend out under the shoulder, and thus a shoulder trench would not provide access to the pavement materials.

Large-diameter coring, followed by augering into the granular sublayers, also is not entirely satisfactory as a substitute for test pits. Water used for coring can change the moisture content of the lower layers. It is very difficult to conduct in-situ density tests. And finally, it is difficult to obtain representative samples of layers that are relatively thin, when using auger methods.

It is possible that in lieu of density and moisture content, the borehole pressure meter or the cone penetrometer could be used to obtain related in-situ properties. These procedures have not been standardized, however, and it is difficult to know how to use the data to assure that a laboratory test specimen, say for a repeated-load triaxial test, has been properly compacted.

Summary and Conclusions

SHRP plans to use test pits to obtain vital information at the GPS and other LTPP test sites. Bulk samples of pavement materials that are truly representative, and data on in-situ conditions such as density and moisture content, will facilitate the laboratory testing program and will be very useful

to explain the field deflection data obtained with the falling weight deflectometer. Observations of subsurface conditions, including rutting and density variations across the wheelpaths, will also be very useful information for correlation with field performance.

Although the use of test pits presents problems in terms of traffic control and patching, no other viable alternatives exist that will accomplish the objectives obtained with a test pit. Coring and boring to obtain bulk samples is equally expensive, and presents many drawbacks. Considering the cost of the entire LTPP program (approx. $50 million), the cost of getting quality information from a test pit is small. Conversely, if an alternative method such as coring and boring is used, the associated possibility of drawing erroneous conclusions from many years of NDT data is real, and would be very costly.

The success of the SHRP LTPP research plan is highly dependent on the use of test pits to gather important subsurface information. In the final analysis, the ability to develop new and better models to explain pavement performance, and the ability to develop improved pavement design methods will be no better than the quality of the information that is gathered on the subsurface materials at the test sites.

APPENDIX E

EXAMPLE FIELD DATA PACKET

APPENDIX E: EXAMPLE FIELD DATA PACKET

This appendix contains an example field data packet for a GPS pavement. The example field data packet contained in this appendix is a representative sample of a field data packet which may be received from a GPS-1 pavement test section. The following items are included:

- Title Page
- As-Sampled Layout Plan
- Project Site Report (Form S07)
- Summary Material Samples Inventory for Shipment to Laboratory (Form S06A)
- Material Samples Inventory for Shipment to Laboratory (Form S06)
- Log of Shoulder Probe (Form S05)
- In Situ Density and Moisture Tests (Form S04)
- Log of Test Pit (Form S03)
- Log of Test Pit-Sketch (Form S03A)
- Log of Bore Hole-A.. Type (Form S02A)
- Log of Bore Hole-BA.. Type (Form S02B)
- Log of Pavement Core for Borehole Locations (Form S01)
- Log of Pavement Cores for C-Type Core Locations (Form S01A)

This data packet is an example only, variations in the number of items and the type of field data forms may occur according to the type of GPS pavement and specific field conditions encountered during the field sampling and field testing operation.

