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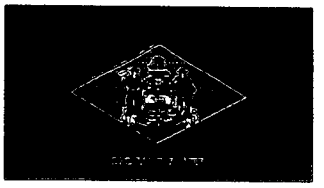

Delaware

LTPP Specific Pavement Studies

Construction Report on SHRP 100200, SPS-2 Project, Ellendale, Delaware
Spring 1994 - Spring 1996

Report No. FHWA-TS-96-10-04

October 1996

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LTPP Specific Pavement Studies

Construction Report on SHRP 100200, SPS-2 Project Ellendale, Delaware Spring 1994 - Spring 1996

Report No. FHWA-TS-96-10-04

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15. *Supplementary Notes*

The SPS Project 100200 is a part of the Specific Pavement Studies Experiment SPS-2, strategic study of Structural Factors for Rigid Pavement It is located in the Wet-Freeze Environmental Zone of the Federal Highway Administration's Long Term Pavement Performance Program and conforms to the L Series of Coarse Subgrades in the Experimental Design.

16. Abstract

Project 100200 is located on the southbound driving lane of the 4-lane divided US-113, between Milford and Georgetown, Sussex Co , DE. There are twelve 500 ft. long SPS-2 experimental sections and two supplemental agency test sections in the 4 03 mile construction contract The prime contractor was Greggo and Ferrara of New Castle, DE The contract was awarded on September 20, 1993. Portland Cement Concrete pavement placement occurred between June 15, 1995 and November 21, 1995.
The southbound lanes were opened to traffic on May 13, 1996

The report includes descriptions of the layout of the test sections, details of materials sampling and field and laboratory testing plans Construction equipment used on the project is named and construction dates and sequences are described. A SPS Project Deviation Report is included as Appendix A.

17. Key Words	18. Distribution Statement
LTPP, SPS-2, Dense Graded Aggregate Base (DGAB) Permeable Asphalt Treated Base (PATB), Lean Concrete Base (LCB), Graded Aggregate Base Course (GABC)	

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SPS-2 - US 113 SB Ellendale, Delaware
FHWA-LTPP Project 100200
Federal Aid Project Number - NH-S113 (2)
DEL DOT CONTRACT NUMBER 88-013-04

INTRODUCTION

This SPS-2 project is located on Highway US 113 between Milford and Georgetown, Delaware, between State Route S 579 and Milford (Station 550+00 - 762+63) a distance of 4.03 miles. The closest town, Ellendale, is located on Route 16 which intersects US 113 south of the project limits (see Figure 1). The project is in the Wet-Freeze Environmental Zone of the Federal Highway Administration's Long Term Pavement (LTPP) Program and conforms to the L series of Coarse Subgrades in the experimental design.

US 113 was a two lane north-south arterial highway in the project area. The average annual daily traffic (two directions) is 10,708 (1989); percent heavy trucks and combinations is 10%; the estimated 18 KESAL rate in the study lane (KESAL/yr.) is 203.2 and the total design 18 KESAL applications in the design lane are 3,048,600 for a design period of fifteen years. The project involved the twinning of the existing two lanes with 2-12' lanes. The two new lanes will carry southbound traffic. The existing two lane facility will be widened and rehabilitated to form the two northbound lanes. Northbound and southbound traffic will be separated by a 26'-42' wide median.

The Delaware DOT SPS-2 project involves the construction of twelve test sections and two supplemental test sections all of which are located in the southbound travel lane between Stations 601+00 and 708+00, a distance of 2.03 miles. Within this area there is an intersecting highway, Route S 625 (Station 666+75) and the Mahonia Road Access to a subdivision on the west side of US 113 (Station 614+00). They will not have any significant effect on the truck traffic through the test sections. The chainage runs opposite to the direction of traffic.

The SPS-2 project is located in the Atlantic Coastal Plain. The topography is flat to gently rolling. The soil is generally sand and silty sand. There are pockets of wet land where the water table is at or near the surface for long periods of time. The depth to bedrock is not known. It is believed to be several hundred feet below the surface. Several of the test sections contain shallow cuts (less than 2') except Section 100208 where the cut is up to 5' in depth.

The Contract Documents (Plans, Supplemental Specifications, Special Provisions and Bid Proposals) were prepared by the Road Design Office at the Delaware DOT head office in Dover. Pavement Management Systems Limited (PMSL), the FHWA-LTPP Regional Contractor provided information on the SPS-2 requirements to the Road Design Office (Mr. L. Casanova, Mr. C. Carucci), in 1992 to assist with the preparation of the Contract Documents. Where existing Specifications did not meet the SPS-2 requirements, Special Provisions were prepared and incorporated into the Contract Documents to comply with the Construction Guidelines for Experiment SPS-2, Strategic Study of Structural Factors for Rigid Pavements.

A pre-bid meeting was held on Wednesday, July 28, 1993 at 1:00pm in the Conference Room at the Delaware DOT's Central District Headquarters Building. The meeting was chaired by Bobbi Hettel-Minner, Contract Supervisor. Several prospective Contractors were in attendance.

The Contract was awarded to Greggo and Farrara on September 20, 1993 with a completion data of 600 calendar days. The total bid price was $7,489,319.29. Change orders issued during the course of construction has increased the cost of the work and the final cost will not be available until the Contract has been completed.

Greggo and Farrara were also the successful bidders on the adjoining SPS-1 project to the south located between Route S 579 and Route S 224 (Station 330+50 - 550+00), Delaware DOT Contract No. 88-013-02, Federal Aid Project No. NH-STP-113 (1). The SPS-1 and this SPS-2 project were underway at the same time and it was possible to exchange equipment and manpower as the need arose.

The Contractor's team from their Head Office included Mr. Nicky Farrara, Executive; Mr. Sam Whitaker, General Superintendent; and Ms. Ellen Rohrback, Engineer. The Contractor's team in the field included Mr. Jim Austin, Superintendent (also Superintendent for SPS-1 project); Mr. Charlie Moore, Grade Foreman; Mr. Randy Lewis, Grade and Dowel Placement Foreman; Mr. Bruce Benson, Asphalt Foreman; Mr. Sam Morris, Concrete Construction Foreman; and Mr. Ron Rineer, Survey Foreman.

The Sub-Contractors were:

1) Wyoming Concrete Industries Inc., Delaware. Mr. Francis A. DiMondi, Jr. was the contact person who prepared the concrete mix designs and established the concrete plant on the Contract about 500' west of Highway US 113 at Station 600+00.

2) Peltz Construction, Nebraska. Peltz Construction placed the soil cement and the lean concrete base on this Contract.

3) Chris Electrical Contractors, Delaware. Delaware DOT arranged a separate Contract with Chris Electrical Contractors for the installation of the Automated Weather Station Compound (AWS) on the Department of Agriculture property at the southwest corner of Route S 623 and US 113 (Station 587+00). Mr. Bob Radish, Delaware DOT arranged for the Hydro and Mr. Brandt Henderson, PMSL, installed the equipment. The AWS became operable on November 15, 1995. It will also serve the SPS-1 project.

4) Sawing Contractor, Concrete Cutting Co., Inc., 539 London Bridge Road, Virginia Beach, Virginia. Mr. George McGuire and Mr. Jim Moore were the Foremen.

The administration and supervision of the Contract was carried out by the Delaware DOT South District Office in Georgetown; - Mr. Allan Redden, District Engineer; Mr. David Mills, Construction Engineer and Mr. Thomas Brown, Construction Supervisor. The field supervision was carried out by Mr. Joe Damen, Chief Project Inspector; Mr. Jay King, Office Supervisor; Mr. LeRoy Hooper, Construction Inspector and Mr. Art Jamieson (from the Consulting Firm of Site Engineers, Inc.). Other construction inspectors were retained (mainly students) from time to time as required. Site Engineers Inc. were also retained to carry out the plate load bearing tests.

The materials sampling, testing and quality control support is provided to the District Construction Staff through the Materials and Research office in Dover. Field Technicians are assigned to specific districts or Contracts and they can call upon other Technicians as the need arises. The Materials and Research personnel directly involved with the SPS-2 project from the Dover office were:

Mr. Wayne Kling, Chief Materials and Research Engineer; Mr. Jim Pappas, Materials Engineer; Mr. Bill Brode, Portland Cement Concrete Supervisor; Mr. David VanKavelaar. Soils Engineer; Mr. Jim Reynolds, Project Field Coordinator; Mr. Elmer Wooleyhand. Field Control Supervisor and Mr. Al Strauss, Random Sampling Supervisor.

Mr. Bob Radish, Field Technician, was assigned to the South District Office in Georgetown and to the SPS-2 project. He undertook and/or coordinated sampling and field testing required for SPS-2 for quality control purposes. Assistance was obtained as required especially for the sampling and testing of fresh concrete, 5-point levels and nuclear density and moisture tests from Technicians Mr. Al Strauss, Mr. Mike Johnson, Mr. Scott Shuh and Mr. Al Brittingham on very short notice so that there was never any hold up to the Contractor.

Mr. Al Strauss also acted for Mr. Bob Radish in his absence, supervised the storage of samples, provided liaison between the field and laboratory, sent samples to the outside laboratories for testing, received and analyzed the test results and then forwarded them to PMSL. All of the bulk soil and aggregate samples and the Shelby tubes were stored in a metal shipping container located in the Delaware DOT maintenance yard in Dover in a fenced-in compound just outside the laboratory.

Mr. Bob Radish also made the arrangements for the soils drilling crew, core drilling crew, sample containers, plate load bearing tests and pavement markings. Mr. Garey Glanden was in charge of the core drilling crew and Mr. Wayne Hurd the soils drilling crew. The drilling crews took the concrete cores and the Shelby tubes to Dover at the end of each day. Mr. Bob Radish supervised the construction of the Automated Weather Station Compound.

The Weigh-in-Motion scale (WIM) was originally planned to be installed at the north end of the LTPP SPS test sections. However, due to lack of hydro at the proposed location it was decided to place it as the south end of the project in the vicinity of Station 580+00 as soon as practical. It will be north of Route 16. The installation of the WIM for the SPS-1 project at Station 329+00 was completed November 13, 1995.

The on-site construction inspection for PMSL was carried out by Mr. Alex Rutka. He was assisted at the various times by Mr. Alfred Lip, Mr. Paul Woelfle, Mr. Dave Bauer and Mr. Ed Lesswing.

PROJECT DETAILS

The SPS-2 project consists of twelve SPS test sections and two supplementary agency test sections. The pavement structure consisted of plain concrete pavement with 15' joint spacing, widths of 12' and 14'; thicknesses of 8" and 11" and DGAB thicknesses of 4", 6" and 8"; PATB thickness of 4" and LCB thickness of 6". The joint spacing of 15' started 50' before and ended 50' after each test section. The slab length in the transition areas varied up to 20' which is the normal Delaware DOT spacing. The concrete flexural strengths were 550 and 900 psi. The two supplementary test sections consisted of a width of 12', 8" DGAB and 10" of concrete with a compressive strength of 3000 PSI. Test section 100260 contained four types of plastic dowels and test section 100259 contained steel dowels.