SHRP REGION : North Atlantic

STATE : North Carolina

SHRP SECTION ID NUMBER : 371817

EXPERIMENT NAME : GPS-1

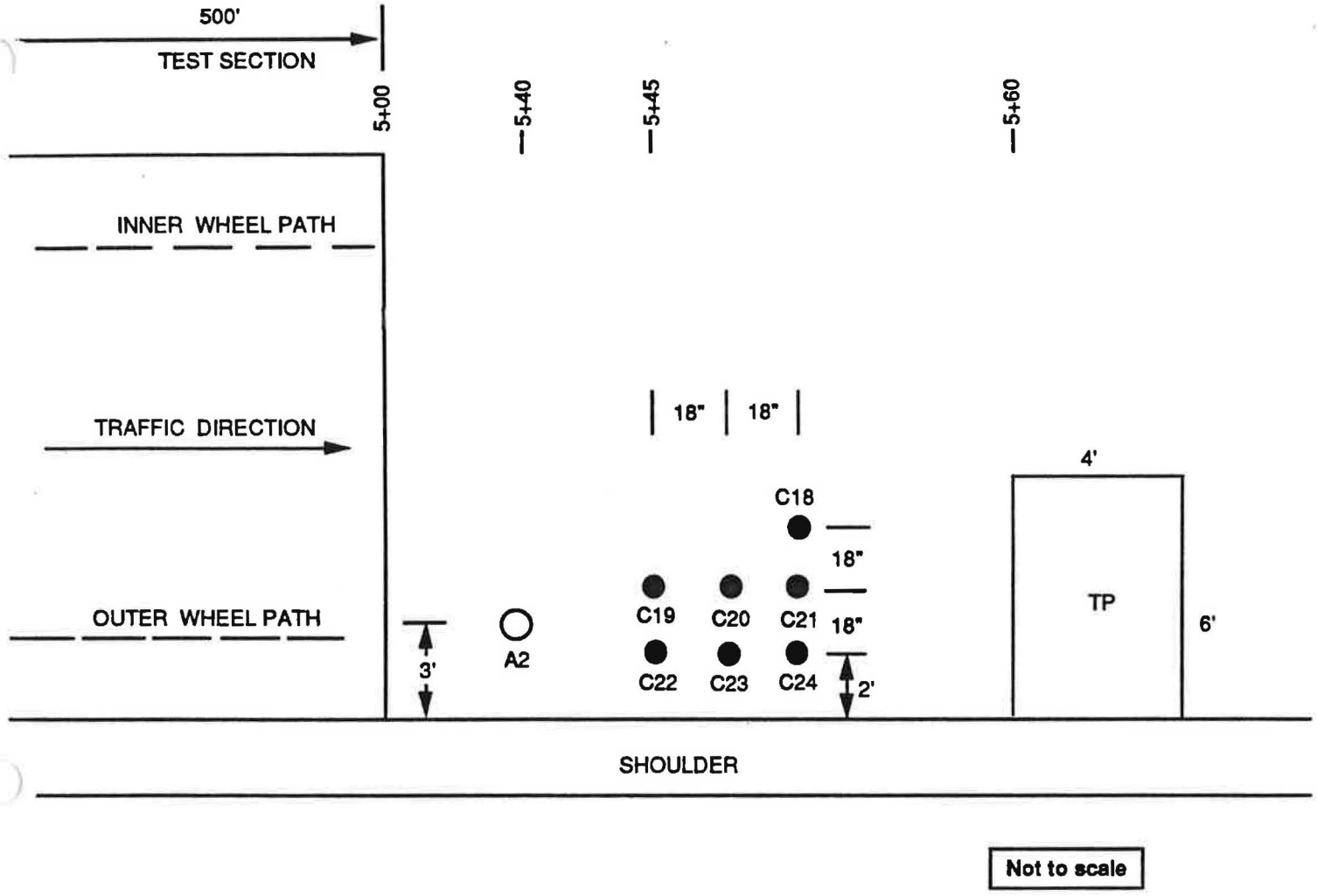
HIGHWAY NUMBER : US 311

DATE OF FIELD MATERIAL SAMPLING AND FIELD TESTING : 3-30-90

SUBMITTING CONTRACTOR : XYZ

TOTAL SHEETS, INCLUDING THIS COVER PAGE : 25

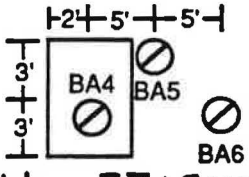
EXAMPLE



● 4" OD core of AC pavement surface: C18-C24

○ 6" OD core of AC pavement surface; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A2

▭ Test pit (4' x 6' x 12" below top of subgrade). Removal of pavement layers; collection of AC pavement block; nuclear density and moisture measurements on unbound granular base and subbase layers and untreated subgrade; bulk sampling of unbound granular base and subbase layers and untreated subgrade: TP

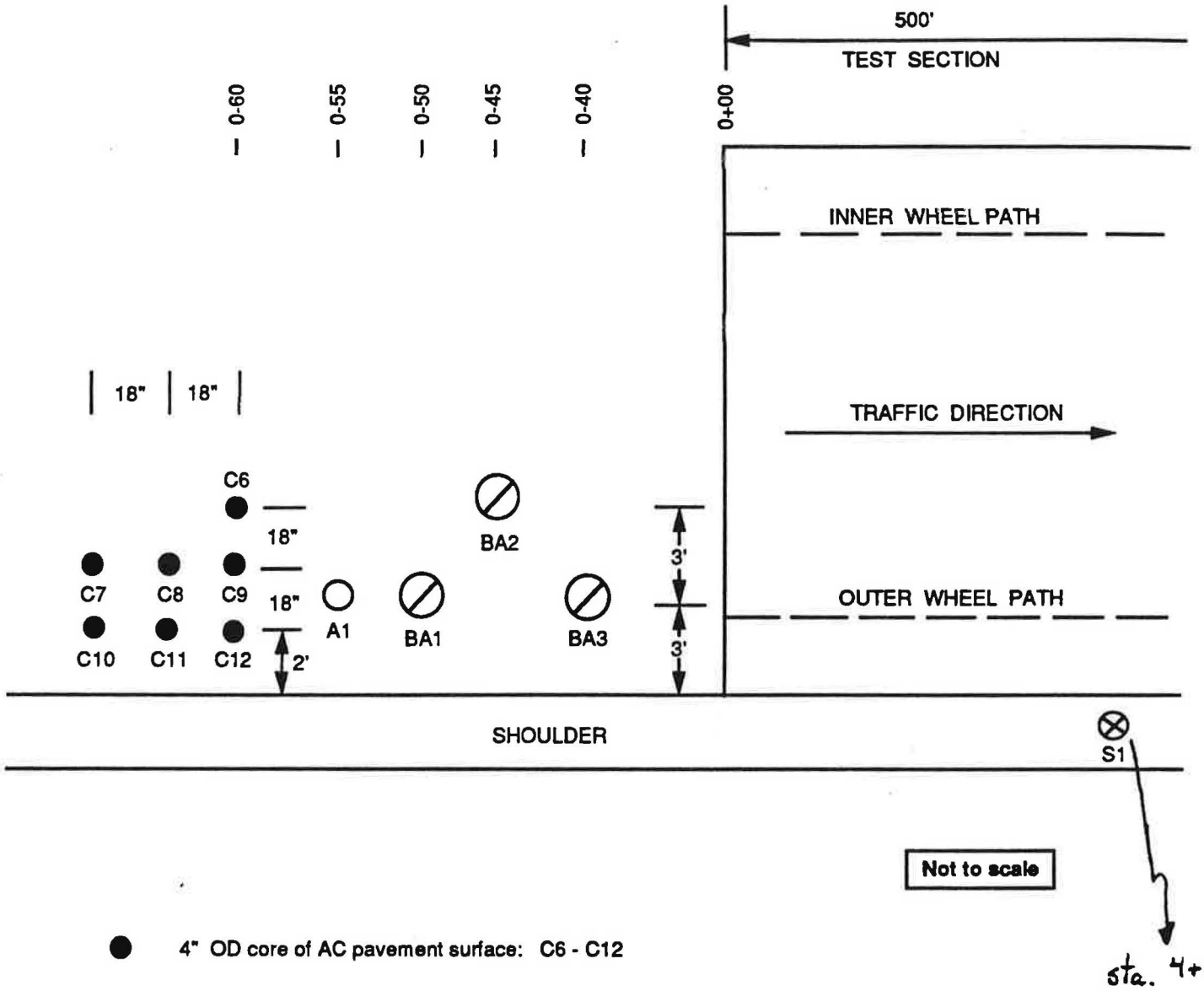


When the test pit cannot be done, use 12" cores and 12" boreholes (BA4, BA5, BA6) for the retrieval of one AC core and bulk and moisture samples of unbound granular base and subbase layers and untreated subgrade. See sketch for approximate locations of BA4, BA5 and BA6.