Figure 2 shows the Longitudinal Layout and Pavement Structure of the Experimental Sections. Similar information is provided in Table 1.

The layout plan was followed throughout construction except for the six 550 psi flexural strength test sections. The 550 psi concrete in test sections 100205, 100201 and 100209 was placed on June 16, 1995. Because of excessive shrinkage cracking, it was broken up later and replaced with Delaware DOT type B mix-3000 psi compressive strength, (+/- 650 psi flexural strength) on October 12, 1995. The other three 550 psi flexural strength test sections 100211, 100203 and 100207 received the 3000 psi concrete on June 28, 1995. The 900 psi flexural strength concrete on test sections 100206, 100202 and 100210 was placed on June 29, 1995. Test sections 100206 and 100202 were broken up later and replaced with another 900 psi flexural strength concrete on November 21, 1995, again because of excessive shrinkage cracking.

Materials Sampling and Testing

The final revised materials sampling and testing plans were issued by PMSL on August 3, 1994. They contained the sampling and testing information in the form of Figures and Tables.

The Figures are as follows:

Figures 3 to 7	The Field Materials Sampling and Testing Plan for Layers 1, 2, 3, 4, 5 and 6
Figures 8 to 21	Sampling and Testing Plans for Each Test Section showing the location of field sampling and testing for each layer

The Tables include information on sampling of materials, on the laboratory materials testing plan and on the laboratory testing requirements by the Delaware DOT State Laboratory or by the FHWA-LTPP Contractor's Laboratory. They are as follows:

Table 2	Scope of Materials Sampling
Table 3	Scope of Material Sampling: Primary SPS-2 Experiment
Table 4	Scope of Field Testing
Table 5	Samples for the Materials Reference Library (MRL)
Table 6	Sampling and Laboratory Testing - State Laboratory Embankment and Subgrade Samples
Table 6A	Sampling and Laboratory Testing - FHWA-LTPP Laboratory-Embankment and Subgrade Samples
Table 7	Sampling and Laboratory Testing - State Laboratory-Shelby Tubes

Table 7A	Sampling and Laboratory Testing - FHWA-LTPP Laboratory-Shelby Tubes
Table 8	Sampling and Laboratory Testing - State Laboratory-Granular Aggregate Base Course (GABC)
Table 8A	Sampling and Laboratory Testing - FHWA-LTPP Laboratory-Granular Aggregate Base Course (GABC)
Table 9	Sampling and Materials Testing - State Laboratory-Permeable Asphalt Treated Base (PATB)
Table 10	Tracking Table for Molded PCC Cylinders and Beams
Table 11	Schedule for Coring and Testing of LCB - 4" OD Cores
Table 12	Schedule for Coring and Testing of PCC - 4" OD Cores

The sampling and field testing was carried out in accordance with the sampling and testing plan. If there were any changes particularly in the sampling locations, these changes were noted in the test section plan sheet or explained in the appropriate test section portion of this report.

All of the field sampling and testing was carried out by the Delaware DOT Field Technicians except for the Plate Load Bearing Test which was done by the firm - Site Engineers, Inc. All of the samples assigned to the State Laboratory are to be tested at the Delaware DOT Materials and Testing Laboratory #1021 located in Dover except for the Coefficient of Thermal Expansion Test P63 and the Air Content Test P68. P63 testing was done at Turner Fairbank. P68 testing was done by the CTL Engineering Laboratory in Columbus, Ohio.

All of the bulk subgrade, embankment and granular base samples and the Shelby tubes assigned to the FHWA-LTPP Contractor Laboratory (code #1311) were collected during the course of construction and stored in the Dover Maintenance yard. They were placed in twenty-nine wooden boxes constructed by the Delaware DOT and taken to TNT Red Star Shipping, Bridgeville, Delaware, along with the Materials Sampling and Testing information for shipment to the FHWA-LTPP Contractor's Laboratory, Law Engineering Inc. 386 Plasters Ave., Atlanta, Georgia, 30324, on April 10, 1996. The samples were received on April 16, 1996.

Samples for the Materials Reference Library (MRL) were taken during the course of construction and stored at the Georgetown Laboratory and in the Dover Maintenance yard. The samples were taken by Mr. Bob Radish to TNT Red Star Shipping, Bridgeville, Delaware on December 18, 1995 for delivery to the Materials Reference Library, 1625 Crane Way, Sparks, Nevada, 89431. The information on the samples submitted is shown in Table 13 and Table 13.1. The contact person was Mr. Colby Rowe.

The field sampling and field testing activities were carried out in conjunction with construction operations from June 1994 to December 1995. The laboratory testing of the concrete cores and beams was also completed by December 1, 1995 and the test results are included in this report. Concrete repairs were made in April 1996. Joint sealing was carried out in March, April and May 1996.

Sampling, field testing and construction dates are shown in Table 14. Table 14 will be referred to throughout the report. The construction dates are significant since they reflect the problems which were encountered. The southbound lanes were opened to two-way traffic on May 13, 1996.

Sampling, field testing and laboratory test results have been summarized in Table form and are presented under the following categories:

Subgrade and Embankment

Subgrade in this report refers to the original ground. Bulk samples were taken when the fill (embankment) was less than 4'. A subgrade bulk sample was also taken in a cut when the subgrade material met type 'A' borrow specifications; see Table 15. Bulk samples of the embankment are shown in Table 16.

Shelby Tubes

Nine of the fourteen test sections contained partial shallow cuts less than two feet except for test section 100208 where the depth of cut was up to five feet. Four of the six Shelby tube test sections contained partial cuts; sections 100201, 100204, 100207 and 100211. The subgrade material in two of these test sections (100201 and 100211) met Type 'A' borrow specifications and was left in place. Two Shelby tubes in test sections 100201 and 100211 (A16 and A14) were taken in cut and the remainder in fill. The subgrade material in the other of these four test sections (100204 and 100207) did not meet the type 'A' borrow specifications as shown in Table 17. Table 17 also shows the depth of recovery in each sample tube, the depth of fill over original ground and the samples assigned to the FHWA-LTPP Contractor Laboratory.

Shoulder Probes

One shoulder probe, S14, was attempted on higher ground just beyond test section 100260, Station 600+00 (Station 5+20) on May 16, 1995 as shown in Table 14. The soil was sandy and the water table was reached at 8'. The power auger could not progress beyond 13'. No further attempts were made because of the previous boring results on the adjoining contract which included the SPS-1 project.

Dense Graded Aggregate Base (DGAB) Course

Three bulk DGAB un-compacted samples were taken at 3 test sections; 100201, 100202 and 100204 as shown in Table 18.

The concrete originally placed on test sections 100201 and 100202 was removed along with some DGAB. A few truck loads of DGAB were added to each section and the surface reworked, reshaped and re-compacted. No additiona. samples were taken; see Table 14.

Nuclear Density and Moisture Tests

Nuclear density and moisture test results were taken according to the sampling and testing plans at all of the bulk subgrade and embankment sample locations but not at the bulk DGAB locations. Nuclear moisture and density tests were taken on both the embankment (and subgrade) and the DGAB at all test section; see Table 19.

The nuclear density and moisture test results appear to be uniform and consistent throughout all of the test sections.

Permeable Asphalt Treated Base (PATB)

Bulk samples were taken from three of the four PATB test sections as shown in Table 20. Each sample contained 2 - 5 gallon pails.

Plate Load Bearing Tests

The plate load bearing test was carried out on embankment (subgrade), DGAB and PATB layers from April 11 to June 7, 1995, as shown in Table 21 and Table 14.

The plate load bearing tests were carried out on the test sections when the appropriate layers were fine graded except for DGAB test section 100201, 100203, 100204 and 100259. These DGAB test sections were compacted to a rough grade and were not scheduled to be fine graded until the next layer was to be placed. However, the Contractor prepared a 50' length of fine grade specifically for the plate load bearing test when requested. When the FWD was on the project, it also carried out a single test at the plate load bearing test location. Nuclear density and moisture tests were also taken to determine if the required compaction had been obtained. The test results for section 100201 were 147.0#/cu. ft., 3.9% moisture and for section 100203 were 149.9#/cu. ft. and 3.9% moisture. Both met the requirements of the Delaware DOT specifications.

The 20' H beam, plates, Ames dials and dial supports, jack and load cell were provided by the Consultant, Site Engineers Inc. Delaware DOT provided 2 trucks with the frames adapted for the beam attachment, and 2 operators.

During the first plate load bearing test, the 20' beam failed by buckling and it was replaced with a 16' beam reinforced in the Delaware DOT machine shop. When the trucks were loaded, there was insufficient clearance between the jack and the beam but it was possible to shave an inch or so from the sandy subgrade. On the DGAB test sections the trucks had to be partially unloaded to obtain an adequate clearance.

Photo 1 shows the plate load bearing test equipment in place just prior to testing.

FWD

FWD tests were carried out as often as practical (4 occasions) relative to other FWD commitments in the Region. It was possible to test 11 of the 14 embankment (subgrade) test sections, 6 of the 8 DGAB sections, 4 (all) of the LCB test sections and 3 of the 4 PATB test sections as shown in Table 14. The PATB on section 100209 was originally tested but it was removed and replaced with the concrete removal/replacement operation but not re-tested. Two DGAB test sections 100201 and 100202, were not re-tested after the original concrete was removed and replaced but the original FWD tests are considered satisfactory. The FWD tests on the PATB were taken 1 to 2 days after placement. Post construction testing of all sections was completed on May 5-9, 1996.

Concrete Samples and Tests - Cylinders and Beams

Molded cylinders and beams were prepared at locations shown on the sampling and testing plans. The fresh concrete was obtained by wheel barrow from which the cylinder and beam specimens were made by the Delaware DOT Field Technicians, see Photos 7 and 8. Six cylinders and six beams (duplicates after June 28) were made for the 14, 28 and 365 day strength tests. The beam molds were obtained from North Carolina since Delaware DOT did not have them available nor do they require the flexural strength test in their concrete pavement designs. The field tests included slump, % air, concrete and air temperatures. The field test results and the available laboratory test results are shown in Table 22. The Delaware DOT laboratory did not have the tensile strength test equipment available until July 25, so the cylinders taken for the tensile strength test prior to that date were tested for compressive strength, hence the reason for the duplication.

The cylinders and beams were placed and cured with wet burlap along the side of the road for 1 or 2 days before transporting them to the materials and testing laboratory in Dover. The laboratory was located about 16 miles from the job site.

LCB Core Samples and Test Results

Lean Concrete Base (LCB) was placed over the embankment (subgr: :) on four test sections; 100205, 100206, 100207 and 100208. Four inch cores we obtained at the locations shown in Figures 6 and 7.