SITE No. 371817 3-30-90 SHEET No. 24 of 25

Figure B.2. Sampling Point Locations After Test Section, GPS-1 Asphalt Concrete over Granular Base

EXAMPLE



● 4" OD core of AC pavement surface: C6 - C12

○ 6" OD core of AC pavement surface; augering of unbound granular base and subbase; thin-walled tube and/or splitspoon sampling as directed by SHRP Authorized Representative to 4' below top of subgrade: A1

⊘ 12" OD core of AC pavement surface; augering of unbound granular base and subbase and untreated subgrade to 12" below top of subgrade for bulk sample retrieval: BA1, BA2, BA3

⊗ Auger Probe - optional as directed by SHRP Authorized Representative: S1

SITE No. 371817 3-30-90 SHEET NO. 23 OF 25

Figure B.1. Sampling Point Locations Before Test Section, GPS-1 Asphalt Concrete over Granular Base

EXAMPLE

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS 1 ROUTE/HIGHWAY US311 Lane 1 Direction S
FIELD SET NO. 1

PROJECT SITE REPORT

SHEET NO. 22 OF 25

DATE 3-30-90 ARRIVAL ON SITE 7:30 (AM)/PM WORK COMPLETED 1:30 AM/(PM)

CREW CHIEF P. McKenna HEAD DRILLER M. Mosley CREW SIZE 7

SHA REPRESENTATIVE John Doe SHRP REPRESENTATIVE Jane Smith

WEATHER Clear, Cold 30-35°F NIGHT AND WEEKEND WORK 0 HOURS

BREAKDOWN NONE HOLIDAY WORK 0 HOURS

REGULAR HOURS (EXTRA) 0 HOURS STANDBY TIME 0 HOURS OVERTIME 0 HOURS

WORK PROGRAM: (a) BASIC GPS (SCHEDULE A) ✓
OPTIONAL ITEMS: S1(SHOULDER AUGER) TP (TEST PIT)

(b) EXTRA GPS (SCHEDULE B) None

(c) DELETED GPS (SCHEDULE B) None

(d) AFTER BASIC GPS (SCHEDULE C) None

(e) OTHER SHRP WORK None

TEST PIT EXCAVATION (Provided by): XYZ PATCHING (Provided by): NCDOT

TRAFFIC CONTROL (Provided by):

SAMPLES TO BE SHIPPED TO:	MATERIALS TYPE(S):	SHIPPING WEIGHT(lbs.)
PSI, Pittsburgh	AC	Unknown
	Granular Base	
	Subgrade	

GENERAL REMARKS: Exact shipping weight is not known at the time of this report.

CERTIFIED	VERIFIED AND APPROVED	MONTH-DAY-YEAR
Signature	Signature	3-30-1990
Crew Chief, Contractor	SHRP Representative	Date
Affiliation: XYZ	Affiliation: ABC	

EXAMPLE

Form S07/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US311 Lane 1 Direction S
FIELD SET NO. 1

SUMMARY
MATERIAL SAMPLES INVENTORY
FOR SHIPMENT TO LABORATORY

WORK COMPLETED ON 3-30-90 SHEET NUMBER 21 OF 25

NOTE: This summary is based on the material samples inventory information provided on Form S06.

LAYER NO. (From Subgrade)	MATERIAL/SAMPLE TYPE	TOTAL NUMBER OF SAMPLES
3	AC CORES: 4" Diameter 14 6" Diameter 2 12" Diameter 1 AC Cores with Bound Base/Subbase ____ AC Cores with PCC ____ AC Cores with PCC and Bound Base/Subbase ____ PCC Cores with Bound Base/Subbase ____	
____	PCC CORES: 4" Diameter ____ 6" Diameter ____	
____	BOUND BASE CORES: 4" Diameter ____	
2	UNBOUND BASE SAMPLES: (a) BAGS (BULK) 16 (b) JARS (MOISTURE) 5	
____	BOUND SUBBASE CORES: 4" Diameter ____	
____	UNBOUND SUBBASE SAMPLES: (a) BAGS (BULK) ____ (b) JARS (MOISTURE) ____	
1	SUBGRADE SAMPLES: (a) BAGS (BULK) 13 (b) JARS (MOISTURE) 5 (c) THIN-WALLED TUBES ____ (d) SPLITSPOON 4 JARS	

PCC CORES TO BE SHIPPED TO: ____

ALL OTHER SAMPLES TO BE SHIPPED TO: PSI Pittsburgh, PA.
(Including combined cores of two or more layers)

GENERAL REMARKS: Also included is on 12" x 12" block sample.