The 14 day LCB cores were obtained before the overlying PCC was placed. No attempt was made to obtain 28 day cores but LCB cores were taken in conjunction with the 14 and 28 day PCC cores. The age for the intended 28 day test is shown in brackets in Table 23.

Two separate Tables have been prepared for the LCB and PCC core sample and test results. When they both occupy the same number, LCB samples are prefixed with the letters CL and PCC samples are prefixed with the letters CP.

PCC and LCB 4" Core Samples and Test Results

The 14 and 28 day cores were taken as shown on the Field Materials Sampling and Testing PCC-Layer 6 Plan, Figure 7, and the cores were tested according to the schedule shown in Table 12 except that the tensile strength tests did not start until July 26, 1995. In the meantime, the cores that were scheduled for tensile strength tests were tested for compressive strength, see Table 24. While the LCB cores were taken with the PCC cores, the LCB test results are shown separately in Table 23.

The Delaware DOT Laboratory carried out all the concrete tests except for the Coefficient of Thermal Expansion (P63) and Air Content (P68). Six cores, CP43, CP100, CP133, CP35, CP125 and CP53 were sent to Ms. Marcia Simon, FHWA (TFHRC) Laboratory, (Code #5111), as shown in Table 24.1 for P63 testing. Two cores CP20 (section 100259) and CP136 (section 100212) were tested for Air Content by the CTL Engineering Laboratory (Code #3951), in Columbus, Ohio.

5 Point Levels

Five point levels were taken of each layer of each test section as soon as the fine grading was completed and approved by Mr. Joe Damen the Chief Project Inspector. The grade of each layer was approved before the next layer was placed. Mr. Bob Radish obtained assistance on short notice for the 5 point levels if required so there was never any hold up to the Contractor.

The 5 point level thickness for each layer compared with the design thickness is shown in Table 25. This Table also shows the aggregated 5 point level thicknesses with the pavement structure design thickness.

Four inch LCB and PCC cores were taken for the 14 and 28 day tests. These core thicknesses are compared with the 5 point level thicknesses and are shown in Table 26. Layer thickness vs. Guideline tolerances can be noted from Tables 25 and 26.

Profile Index

A California type Profilograph was used by the Construction Staff to determine the Profile Index for payment adjustment purposes. The payment schedule is as follows:

Profile Index inches per mile	Contract Unit Price Adjustment (percent of unit bid price to be paid)
7 or less	105
over 7 to 12	100
over 12 to 14	97
over 14 to 15	95
over 15	corrective work required

Mr. Tom Webster from the Materials and Research Office in Dover is in charge of the Profilograph. He laid out the plan for the Profilograph to coincide with the test sections.

The field data was obtained by the Construction Inspectors following the normal Delaware DOT procedure consisting of 3 runs. A run 3' in from each edge of the pavement and one run with a 1' offset from the center line are required. The Profilograph rolls were sent to Mr. Tom Webster for analysis and for recommendations of remedial measures required to meet the Profile Index requirements.

The SPS-2 Construction Data Sheet 22 Portland Cement Concrete Surface Layer Profile Data contains information regarding the Profile Index and remedial measures taken if any are required. The Profile Index is shown in Table 14.

Concrete Mix Designs

The concrete mix designs for the SHRP test sections were designed by Wyoming Concrete Industries Inc. and approved by Delaware DOT. Wyoming Concrete also supplied the concrete from their plant located on the project.

Problems developed with the performance of the concrete in both the 550 and 900 psi flexural strength concrete test sections resulting in some changes to the mix designs. The mix designs originally used and the mix designs used to replace the concrete that was broken up and removed are shown in Table 27. Detailed Tables of the concrete mix designs and of the test sections in which they were used are as follows:

Table 27.1 This is the LCB mix design used on test sections 100205, 100206, 100207 and 100208. It remained unchanged.

Table 27.2 This is the normal Delaware DOT Type B slip-form design mix without NEWCEM. The concrete has a compressive strength of 3000 psi. It was used on supplementary test section 100260 and again on 100211, 100203 and 100207 replacing 550 psi flexural concrete. It is a 6-bag mix.

Table 27.3 This Table shows the 4-bag 550 psi concrete without NEWCEM placed in test section 100205, 100201 and 100209. They were broken up and replaced with the concrete mix design shown in Table 27.4.

Table 27.4 This Table shows the 6-bag mix design with NEWCEM that replaced the 4-bag mix design on test sections 100205, 100201 and 100209. It was also used on 100259.

Table 27.5 This Table shows the 6-1/2 bag 900 psi with NEWCEM concrete used on test sections 100206, 100202 and 100210. Test sections 100206 and 100202 were broken up and replaced but 100210 remained.

Table 27.6 This Table shows the 7-1/2 bag 900 psi concrete mix with NEWCEM that replaced the concrete in sections 100206 and 100202.

Table 27.7 This Table shows the 7-1/2 bag 900 psi concrete mix without NEWCEM used on the trial section and test sections 100212, 100208 and 100204.

Edge Drains

Four inch edge drains and 6" drainage outlets were placed in 4 PATB SPS test sections (100209, 100210, 100211 and 100212) and in supplementary test sections 100259 and 100260 without PATB. The edge drains for 100260 were installed in 1994 and the rest in April and May 1995 as shown in Tables 28 and 14.

The drainage trench and the trench outlets were made with a small backhoe. The excavation was lined with 90" wide filter fabric which was depressed into the trench and #57 stone placed with a side bucket front end loader. The completed installation is shown for section 100209 (see Photo 5). The specification for the Amoco Geotextile (filter fabric) is shown in Table 29. It is non-woven fabric class 85 Amoco 4545.

NOTES ON CONSTRUCTION OPERATIONS

Contract Documents

The Contract Documents were prepared with the background information provided in the Construction Guidelines for Experiment SPS-2 Strategic Study of Structural Factors For Rigid Pavements.

The Contract Documents show the longitudinal profile of the pavement structure as noted in Figure 22, which is similar to Figure 2; Figure 23 shows the pavement structure for sections 100201, 100202 and 100203; Figure 24 for sections 100204, 100205 and 100206; Figure 25 for sections 100207, 100208 and 100209 and Figure 26 for sections 100210, 100211 and 100212. Figure 27 shows the Delaware DOT southbound typical sections with special notes for the 2 supplementary sections 100260 (PD10) and 100259 (DE10).

The SPS and supplementary test sections were constructed according to the Contract Documents and Specifications. Deviations from the SPS-2 Construction Guidelines, can be noted in Figures 23-26 where the bases do not extend for the full width of the shoulders and the edge drains were not placed a minimum of 3' from the edge of pavement or at the edge of the shoulder.

Two grade changes were made. The grade was raised 9" to get more cover over the culvert at Hudsons's Pond (Station 597+00). This grade change extended into sections 100260 and 100205. The grade was also raised 9" in the area of section 100210 to get the grade higher above the water reservoir in the outside ditch.

Subgrade and Embankment

While the topography is generally flat to gently rolling, nine of the fourteen test sections were located in partial shallow cuts and fills. They are sections 100260, 100205, 100201, 100209, 100211, 100203, 100207, 100208 (up to 5') and 100204. The Contract plans show that 12" of Type 'A' borrow is required below the bases throughout the whole project. However, cut subgrade materials that met Type 'A' borrow requirements were left in place. When the topsoil and roots were removed in some of the scratch cuts, sufficient depth was available to receive the 12" of Type 'A' borrow. The Type 'A' borrow specification is as follows:

> "The material shall have between 95 to 100% inclusive of dry weight passing a 3" (76mm) sieve and a maximum of 35% by dry weight passing the No. 200 (0.75mm) sieve".

The cuts with subgrade materials meeting the Type 'A' borrow requirements are at sections 100205, 100201, 100209 and 100208. Borrow was obtained at the Eskridge Pit acquired by Delaware DOT for the project and it was delivered by truck by a designated haul route in the Contract. The borrow was end dumped, leveled with a bulldozer and compacted with a DYNAPAC 105 CA25 single drum vibratory roller.

Construction started very slowly in the spring and summer for 1994 because of wet weather. However, the fall of 1994 was dry and it was possible to construct the embankment (subgrade) to a rough grade in most of the test sections by the end of 1994. One area between Stations 671+00 - 678+00 was swampy with a very soft foundation and needed special attention. The treatment provided is described in the Construction Specifics for section 100210.

Construction of the subgrade and embankment started again in early April of 1995. The final grading of all of the test sections was completed by the end of April as shown in Table 14. When the fine grading for each section was completed and approved, 5 point levels and nuclear density and moisture tests were taken as quickly as possible to avoid any hold up to the Contractor and to allow the Contractor to place the next layer over the sandy subgrade.

Dense Graded Aggregate Base (DGAB)

The gradation specification for DGAB is as follows:

Sieve	Weight Percentage Passing
1-1/2	100
1	95-100
3/4	50-90
#4	20-50
#10	15-40
#30	15-40
#200	0-10

The crusher run aggregate came from the ARUNDEL Quarry, Havre de Grace, Maryland. It is an igneous diorite rock (traprock) and was stockpiled at the Contractor's yard at Hudson's Pond from where it was taken as required. Sieve analysis of the aggregate during stockpiling indicated that the material had about 90% passing the 1" sieve, otherwise the materials met the rest of the gradation requirements.

Eight of the fourteen test sections required DGAB to be placed directly over the sandy subgrade. The DGAB was placed, watered and compacted to a rough grade (Photo 2) as soon as the embankment (subgrade) was approved to protect the subgrade. The DGAB was placed in 4" increments or less with a spreader box in 2 passes. The trucks always backed into the spreader box over the sandy subgrade. Each lift was compacted with a DYNAPAC 105 CA25 single drum vibratory compactor. Bulk samples as shown in Table 18 were taken prior to watering and compaction.

During the removal of the concrete on test sections 100201 and 100202 some of the DGAB was also removed. It was replaced with a few loads per section, reworked, re-graded and re-compacted. It was difficult to fine grade the DGAB because of the size of the aggregate. The fine grading was usually left until the next layer was to be placed. The Contractor did however fine grade 50' segments on four test sections so that plate load bearing and FWD tests could be carried out (see Table 21).

Lean Concrete Base (LCB)

The lean concrete was produced by Wyoming Concrete from the mobile plant on the job site. It was placed by the Subcontractor, Peltz Construction, who also placed the soil cement on the project. The same equipment was used. It consisted of a Blaw Knox MC30 mobile conveyor and ABG Titan 511 Paver having a high density screed with 2 tamping bars.

This equipment had never been used for laying LCB so to determine its performance, a trial section was laid in the Contractor's stockpile area on April 26, 1995. The trial was satisfactory, and the equipment was used to lay test sections; 100208 and 100205 on May 24, 1995, and 100206 and 100207 on May 25, 1995.

Laying the LCB was an efficient operation. However, since the subgrade was sandy, rutting developed from trucks backing into the conveyor and from the concentrated loads of the conveyor. This was corrected by a compacting roller. The LCB was laid to a width of 29' for the 24' pavement and 31' for the 26' pavement allowing 2-1/2' on each side for the concrete paver tracks. LCB was laid on section 100208 first. The Contractor attempted to form a 2" center joint with a groover attached to the paver. It proved unsatisfactory so the joint was sawn. A groover was tried again and used on the remaining 3 test sections. For sections 100208 and 100205, the joint was offset 12" from the center line into the passing lane. For sections 100206 and 100207, the joint was offset 18" from center line and placed in the driving lane.

While the pavement surface texture was fairly smooth, the paver stopped several times and a slight depression in the LCB occurred because of the tamping bars. Shrinkage cracks developed at most of these depressions. This was in addition to other transverse shrinkage cracks. The following curing membrane was used on all of the concrete paving on this project:

W.R. Meadows Voc Compliant
White Pigmented - Wax Type
1600 White
Water Base Concrete Curing Compound Green Line

The concrete paver had side plates to control the depth of concrete. These plates allow very little tolerance. When the concrete is placed over DGAB and PATB, the plates can displace the high spots. In LCB, the high spots stop the paver. To ensure that this situation did not occur during construction, the Contractor made a dry run over the LCB with the paver. A few high spots were detected and milled.

Prior to concrete paving, the LCB received another application of the curing membrane. In addition, the milled areas received a light coating of sand to minimize the chance of bonding.

PATB

The PATB was obtained from Tilcon Plant 4 and placed on the driving lane of test sections 100209, 100210, 100211 and 100212 on June 5, 1995. The PATB was placed on a primed DGAB layer. Subsequently, the concrete was removed on section 100209 taking all of the PATB with it, the PATB was replaced on Sept. 19, 1995. To avoid damage to the under-drains, a 4" saw cut was made in the PATB at the edge of the pavement to form a clean cut.

The PATB mix was very slippery and the tail gate had to be chained to control the flow into the shuttle buggy. On two occasions, the PATB had to be cleared from the bin before the conveyor could engage the mix. The paving train is shown in Photo 3.

On July 8, 1995 the Contractor noted that the grade on the passing lane for sections 100209 and 100211 were a little high. The ATB was lowered with a grader and a front end loader.

There were no problems laying the PATB. The laydown temperature was from 220-245° F. as shown in Table 20 and rolling was permitted when the temperature was 150-170° F. The rolling was done with an Ingersol Rand DD99 10-ton static roller. A small DYNAPAC CC102 3-1/2-ton Roller was used on the inside edge directly behind the paver also t take out any irregularities.

The Asphalt Plant Inspectors Daily Report is shown in Table 30.

Chronology of Concrete Paving

The concrete was produced by Wyoming Concrete from a mobile plant located in the stockpile area near Hudson's Pond about 500' west of Station 601+00. The paving equipment was as follows:

Concrete Paver	CMI
Number Vibrators	14 (6" from edge)
Vibrator Spacings	21"
Concrete Spreader	PS 350
Tineing and Curing	CMI TC 250

Concrete paving started out with the concrete mix design having compressive and flexural strength properties shown in Table 1. Because of performance problems with the concrete, several changes in the mix design were made during the course of construction. The chronological events that took place from June 15 to November 21, 1995 are as follows:

June 15, 1995 — Supplementary test section 100260 was laid using Delaware DOT Type B mix. It is a 6-bag 3000 psi compressive strength concrete; 10" thick and 24' wide.

June 16, 1995 — Test sections 100205, 100201 and 100209 were laid to a width of 24' and to a depth of 8". The mix was a 4-bag 550 psi concrete which was difficult to finish.

Serious shrinkage cracking was evident on June 17. During the change over of the paving machine to a 26' width which usually takes 5 days, Delaware DOT decided to replace the next three 500 PSI concrete test sections with the Delaware DOT Type 'B' mix similar to that used on section 100260 having a flexural strength of +/- 650 psi. Delaware DOT believed that the cracks were due to the low cement content of the concrete (4 bags) and that the low strength concrete would not perform well under traffic and should be removed and replaced.

June 28, 1995 — Test sections 100211, 100203 and 100207 were placed using the Delaware DOT Type 'B' mix to a width of 26' and to a depth of 11". No contraction cracks were evident.

June 29, 1995

Test sections 100206, 100202 and 100210 were placed with 900 psi concrete (6-1/2 bags of cement with NEWCEM) to a width of 26' and to a depth of 8".

On June 30, several transverse cracks were noted in test sections 100206, 100202 and 100210. In addition, longitudinal cracks appeared in 100206 which had a LCB. There was no easy explanation for this cracking since the mix was similar to that used on the Dover By-Pass with good results.

Delaware DOT considered the cracking due to the Contractors operation (sawing operation) for which he should be responsible. The Contractor believes he sawed the joints as early as possible and that he should not be held responsible. In order to find out the cause of the cracking, a trial section was proposed ruling out as many variables as possible.

July 7, 1995

This trial section was placed in the transition zone between sections 100210 and 100212 (Stations 675+50 - 681+35) to a width of 24' and to a depth of 11". No contraction cracks were evident after several days of observation and it was decided to continue with this mix in the next 3 test sections.

July 13, 1995

The cracking of the pavement was the subject of a number of newspaper articles. Mr. Monte Symons (FHWA) requested Dr. Gonzalo Rada of PCS/Law Engineering, the Technical Consultants to FHWA, to undertake a forensic study of the concrete pavement performance problem.

In the meantime, Delaware DOT had decided that five test sections, the three with the 550 psi concrete, sections 100205, 100201 and 100209 and two with the 900 psi concrete, sections 100206 and 100202 would be broken up and replaced. The status of test section 100210 (900 psi concrete) would be decided at a later date.

July 17/18, 1995 — Test sections 100212, 100208 and 100204 were placed with the same concrete mix used in the trial section; 900 psi concrete, 7-1/2 bags of cement without NEWCEM to a depth of 11" and width of 24'.

Problems were encountered during the paving operation. Paving started at 6:40am on July 17 and stopped at 8:53am because of the high concrete temperatures. Paving resumed at 8:15pm leaving a gap of 30' in section 100212, the only gap within any of the test sections. Paving continued until 10:40am July 18. During this period, two heavy rain storms were encountered which stopped the paving operation for 90 minutes at 11:45pm and again at 6:25am.

July 18, 1995 — A meeting was held at the Project Construction Office and in the field with Mr. Gary Elkins, PCS/Law Engineering who was gathering information for the forensic study. In attendance were representatives from FHWA, Greggo and Farrara, Delaware DOT and Pavement Management Systems. Background information was provided at the meeting.

On July 21, 1995, Mr. Gary Elkins submitted a letter to Mr. Monte Symons requesting additional specific information which was passed on to Pavement Management Systems for appropriate action.

July 20. 1995 — Supplementary test section 100259 was placed with a 3000 psi concrete (+/- 650 psi flexural strength), 6 bags of cement with NEWCEM, to a width of 24' and a depth of 10".

Aug. 15-30, 1995 — The concrete in sections 100205. 100201, 100209, 100206 and 100202 were broken up with a MDI Yutani Rammer from Aug. 15-17. The broken concrete was removed by backhoe and trucks and taken to the Delaware DOT Maintenance Yard in Ellendale from Aug. 21-30.

No damage was done to the two LCB test sections as a result of the pavement removal. Some DGAB was removed with the concrete in the two DGAB test sections. This was later replaced and restored. The PATB in section 100209 bonded to the concrete and had to be replaced.

Oct. 3, 1995

The information requested by Mr. Gary Elkins on July 21, 1995, including the information package prepared for the meeting on July 18, was sent to Mr. Monte Symons by Mr. Ed Lesswing, PMS, with a copy to Dr. Gonzalo Rada, PCS/Law (see Appendix B).

Oct. 12, 1995

The concrete was replaced in test sections 100205, 100201 and 100209. The concrete mix was the same as that used on section 100259 having a compressive strength of 3000 psi (+/- 650 psi flexural strength), 6 bags of cement with NEWCEM. The reason for the delay, (August 30 - Oct. 12) was that the dowels were not available from the manufacturer earlier.

A complete crack survey was carried out on sections 100205, 100201 and 100209 on October 25, 1995, and it was noted that some cracking had developed in all of the test sections but not to the extent of the cracking in the original pavement.

The Contractor was being held responsible for the cracked pavement and hesitated to proceed with any further paving because he believed he had sawn the joints as soon as possible judging by the markings on the concrete by the saw equipment and the roughness of the saw cut.

Nov. 21, 1995

Test sections 100206 and 100202 were replaced with 900 psi concrete having 7-1/2 bags of cement with NEWCEM. There were several days of delay because of cold weather. Graphite grease was brushed onto the dowels. The Contractor for the first time used 'soft cutting' after 6 hours from a moving bridge. The soft saw was self propelled and it took about 10 minutes to saw a joint. It was used alone between Stations 651+85 and 656+90. A pipe saw was then brought in working from boards. The soft saw cut every third joint and the pipe saw cut the joints in between. This procedure was used to the end of the section at Station 667+50. The next day the regular saw crew came and re-sawed the joints to a depth of approximately 4".

No cracking was evident after placement. The joint cuts are rough.

Concrete Paving Gaps

Gaps were placed in the concrete of 2, 3 or 4 slab lengths instead of building a bulkhead. The concrete is over-placed at the proposed joints. It is then sawn to full depth, holes drilled and the dowels grouted. Forms are placed and ready mix concrete is used with a vibrating bridge screed. All of the gaps are located in transition areas except for the one within test section 100212 which was caused by stopping the paving because of the high temperature of the concrete. The gaps were placed to provide access to properties/side roads.

The locations of the gaps are as follows:

	Location	Chainage
1.	between 100205 and 100201	613+90 - 614+50
2.	between 100209 and 100211	629+80 - 630+15
3.	between 100211 and 100203	636+95 - 637+35
4.	between 100206 and 100207	651+50 - 651+75
5.	between 100202 and 100210	666+50 - 666+75
6.	between 100210 and trial	675+10 - 675+50
7.	between trial and 100212	681+00 - 681+30
8.	within 100212	684+05 - 648+35
9.	between 100204 and 100259	701+00 - 701+40

Concrete Placement Problems

The dowel baskets were laid out very carefully starting at the 15' joint spacing 50' before the test section and ending 50' after the test section. The joint spacing in the transition area was usually 20' which is the normal Delaware DOT spacing. The dowels in all of the test sections were well aligned and were positioned at mid slab.

The 550 psi concrete was stiff and the edges were hard to finish. A bull and tail float were used directly behind the paver and the edge finishers were about 100' behind (see Photo 9) the paver. The 900 psi concrete was also hard to finish. The finishers had the desire to add water for an easier finish. All of the haul trucks for the 900 psi concrete had vibrators but some concrete still stuck to the body of the truck which had to be prodded loose.