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

PREPARED ON:
MONTH-DAY-YEAR
3-30-1990
Date

EXAMPLE

Form S06A/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US311 Lane 1 Direction S
FIELD SET NO.

MATERIAL SAMPLES INVENTORY FOR SHIPMENT TO LABORATORY

WORK COMPLETED ON 3-30-90 SHEET NUMBER 20 OF 25

Note: Use additional sheets if necessary. Include Form S06A for summary information and "as actual" sampling location plan sheets with this material samples inventory.

SAMPLE LOCATION	SAMPLE NUMBER	SAMPLE SIZE	SAMPLE TYPE	SAMPLE MATERIAL	SAMPLE CONDITION	PROGRAM OF WORK *
BA1	CAG1	12"	Core	AC	Good	Basic GPS
BA1	BG01	2 bags	bulk	base	Satisfactory	"
BA1	MG01	Jar	moisture	base	"	"
BA1	BS01	2 Bags	bulk	Subgrade	"	"
BA1	MS01	Jar	moisture	Subgrade	"	"
BA2	BG02	2 Bags	bulk	base	"	"
BA2	MG02	Jar	moisture	base	"	"
BA2	BS02	2 Bags	bulk	Subgrade	"	"
BA2	MS02	Jar	moisture	Subgrade	"	"
BA3	BG03	2 Bags	bulk	base	"	"
BA3	MG03	Jar	moisture	base	"	"
BA3	BS03	2 Bags	bulk	Subgrade	"	"
BA3	MS03	Jar	moisture	Subgrade	"	"
TP	KA01	12" x 12"	block	AC	Good	"
TP	BG55	10 BAGS	bulk	base	Satisfactory	"
TP	MG55	2 Jars	moisture	base	"	"
TP	BS55	7 Bags	bulk	Subgrade	"	"
TP	MS55	2 Jars	moisture	Subgrade	"	"

* Enter "Basic GPS" or "Extra GPS" or "Deleted GPS" or "After Basic GPS" or "Other."

GENERAL REMARKS:

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC
EXAMPLE

PREPARED ON:
MONTH-DAY-YEAR
3-30-1990
Date

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS-1 ROUTE/HIGHWAY US 311 Lane 1 Direction S
FIELD SET NO. 1

MATERIAL SAMPLES INVENTORY FOR SHIPMENT TO LABORATORY

WORK COMPLETED ON 3-30-90 SHEET NUMBER 19 OF 25

Note: Use additional sheets if necessary. Include Form S06A for summary information and "as actual" sampling location plan sheets with this material samples inventory.

SAMPLE LOCATION	SAMPLE NUMBER	SAMPLE SIZE	SAMPLE TYPE	SAMPLE MATERIAL	SAMPLE CONDITION	PROGRAM OF WORK *
C6	CA06	4"	Core	AC	Good	Basic GPS
C7	CA07	"	"	"	"	"
C8	CA08	"	"	"	"	"
C9	CA09	"	"	"	"	"
C10	CA10	"	"	"	"	"
C11	CA11	"	"	"	"	"
C12	CA12	"	"	"	"	"
C18	CA18	"	"	"	"	"
C19A	CA19	"	"	"	"	"
C20	CA20	"	"	"	"	"
C21	CA21	"	"	"	"	"
C22	CA22	"	"	"	"	"
C23	CA23	"	"	"	"	"
C24	CA24	"	"	"	"	"
A1	CA51	6"	Core	AC	Good	Basic GPS
A1	JS01	Jar	Splitspoon	Subgrade	Satisfactory	"
A1	JS02	Jar	Splitspoon	Subgrade	"	"
A2	CA52	6"	Core	AC	Good	Basic GPS
A2	JS03	Jar	Splitspoon	Subgrade	Satisfactory	"
A2	JS04	Jar	Splitspoon	Subgrade	"	"

* Enter "Basic GPS" or "Extra GPS" or "Deleted GPS" or "After Basic GPS" or "Other."