The concrete paver had a sensor which operated from a string line on the outside shoulder for both the driving and passing lanes. The sensor could not carry the grade to the passing lane at times, because, it was thought, of distortion caused by the depression of the soil under the paver tracks. Paving was held up on July 11 prior to placing section 100212 to place and try a separate sensor for the passing lane. This did not work well so for sections 100212, 100208 and 100204 the grade control was established from string lines on both the inside and outside shoulders. The profilograph detected the grade control problem which resulted in grinding some of the high spots in the passing lane. The driving lane did not seem to be affected.

Joint Sealants

Sawing for the transverse and longitudinal joint sealant reservoirs started at the north end of the project in November 1995. It progressed southward, off and on, reaching the south end on May 4, 1996. Joint sealing started at the north end of the project during the last week of March 1996 and ended on May 11, 1996. The road was opened to construction traffic at all times during the sawing and sealing operation. The same crew was used for sawing and sealing. A few temporary gaps were left the sawing and sealing operation to avoid any interference with construction operations. Shoulders were being paved during the joint sealing operation and the shoulder paving was completed on several of the southern test sections prior to the sealing of the joints.

The transverse joints were sawn to a width of 3/8" and to a depth of 1-1/2" and then wire brushed. The longitudinal joints were sawn to a width of 1/4" - 5/16" and to a depth of 1-1/2" and then sand blasted.

The sealing operation on the test sections was the same as that used for the Delaware DOT portion of the contract. The transverse joints received the performed neoprene sealant with two exceptions. The longitudinal joint received a 3/8" backer rod and hot poured rubberized asphalt sealant. The hot poured rubberized asphalt sealant was used at the transverse joints in two areas.

1) Test sections 100206, 100202 and 100210.

   The transverse joints were too rough for the neoprene sealant to perform effectively. 1/2" backer rod was used.

2) At the leaving end of the concrete repair patches over the cork board in sections 100205, 100201 and 100209. Also at the approach and leaving ends of concrete patches on section 100210.

The transverse and longitudinal joint details are shown on Sheet 59 of the contract drawings and reproduced in Figure 28. The neoprene (performed elastomeric) sealant was obtained from O.S. Brown, Ohio and the rubberized asphalt sealant from KOCH Materials.

Shoulders

The Contract Documents show 6" of DGAB plus 4" of hot mix over the earth shoulder subgrade. The 6" of DGAB has been replaced with 3" of type 'A' borrow and 3" of bituminous base. The strength of the inside and outside shoulders on the turning areas has been increased by another 6" of bituminous base. As the outside shoulder could have an effect on the performance of the driving lane, the outside turning lanes are located as follows:

Stations	Test Sections	Purpose
606+75 - 608+25	transition	turning lane
613+80 - 619+50	100201 partial	Mahonia Road
634+70 - 636+25	100211	turning lane
645+75 - 647+25	100207 partial	turning lane
665+75 - 672+00	100210	RD 625
685+75 - 687+25	100212	turning lane
697+75 - 699+25	100204	turning lane

Paving of the shoulders was completed on April 26, 1996.

CONCRETE REPAIRS AND PERFORMANCE

All of the transverse cracks were repaired with concrete patches.

Test Section 100210

Test section 100210, was laid on June 29, 1995 along with sections 100206 and 100202. It was decided to remove and replace the concrete in sections 100206 and 100202 and to patch the transverse cracks in section 100210. The patching was carried out between August 23-30, 1995 and involved 3 patches.

1. 668+01 - 668+08 in transition area
2. 669+02 - 669+08
3. 670+07 - 670+13

On October 30, 1995, it was noted that patch #2 had a longitudinal crack 7-13" long parallel to the center joint in the passing lane.

Test Sections 100205, 100201 and 100209

The concrete was replaced in test sections 100205, 100201 and 100209 on October 12, 1995. A crack survey on October 25, 1995 indicated that several transverse cracks had developed, most of them in the driving lane. A follow-up crack survey on November 29, 1995 indicated that the cracking had not progressed significantly since the October 25 survey. However, over the winter, several additional cracks had developed in section 100205 (with LCB), two additional cracks in section 100201 (with DGAB) and no additional cracks in section 100209 (with PATB).

The decision to patch and the location of patches was made by Delaware DOT. The patches were a minimum of 6' long and the full 24' width of the pavement. Most of the cracks were near a transverse joint, so the joint was replaced with a patch. Where the cracks were closer to mid-slab, the complete slab was removed to avoid joint spacings of less than 6'. The information on the patches is shown in Table 31. Within the transition areas and the test sections there were 21 patches in section 100205, 12 patches in section 100201 and 5 patches in section 100209. A total of 38 patches (including 3 slabs) were placed in these three test sections.

Three saw cuts were made at each patch. The saw cuts were for the full depth of the pavement; one at the beginning, one at the end and one in the middle of the patch area. Holes were drilled into the concrete on an angle to facilitate concrete removal with a crane. There was some damage due to concrete removal in the form of spalling at a few joints. The slabs were stockpiled in the Contractors yard and will be broken up into 2' squares for scour protection.

It was noted by the Foreman that during the concrete removal operation, several of the cracks in test section 100205 reflected from the shrinkage cracks in the LCB. There was some local bonding of the LCB to the PCC resulting in pot holes. These potholes were filled with sand. Curing membrane was also applied to minimize the bonding of the concrete. The underside of the slabs in the stockpile indicated some isolated bonding of the LCB but for the most part, the underside was smooth and clean. The DGAB in section 100201 was reshaped. The PATB in section 100209 was removed with the concrete and it was replaced with PATB.

Following the preparation of the bases, holes were drilled in mid-slab into the concrete at 12" centers to accommodate #10 (1-1/4") epoxy coated deformed dowel bars on the approach joint (north end) and #9 (1-1/4") epoxy coated smooth dowel bar on the leaving joint (south end) of all of the patches. A non-shrinking grout was placed into and over the holes before inserting the dowels. Graphite grease was brushed on the leaving joint dowels. A 1/2" cork board was also placed at the leaving joints.

The concrete patches were placed on April 18-19, 1996. The mix design used is shown in Table 32. It is very similar to that used in the replaced concrete laid on October 12, 1995 and shown in Table 27.4. The concrete was placed using a hand held vibrator and a vibratory screed. The concrete was finished by hand trawling. The approach transverse joints were sawn to a width of 3/8" and to a depth of 1-1/2" and received the neoprene joint sealant. The leaving transverse joints received the hot poured rubberized sealant. The longitudinal joint of the patch was sawn the next day (24 hours after the pour) and later sawn to a width of 5/16" and to a depth of 1-1/2" to receive the hot poured rubberized asphalt.

On April 19, 1996, an inspection by FHWA found that 34 concrete patches had already been placed and that the dowels in the remaining 3 of the 4 patches which were to received concrete that day were not anchored adequately and could easily be removed. FHWA questioned the adequacy of the load transfer of the joints of all of the patches. There was concern about the possibility of failures including faulting, rocking and pumping if the dowel bars were inadequately anchored.

During the inspection of April 19, Mr. Joe Damen mentioned that 17 very fine transverse cracks had been observed in addition to those cracks that were to be patched as shown in Table 31. These transverse cracks were first noticed at the edge of the pavement and they extended a few feet into the concrete pavement but not full width. These cracks were not recorded. The shoulders have since been paved so it is not possible to find them on the surface during the heat of the day. Mr. Joe Damen advised that it is possible to see these cracks early in the morning. They were not observed during an inspection of May 2, 1996. The Delaware DOT Materials Office has requested the District to monitor them and if any movement is detected, then some type of retrofitting may be needed.

A meeting organized by Mr. Monte Symons, FHWA, was held at the construction site on May 2, 1996 to review the performance of the pavement and to arrive at steps that should be taken to determine the adequacy of the load transfer of the joints. In attendance were Representatives from the FHWA Regional Office, PCS/Law, Delaware DOT and PMS.

It was noted that 10 of the 38 patches (all in section 100205) had a longitudinal crack, 6-18" o/s from center line and that a few patches were not quite level with the pavement.

It was decided that FWD tests should be undertaken to determine the adequacy of the load transfer of the joints at the patched locations and also at other joints. Due to the imminent opening of the southbound lane to traffic, arrangements were made for the FWD testing to be carried out on May 5-7, 1996. A concrete cylinder made on April 19 showed a compressive strength of 2140 psi after 5 days and it was considered that the concrete had reached sufficient strength and was safe for the FWD testing to be performed. Concrete that had been damaged during the removal of the slabs (usually spalling) was repaired with an epoxy concrete.

In late May, PCS/Law completed it's determination of the load (deflection) transfer efficiency based on the above noted FWD testing for both patched and non-patched joints. PCS/Law concluded that based on the FWD data, there does not appear to be a problem with the load transfer efficiency of the patched or non-patched joints.

CONSTRUCTION OF THE TEST SECTIONS

There was excellent cooperation and support by the Contractor, by the District Construction Staff for this SPS-2 project and by the Materials and Research Staff who were assigned the responsibility of ensuring that the required data was collected.

Problems were encountered with weather conditions and with poor performance of the concrete in some of the test sections which required special attention, additional work and a re-scheduling of the paving operations.

The description of the test sections that follows provides an overview and the highlights of the construction activities:

Test Section 100201: Station 617+00 - Station 622+00

This section is located in fill except from Station 620+25 - Station 621+75 which is located in shallow cut. The cut material met the Type 'A' borrow specification. The pavement structure consists of DGAB-6" and PCC-8".

The subgrade was constructed to rough grade in 1994. The fine grading was approved on April 4, 1995. The DGAB was placed and compacted to rough grade on April 10 and find graded on June 3 (see Table 14). Nuclear moisture and density tests and the 5 point levels were taken on June 3. The original 550 psi concrete was placed on June 16. The concrete joints were sawn to a depth of 2-1/2" 12 hours after placement and there was a placement problem between Station 618+00 - 619+00 but since the concrete was later removed. no further discussion is necessary.

Extensive transverse cracking soon developed. After 1 day, 8 transverse cracks developed and after 8 days there were 16 cracks in the test section and in the transition areas. Several of these cracks were close to a joint.

Delaware DOT decided to replace the concrete so it was broken up and removed between August 15-31. The removal was an efficient operation but some of the DGAB was lost with the broken concrete. A few truck loads of DGAB were dumped on the grade, leveled, re-worked, re-compacted on September 13. The DGAB grade was approved on September 15. The 5 point levels of DGAB and the nuclear density and moisture tests were re-taken.

The PCC was placed on October 12 with the Delaware DOT Type 'B' concrete mix containing 6 bags of cement with NEWCEM. There was a problem with the conveyor belt on the spreader and paving stopped for 30 minutes at Station 619+25. Seven trucks had lined up before the belt was repaired. The interval between placement and sawing was 12-14 hours, sawing was to a depth of 3". A crack survey on October 25 showed that 10 cracks had developed (transition areas and test section); 2 full width cracks and 8 partial cracks (in the driving lane only). All of the cracks were close to transverse joints. Two additional cracks developed during the winter.

All of the cracks were repaired with concrete patches between April 5 and April 19, 1996 as shown in Table 31. There were 12 patches numbered consecutively (#22 - #33) from south to north; 6 in the test section and 6 in the transition areas. All of the patches were 6' long (except patch #26 which was 7' long and the full 24' width of the pavement.

The concrete sample taken at patch #19 at Station 612+50 gave the following results:

Slump	3"
Air	5.7%
Conc. Temp.	63° F.
Air Temp.	61° F
AEA 90	1-5/8 oz./sack
WRA 220N	2 oz./sack

The cylinders taken were scheduled for 5, 14, 28 and 365 day tests.

The pavement performance survey on May 1, 1996 indicated that there was no longitudinal or transverse cracks in any of the patches. There was some spalling because of the pavement removed at 2 transverse joints which were repaired with epoxy concrete.

Table 25 shows that the total pavement thickness obtained by the five point levels was 14.5" versus a design thickness of 14". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels versus Design (8.00" vs. 8.28" vs. 8.00", respectively).

The 28 day core (CP113) is not shown in Table 12 but is shown in Figure 7. It was taken on the 550 psi concrete but was not taken when the concrete was replaced on October 12. 1995.

Test Section 100202: Station 660+00 - Station 665+00

This section is located in fill. The pavement structure consists of DGAB-6" and PCC-8".

The subgrade was constructed to a rough grade in 1994. The final grade was completed on April 11, 1995. DGAB was placed and compacted to a rough grade on April 12 and the fine grading was carried out on June 6.

The 900 psi concrete used on Section 100206 continued into Section 100202 with the same placement problems as noted in the Section 100206 write-up. This was done on June 29. The interval between placement and sawing was 15 hours. The transverse joints were sawn to a depth of 2-3/8". The longitudinal joint was sawn on July 3.

Crack surveys were made on June 30 and again on July 10. Twenty three (23), mostly full width cracks were recorded in the test section and 10 of them were within 12" of a contraction joint. It was later decided to remove and replace the concrete.

The concrete was broken up and removed between August 15-31. The concrete removal was an efficient operation but again some of the DGAB was lost. About 20 loads of DGAB were end dumped on the grade between October 9-11, leveled out and compacted. The DGAB grade was approved on October 13. The nuclear density and moisture tests and the 5 point levels were re-taken.

The same 900 psi concrete mix was used on November 21 on this section as on section 100206 consisting of 7-1/2 bags of cement with NEWCEM. Graphite grease was also brushed onto the dowels. The same sawing procedure was used as well except that 2 saws were used for the full length of the section. The soft saw cut every third joint and the pipe saw cut in between to a depth of 2" about 6 hours after placement. The transverse joints were re-sawn to a depth of 3-3/4 to 4" the next day with normal concrete saws. The longitudinal joints were also sawn to a depth of 4" for the first time. The curing and protection against frost were the same as 100206. No cracking has been evident. The transverse joints are rough and ragged.

Table 25 shows that the total pavement thickness obtained by the five point levels was 15.2" versus a design thickness of 14". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (8.45" vs. 8.76" vs. 8.00", respectively).

Test Section 100203: Station 639+00 - Station 644+00

This section is located in fill except from Station 639+00 - Station 641+00 which is located in a scratch cut. A minimum of 12" of type borrow was placed throughout the test section. The pavement structure consists of DGAB-6" and PCC-11".

The subgrade was constructed to a rough grade in 1994. The fine grading was completed on April 7, 1995 and the DGAB placed on April 11 was not fine graded and approved until June 8.

The PCC was placed on June 28, 1995 with the Delaware DOT Type 'B' concrete mix having 6 bags of cement without NEWCEM which was used instead of the 550 psi flexural strength concrete. The tineing machine ran into the outside edge of the concrete at Station 634+48. This took 30 minutes to repair. The paver broke down at Station 641+75 and it was repaired in 30 minutes.

Sawing started with 15 lines after 9 hours but it was found that the concrete was too soft so the sawing was carried out after 15 hours. The transverse saw cuts were made to a depth of 3-1/2". Normally the longitudinal joint was sawn along with the transverse joint but one saw broke down. The longitudinal joint was sawn on July 3 to a depth of 2-1/8". Both the transverse and longitudinal joints are good.

Table 25 shows that the total pavement thickness obtained by the five point levels was 17.9" versus a design thickness of 17". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (11.55" vs. 11.74" vs 11.00", respectively).

Test Section 100204: Station 695+50 - Station 700+50

This section is located in fill but the subgrade is in scratch cut from Station 697+00 - Station 700+00. The cut subgrade material was not suitable for Type 'A' borrow and there is a minimum of 12" of Type 'A' fill. The pavement structure consists of DGAB-6" and PCC-11".

The subgrade was completed to a rough grade in 1994. The fine grading was completed on April 17, 1995. The DGAB was placed on April 19-20 to a rough grade and it was fine graded on June 19.

Concrete paving continued through the night of July 17 and reached the start of the test section at Station 694+75 around 4:00am, July 18. A heavy downpour came at 6:25 to 6:45am and the paving train was stopped between Station 697+25 - 697+50. During the heavy rain the concrete stayed in the spreader and paver and was not leveled out. Before paving resumed, it was necessary to repair the concrete surface from Sections 696+00 - 697+25 which was exposed and not tined. The section from Stations 694+75 - 696+00 has been tined but the tining depths were reduced.

Two truck loads of concrete were dumped after sitting out the storm and paving resumed at 8:00am completing the paving at Station 701+00 at 10:40am.

The interval between placement and sawing the joints was 8 hours. The sawed depth of the transverse joint was 3-5/8" while the depth of the longitudinal joint was 2-1/2".

The transverse and longitudinal joints were sawn for the sealant in November, 1995 as follows:

Transverse Joints	W = 3/8"
	D = 1-1/2"
Longitudinal Joints	W - 1/4"
	D = 1-1/2"

Table 25 shows that the total pavement thickness obtained by the five point levels was 17.3" versus a design thickness of 17". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (10.47" vs. 11.04" vs. 11.00", respectively).

Test Section 100205: Station 607+00 - Station 612+00

This test section is located in fill except for a shallow cut from Station 610+00 - Station 611+50. The cut material met the Type 'A' borrow specification. The pavement structure consists of LCB-6" and PCC-8".

The subgrade was constructed to a rough grade in 1994. The fine grading was approved on April 4, 1995. The LCB was laid on May 24 and the 550 PSI PCC was placed on June 16. The PCC was later broken up and replaced on October 12, 1995.

The LCB was laid to a width of 29' with a 2" grove for the longitudinal joint o/s 13' or 1' from center line in the passing lane. Trucks backed in over the sandy subgrade and discharged the LCB into the conveyor bin. A compactor was present to level out the rutting caused by the trucks. However, excessive rutting developed at 2 locations because of the sand subgrade, and because of the concentrated load on the conveyor: Stations 607+75 - 608+00 and Stations 612+75 - 613+25. It was necessary to remove the conveyor and to water and re-compact the rutted areas.

A slight depression was noted at each location where the paver stopped due to the weight of the tamping bar. Full width very fine shrinkage cracks were evident in about 50% of the 10 depressions. This took place over a 2 week period.

To ensure that the concrete paver would not be hung up, a dry run was made over the LCB with the paver to detect, any high spots. Several high spots were detected and milled. The 550 psi concrete was placed June 16, 1995. The concrete was harsh and hard to finish and the finishers ended up well back of the paver.

The concrete joints were sawn to a depth of 2-1/2" 12 hours after placement. Several transverse and longitudinal cracks developed the day after placement and continued to develop for a few days. Two cores were taken on June 26. The core at the transverse crack showed that the crack extended 7" into the 8" concrete slab; the crack at the longitudinal joint showed that the crack extended for the full depth of the PCC but not into the LCB. The 2 cores indicated that there was no bond between the LCB and PCC. Another core was taken of a fine transverse crack on July 28 and it showed that the crack extended 4" into the concrete and not into the LCB.

Delaware DOT decided to break-up, remove and replace the concrete. The concrete was broken-up and removed between August 15-30. The LCB was not damaged to any great extent. The rammer punched holes into the LCB and few cracks developed primarily on the outer 3' of the LCB. A crack survey of the LCB was made on September 11. The LCB was swept clean, curing membrane applied and the punched holes and the milled areas were sanded to minimize the effect of the bond between the LCB and PCC.

Replacement PCC was placed on October 12 using the Delaware DOT Type 'B' concrete mix design - 6 bags of cement with NEWCEM. The paver sensor was set using the inside and outside string lines. The inside grade was set to the wrong offset which resulted in a lower passing lane pavement edge of about 1/2" (0.04') and which is within the tolerance allowed by the specifications.

The interval between placement and sawing was 12 hours with an average saw depth of the joints of 3-1/8". The Contractor tried to saw the contraction joints as quickly as possible. A crack survey on October 25 showed that several cracks developed mainly in the driving lane. Many of these were close to contraction joints. Additional cracks developed during the winter.

Core CP125 was sent to FHWA (Ms. Marcia Simon) for P63 testing.

All of the cracks in the concrete were repaired with concrete patches as shown in Table 31. There were 21 patches numbered consecutively (#1 - #21) from south to north. Seventeen patches in the test section and 4 in the approaching transition area. Three of the 17 transverse cracks were located near mid-slab and the whole slab was removed to avoid joint spacings of less than 6'.

The concrete in the patch areas was sawn on April 4 and 5, removed between April 5 and 8 and repaved on April 18, 1996. Small pieces of LCB were bonded to the concrete in some of the patched areas resulting in pot holes which were filled with sand to avoid any interlocking of the LCB and the PCC patch. Curing membrane was also placed on the LCB. The concrete sample taken at patch #1, Station 607+10 gave the following results:

Slump	2"
Air %	4.3%
Conc. Temp.	61° F
Air Temp.	54° F
AEA 90	1-3/4 oz./sack
WRA	2 oz./sack

The cylinders taken were scheduled to be tested at 5, 14, 28 and 365 days.

A survey on May 1, 1996 showed that 10 of the first 11 patches (all except patch #6) had longitudinal cracks with an offset of 6-18" and parallel to the longitudinal joint. Two of these cracks appeared in the passing lane and 8 in the driving lane. Four of the 8 cracks in the driving lane were the length of the patch and the remaining 4 only extended part way. Patch #1, Station 607+09 - 607+26 also had a transverse crack at the mid-point of the slab extending the full width of the pavement.

Concrete spalls that had been caused by pavement removal were repaired with epoxy concrete. Seven of the 21 patches had spalling repairs.

Table 25 shows that the total pavement thickness obtained by the five point levels was 14.6" versus a design thickness of 14". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (8.59" vs. 9.12" vs. 8.00", respectively).