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

PREPARED ON:
MONTH-DAY-YEAR
3-30-1990
Date

EXAMPLE

SHRP-LTPP FIELD MATERIAL SAMPLING AND FIELD TESTING

STATE CODE 37

SHRP REGION NA

STATE NC

SHRP ASSIGNED ID 371817

LTPP EXPERIMENT 0251 ROUTE/HIGHWAY US311 Lane 1 Direction S

SAMPLE/TEST: (a) Before Section _____ (b) After Section _____ FIELD SET NO. 1

LOG OF SHOULDER PROBE

DCG SHEET: 08

OPERATOR M. Mosley EQUIPMENT USED Mobile B55 SHEET NUMBER 18 OF 25

AUGERING DATE 3-30-90 LOCATION STATION: 4+00 AUGER PROBE NUMBER S1

TOP OF ROCK BASED ON: — OFFSET: 3 feet from °/s

NOTE: SHOULDER AUGER PROBE IS AN OPTIONAL ITEM, AS DIRECTED BY SAR.

Scale (feet)	Depth from Surface (Feet)	Material Description	Material Code
1			
2		Brown micaceous clayey silt	148
3			
4	4.0		
	4.5	Boulder	284
5		Brown micaceous clayey silt	141
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

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

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

EXAMPLE

Form S05/April 1990

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS1 ROUTE/HIGHWAY US 311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section _____ (b) After Section ✓ FIELD SET NO. 1

IN SITU DENSITY AND MOISTURE TESTS

DCG SHEET: 07

OPERATOR P. McKenna NUCLEAR DENSITY GAUGE I.D. 10017 SHEET NUMBER 17 OF 25
TEST DATE 3-30-90 LOCATION: STATION 5+62 TEST PIT NUMBER TP1
DATE OF LAST MAJOR CALIBRATION 12-13-89 OFFSET 3 feet from °/s
Note: Use additional sheets if necessary

DEPTH FROM SURFACE TO THE TOP OF THE LAYER, INCHES (SEE S03)		4.6				16.6	
TEST TYPE		BASE COURSE TOP Result, pcf Wet	Dry	SUBBASE TOP Result, pcf Wet	Dry	SUBGRADE TOP Result, pcf Wet	Dry
MATERIAL TYPE: (Unbound-G Other-T)		G				G	
IN SITU DENSITY, pcf (AASHTO T238-86)	1	139.9				99.4	
	2	139.0				98.1	
	3	137.1				100.0	
	4	140.2				98.1	
AVERAGE		139.0				98.9	
Method (A,B,or C)		B				B	
Rod Depth, inches		8				8	
IN SITU MOISTURE CONTENT, % (AASHTO T239-86)	1	5.6				28.2	
	2	5.9				30.1	
	3	5.3				28.0	
	4	5.4				29.5	
AVERAGE		5.6				29.0	

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

EXAMPLE

SHRP REGION NA
STATE NC

SHRP-LTPP
FIELD MATERIAL SAMPLING
AND FIELD TESTING

STATE CODE 37
SHRP ASSIGNED ID 371817

LTPP EXPERIMENT GPS1 ROUTE/HIGHWAY US 311 Lane 1 Direction S
SAMPLE/TEST: (a) Before Section _____ (b) After Section ✓ *FIELD SET NO.* 1

LOG OF TEST PIT

DCG SHEET: 05
TECHNICIAN P. McKenna EQUIPMENT Backhoe SHEET NUMBER 16 OF 25
EXPLORATION DATE 3-30-90 *LOCATION: STATION* 5+62 *TEST PIT NUMBER* TP1
PIT SIZE: (a) *Length* 6 feet *OFFSET* 3 feet *from* °/s
(b) *Width* 4 feet

Scale (Inches)	Strata Changed (Inches)	Moisture Sample No.	Bulk Sample No.	Material Description	Material Code
4	4.6	—	KA01	AC	700
8					
12		MG55 (2 jars)	BG55 (10 bags)	Crushed Stone Base	
16	16.6				303
20				Reddish Brown clayey silt (micaceous)	
24		MS55 (2 jars)	BS55 (7 bags)		
28	28.6				148
32					
36					
40					
44					
48					

GENERAL REMARKS: _____

CERTIFIED
Signature
Crew Chief, Contractor
Affiliation: XYZ

VERIFIED AND APPROVED
Signature
SHRP Representative
Affiliation: ABC

MONTH-DAY-YEAR
3-30-1990
Date

EXAMPLE

Form S03/April 1990