Test Section 100206: Station 652+75 - Station 657+75

This section is located in fill. The pavement structure consists of LCB-6" and PCC-8".

The subgrade was constructed to a rough grade in 1994. The final grade was completed on April 11, 1995. The LCB was placed on May 25 to a width of 31' and a 3" longitudinal joint was grooved in with the paver. The longitudinal joint is located in the driving lane 18" from center line, o/s 12-1/2'. The subgrade was watered and compacted ahead of the LCB so no serious rutting problems developed. The subgrade was sandy and soft from Station 651+75 - Station 653+00.

A crack survey of the LCB was completed on June 4 and June 27. Six full-width transverse shrinkage cracks were noted within the test section. Milling to accommodate the concrete paver was done continuously on the passing lane on the outer 3-6'. No milling was done on the driving lane.

The PCC was placed on June 29, 1995 using the 900 psi concrete consisting of 6-1/2 bags cement with NEWCEM. The concrete was sticky and hard to finish. Voids appeared on the concrete surface and there was a temptation to get more mortar by adding water. Even though the truck boxes had vibrators, it was necessary to loosen the concrete stuck to the boxes. The first 7 lines were sawn after 9 hours but the concrete was too soft and it was necessary to wait for 3 more hours. The depth of the saw cut was 2'1/4". The transverse joints were rough and ragged. The longitudinal joint sawn on July 3 was good.

The pavement had many transverse and longitudinal cracks very similar to those found in Section 100205 which also has an LCB base.

A core was obtained from a very fine transverse crack. The crack extended for the full depth of the pavement but not into the LCB. There was no bond. A core was also obtained from a longitudinal crack which also extended for the full depth of the concrete but not into the LCB. There was no bond.

There was no apparent reason for this cracking to occur. Delaware DOT believed that it was the result of a construction procedure which was under the Contractor control and that he was responsible. It was serious enough to have the concrete removed and replaced. There was no significant damage done to the LCB during PCC removal operations. The rammer punched some holes in the LCB which were filled with sand to minimize any interlock with the PCC.

Graphite grease was brushed onto the dowels which already had an epoxy coating. The cold weather held up the replacement of the concrete. It was placed on November 21 using a 900 psi concrete with 7-1/2 bags of cement with NEWCEM. Soft cutting was used for the first time starting at Station 651+85 after 6 hours of placement. The concrete was still relatively soft so the saw cut was made from a self propelled bridge. The soft saw is self propelled and takes about 10 minutes to saw a joint to a depth of 2". It was a slow process so a pipe saw was brought in at Station 656+90 which carried through into section 100202. The pipe saw cuts were made working from planks. The soft saw was used on every third joint and the pipe saw for the joints in between. The concrete was covered with polyethylene for frost protection. The next day, the longitudinal joint was sawn to a depth of 4". The joints were rough and ragged, straw and polyethylene was replaced on the test section for frost protection.

Table 25 shows that the total pavement thickness obtained by the five point levels was 15.0" versus a design thickness of 14". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (8.55" vs. 8.88" vs. 8.00", respectively).

Core CP70 for P68 testing was shifted to CP53 test section 100210 because the concrete was to be removed and replaced. CP53 was sent to the FHWA (Ms. Marcia Simon) in error on August 2, 1995.

Test Section 100207: Station 646+00 - Station 651+00

The section is located in fill except for the area from Station 649+00 - Station 651-00 which is located in cut. The cut subgrade material did not meet the Type 'A' borrow specification. The pavement structure consists of LCB-6" and PCC-11".

The subgrade was constructed to rough grade in 1994. The final grade was completed on April 10, 1995. The LCB was placed on May 25 to a width of 31' and a 3" longitudinal joint was grooved in with the paver. The longitudinal joint is located in the driving lane 18" from center line o/s 12-1/2'. The subgrade was watered and compacted as the LCB was placed and there were no placement problems.

A crack survey on June 4 and again on June 27 showed 20 fine full width shrinkage cracks some which were in the depressions caused by stopping of the paver. The survey also included the milling that was done to avoid any hang up of the paving machine during the paving operation.

The PCC was placed on June 28, 1995 using the Delaware DOT Type 'B' concrete mix having 6 bags of cement without NEWCEM which was used instead of 550 psi flexural strength concrete. The interval between placement and sawing the transverse joints was 15 hours. The transverse joints were sawn to a depth of 3-1/2" and the longitudinal joint to a depth of 2-1/8" on July 3.

On October 13, it was noted that a fine longitudinal crack had developed 18" from and parallel to center line in the vicinity of the joint in the LCB from Station 649+31 to Station 650+60. Cores taken on October 26 indicated that the crack did not extend for the full depth of the concrete pavement.

Table 25 shows that the total pavement thickness obtained by the five point levels was 18.3" versus a height thickness of 17". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (11.42" vs. 11.30" vs. 11.00", respectively).

It is noted that the C81 core was taken at the C84 location. The 365 day C84 core will be taken at the C81 location.

Test Section 100208: Station 689+00 - Station 694+00

This section is located in cut from Station 689+00 - Station 691+00 and in fill from Station 691+00 - Station 694+00. The cut material met the Type 'A' borrow specification. The pavement structure consists of LCB-6" and PCC-11".

The subgrade of this section was completed to a rough grade in 1994. The fine grading was completed on April 18, 1995.

The LCB was placed on May 24 to a width of 29'. The grooving attachment was not working properly so the longitudinal joint was sawn to a depth of 2". It was offset 12" from the center line and is located in the passing lane.

Crack surveys on May 25 and on June 27 showed that there were 15 transverse cracks. Some of these cracks were located in the slight depressions caused when the LCB paver stopped. Any high spots were detected by a dry run of the concrete paver. The LCB required substantial milling. The LCB surface was milled from Station 688+00 - Station 693+55 on both edges anywhere from 0-6'; from Station 693+55 - Station 694+68, the milling was done full width. Prior to paving, the milled areas were sanded (see Photo 6). Special attention was given to a few LCB cracks.

1) Station 689+69 - a 2' wire mesh was placed over the crack which is located 2' south of a dowel basket.
2) Station 691+02 - a 2' wire mesh was placed on an angle near a dowel basket.
3) Station 691+41 - moved dowel basket 6" to make the crack the center line of the dowel basket. The crack is in a slight depression.
4) Station 693+20 - moved dowel basket 4" to the south to make the crack the center of the dowel basket.
5) Station 693+50 - moved dowel basket 4" to the south to make the crack the center of the dowel basket.

The 900 psi concrete placement continued from section 100212 and reached Station 688+00, the start of section 100208 at 9:45pm on July 17. Paving continued until 11:45pm and had reached Station 691+00 when it began to rain and the paving operation was stopped.

The fresh concrete was covered with Polyethylene. Concrete paving resumed at 1:15am July 18 and reached the end of the test section, Station 694+75, at 4:00am. It rained heavily again between 6:25 - 6:45am, while the paver and spreader were at Station 697+25, section 100204.. The section between Stations 692+25 and 695+00 was rained on and the tined surface was reduced. The concrete temperature was 84-87° and the air temperature was 80° degrees.

The interval between placement and sawing of the joints was 10 hours. The depth of the transverse joint was 3-5/8" and the longitudinal 2-1/2".

Table 25 shows that the total pavement thickness obtained by the five point levels was 18.0" versus a design thickness of 17". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (11.08" vs. 12.00" vs. 11.00", respectively).

The 28 day core CP43 was sent to FHWA (Ms. Marcia Simon) for P63 testing on August 22, 1995.

Test Section 100209: Station 624+00 - Station 629+00

This section is located in fill except for the area between Station 626+00 - Station 627+50 which is located in a shallow cut. The cut subgrade material met the Type 'A' borrow specification. The pavement structure consists of DGAB-4", PATB-4" and PCC-8".

The subgrade was constructed to a rough grade in 1994. The fine grading was carried out on April 6, 1995. The DGAB was placed on April 11 but not watered or compacted. The edge drains were installed on April 18 and the DGAB was fine graded and the grade approved on April 26.

The CSSIH prime was applied to the DGAB surface at the rate of 0.12 gals./sq. yd. prior to laying the PATB. The PATB in the passing lane was placed to a width of 13' on June 1 in test sections 100211 and 100209. The PATB was placed to a width of 16' over the driving lane in both test sections on June 5. The PATB covered both the inside and the outside edge drains.

The PATB was placed from north to south and the trucks backed in from Station 624+00 and dumped their loads into the shuttle buggy ensuring that discharge at the tail gate was controlled so as not to disengage the conveyor belt as happened on two previous occasions.

The 550 psi concrete consisting of 4 bags of cement without NEWCEM was placed on June 16. The sawing time after placement was 15 hours. The saw depth was 2-1/2". The Contractor considered that the joints were sawn too early judging by the stone pick out and the rough and ragged edges of the joints.

There was 1 shrinkage crack in the test section and 3 in the transition areas (see Photo 10). Even though the shrinkage cracking was not as severe as in the previous two sections, 100205 and 100201, Delaware DOT had no confidence in the performance of the 550 PSI concrete and wanted it removed.

The concrete was broken up and removed between August 15-31. In order not to damage the edge drains, the PATB was sawn to a depth of 4" at the edge of the pavement so that after concrete removal, the edge of the PATB was left neat. The full depth of the PATB stuck to the concrete and it was replaced on September 19.

The PCC was replaced on October 12 with the Delaware DOT Type 'B' mix consisting of 6 bags of cement with NEWCEM. The interval between placement and sawing was 14 hours. The joints were sawn to a depth of 3".

A crack survey on October 25 showed that there were 2 cracks in the driving lane of the leaving transition area and 3 cracks in the driving lane of the test section. The transverse cracks started at the edge of the pavement 3-6" from a joint and merged into the joint about half-way across the driving lane. There are saw cut equipment turning marks on nearly every joint located 30" from the edge of the pavement.

No additional cracks developed during the winter. All of the 5 cracks were repaired with a 6' long concrete patch for the full 24' width of the pavement as noted in Table 31. The PATB stayed attached to the removed slabs and was replaced. The patches were numbered consecutively from south to north (#34 - #38); two in the leaving transition and 3 in the test section.

On April 19, the last 4 patches (#35 - #38) were about to be poured when it was found that the dowels could be moved and hence inadequately secured. This situation was corrected before the concrete was poured but there was some doubt as to the adequacy of the load transfer of the other patched joints. Arrangements were made to check the load transfer at the joints before the road was opened to traffic. It was determined that the load transfer efficiency of the joints in question was satisfactory.

The concrete sample taken at patch #35, Station 623+92 gave the following results:

Slump	3.5"
Air %	5.5%
Conc. Temp.	72° F
Air Temp.	68° F
AEA 90	1-5/8 oz./sack
WRA	2 oz./sack

The cylinders taken were scheduled for 5, 14, 28 and 365 day tests.

A survey on May 1, 1996 indicated that there were no longitudinal or transverse cracks in any of the patches. There was however spalling at the joints of 4 of the 5 patches which were repaired with epoxy concrete.

Table 25 shows that the total pavement thickness obtained by the five point levels was 16.3" versus a design thickness of 16". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (8.51" vs. 8.22" vs. 8.00", respectively).

Test Section 100210: Station 668+50 - Station 673+50

This section is located in fill. The pavement structure consists of DGAB-4", PATB-4" and PCC-8".

The subgrade was constructed to a rough grade in 1994 with much difficulty. The section from Station 671+00 - Station 678+39 is located in a swampy area with organic matter and a soft foundation. Excavation of the organic matter started at Station 678+39 at 18" and ended up at Station 675+00 moving south with an excavation of 3-1/2' and backfilled. The area from Station 675+00 - Station 674+00 was excavated and left to dry. In the meantime, heavy rains filled the excavation and the layer method of earth construction could not continue. The excavation from Station 674+00 - Station 671+00 had to be backfilled in 2-1/2" lifts with sand from the Eskridge pit. This area is low and there is no water outlet from the ditch until a certain level is reached. The outside ditch was designed as a water reservoir. The edge drains were installed on May 8.

The fine grading of the subgrade was approved on May 28, 1995. The DGAB was placed on May 28 and 29 and the grade was approved on May 30. The CSSIH prime at the rate of 0.12 gal./sq. yd. was placed on the passing and driving lane on June 1. The PATB on the passing lane was placed on June 1 to a width of 13'. The PATB was placed on the driving lane to a width of 18' on June 5. The PATB extended over both edge drains (see Photo 4).

The same 900 psi concrete mix used on sections 100206 and 100201 was used o section 100210. Similar placement problems were encountered. The surface temperature of the PATB was 85° F, and three applications of water were made to cool it for the concrete.

Sawing of the transition joints was about to start at 8:00am on June 30, when it was noted that five shrinkage cracks had already developed. Three were in the transitions area and two were in the test section. The sawing Contractor determined when the concrete was ready for sawing by the color of concrete surface markings. Even at 8:00am, the Contractor considered that the concrete was not ready to be sawn because he could push a screwdriver into the concrete. The Contractor hurriedly sawed the transverse joints to a depth of 2-1/4" after an elapsed time of 15 hours. The transverse joints were rough. The longitudinal joint sawn on July 3 to a depth of 2-1/8" was satisfactory.

A heavy rain storm occurred on Saturday night, July 23. The median drain outlets were plugged and the median filled up and water spilled over onto the 2 northbound lanes between Stations 668+50 - 693+50. The water cleared as soon as the drains were cleared. The grade was raised 9" in this area, as previously noted.

Delaware DOT decided that this test section would be held under observation. In the end, the concrete was not replaced. Two of the cracks were eliminated with the concrete removal of section 100202 and the remaining three were patched. Concrete repairs were made between August 23-30, 1995.

Seven cuts were made in each patch area; a cut in the approaching and leaving edges about 1' in from the first cuts, at the center line and at a point in each lane, to ease in the removal of the concrete. The concrete was further broken up with a rammer and then removed with a small backhoe. Holes were drilled for dowels which were placed with a non-shrinking grout and a 1/2" cork board was installed at the leaving edge. The patches are at the following locations:

1) Station 668+01 - Station 668+08

2) Station 669+02 - Station 669+08

3) Station 670+07 - Station 670+13

The 4" of PATB was removed with the concrete removal and replaced with #57 stone.

Field tests were taken of the fresh concrete. The concrete was finished by hand using a hand weld vibrator. The concrete used for patching was the Delaware DOT Type 'A' mix consisting of 7.8 bags of cement with NEWCEM.

On October 30, it was noted that patch #2, Station 669+02 - Station 669+08 had a longitudinal crack 7-13" away from and parallel to center line in the passing lane which will need attention. The longitudinal joint depth was 1-1/2".

Table 25 shows that the total pavement thickness obtained by the five point levels was 16.5" versus a design thickness of 16". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (8.02" vs. 8.30" vs. 8.00", respectively).

Test Section 100211: Station 631+00 - Station 636+00

This section is located in fill except for the area from Station 632+50 - Station 634+00 which is located in a shallow cut. The cut subgrade material met the Type 'A' borrow specification. The pavement structure consists of DGAB-4", PATB-4" and PCC-11".

The subgrade was constructed to a rough grade in 1994. The fine grading was carried out on April 6, 1995, the DGAB was placed and compacted to a rough grade on April 12, the edge drains were paced April 19 and the DGAB was fine graded and the grade approved on April 27.

The PATB was constructed in conjunction with the adjoining test section 100209. The CSSIH prime was applied to the DGAB surface at the rate of 0.12 gals./sq. yd. The PATB on the passing lane was placed to a width of 13' on June 1 and on the driving lane to a width of 18' on June 5. The PATB ends at Station 637+25 but the edge drains end at Station 636+50 (0-50). There is no edge drain for the PATB from Stations 666+50 - 637+25.

On June 8, it was discovered that the grade on the PATB passing lane was a little high. It was lowered with a grader and the PATB was picked up with a front end loader and taken away by truck.

After concrete paving was completed on section 100209, the concrete paving machine was adjusted to accommodate the 26' paving width (14' SPS lane) for the next 6 test sections. During this period, it was decided through discussions with Delaware DOT and PMSL to replace the 550 psi concrete with the Delaware DOT Type 'B' mix which has a 3000 PSI compressive strength (+/- 650 psi flexural strength), a 6 bag mix without NEWCEM. The PCC was placed on June 28, 1995 starting at Station 630+15. The grade was a little low from Station 630+15 - Station 630+25 and some concrete was brought in by wheel barrow. The concrete had built up in front of the paver from Station 631+75 - Station 631+80 and a grade-all came in and placed the excessive concrete in front of the spreader. The concrete was easy to work with and finished nicely. The interval between placement and sawing was 12-15 hours. The depth of the transverse joints were 3-1/2" and the longitudinal joint 2". The longitudinal joint was sawn on July 3.

Table 25 shows that the total pavement thickness obtained by the five point levels was 19.3" versus a design thickness of 19". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (11.14" vs. 11.75" vs. 11.00", respectively).

Mr. Bill Brode, Delaware DOT PCC Supervisor, requested that duplicate beams be made for the remainder of the flexural tests. The 28 day core CP100 was sent to FHWA (Ms. Marcia Simon) on July 25, 1995. This was for P63 testing.

Test Section 100212: Station 682+00 - Station 687+00

This section is located in fill. The pavement structure consists of DGAB-4", PATB-4" and PCC-11".

The subgrade was constructed to a rough grade in 1994. The fine grade was approved on April 20, 1995. DGAB was placed on April 21 by backing in from Station 688+00 to the beginning of the DGAB at Station 675+50. The trucks did not drive on the DGAB. The passing lane was placed first and the trucks use the driving lane for entering and leaving, thus rutting up the subgrade. The DGAB grade was approved on May 30. The edge drains were installed on April 27.

The PATB was placed in conjunction with section 100210 on June 1 and June 5.

Because of the cracking in the concrete in the previous three section, a trial section was laid in the transition zone from Station 675+50 - Station 681+35 on July 7. It was a 900 psi concrete mix with 7-1/2 bags of cement without NEWCEM. The trial was successful and it was decided to continue with this mix over the next 3 sections 100212, 100208 and 100204. Paving was held up to correct a sensor which was used from a stringline on the outside stakes to control the grade on both the driving and passing lanes. Even with the correction of the sensor, there was still minor problems with the grade of the passing lane.

Concrete paving started at 6:40am on July 17. At 8:53am at Station 684+05 paving was stopped because the concrete temperature had reached 90° F. The paving restarted at Station 684+35 at 8:15pm and reached Station 688+00 at 9:45pm. The interval between placement and joint sawing was 13 hours. The depth of the transverse joints was 3-5/8".

The patch between Station 684+05 and Station 684+35 was placed on August 14 and 15. The concrete for the patch was supplied by Wyoming Concrete Industries, Inc. and it came from the Long Point Plant, Dover, by Ready-Mix truck. It was a 6 bag mix with NEWCEM.

Table 25 shows that the total pavement thickness obtained by the five point levels was 19.8" versus a design thickness of 19". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (11.70" vs. 12.40" vs. 12.00", respectively).

Test Section 100259: Station 702+50 - 707+50

This is a Delaware DOT experimental test section and it is located in fill. The pavement structure consists of DGAB-8" and PCC-10". It is similar to Delaware DOT section 100260 except that it has steel dowels instead of plastic dowels.

The subgrade was completed to rough grade in 1994. The fine grading was completed on April 21, 1995. The DGAB was placed on April 22 and 26 and compacted to a rough grade. The fine grading was carried out on June 19. The edge drains were placed on April 19.

The Delaware DOT Type 'B' concrete mix consisting of 3000 psi compressive strength was placed on July 20. Low alkali cement was no longer available and it was replaced with the Type 1 regular cement from the same Keystone source. The coarse aggregate from the Arundel Quarry had also become depleted and was replaced by coarse aggregate from Maryland Materials.

Paving started at 6:15am at Station 701+40 and ended at Station 707+50 at 8:30am.

The interval between placement and sawing the joints was 8 hours. The depth of the transverse joints was 3-5/8" and the longitudinal joint 2-1/2".

The transverse and longitudinal joints were sawn for the sealant in November 1995 as follows:

Transverse Joints	W=3/8"
	D=1-1/2"
Longitudinal Joints	W=1/4"
	D=1-1/2"

Table 25 shows that the total pavement thickness obtained by the five point levels was 18.1" versus a design thickness of 18". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (10.75" vs. 10.20" vs. 10.00", respectively).

Test Section 100260: Station 601+20 - Station 606+20

This is a Delaware DOT supplementary test section. It is located in a scratch cut from Station 601+20 - Station 604+00 and it contains a minimum of 12" of Type 'A' borrow. The remainder of the test section is in fill.

The pavement structure consists of DGAB-8" and PCC-10". The concrete pavement adjoining this test section was paved in 1994 from the south end of the contract at Station 550+00 to the start of this test section at Station 601+00. The approaching and leaving transitions are both 20' long. The grade was raided 9" over the culvert at Hudson's Pond, Station 597+00 resulting in a raise in grade over test section 100260 which feathered out in test section 100205.

The edge drains were placed in October 1994. The subgrade was built to a rough grade in 1994 and the fine grading was carried out on April 3, 1995. The DGAB was placed on April 10-12. 1995 to rough grade but it was not fine graded until June 30, 1995. Shoulder probe S14 was made at Station 600+00 (5+20) o/s 40'. It was the only shoulder probe made on this SPS-2 project because of the sandy nature of the soil and the high water table which limited the depth of penetration to 13'.

The test section consisted of the Delaware DOT Type 'B' concrete mix having 6 bags of cement and compressive strength of 3000 PSI. The experiment consisted of 4 types of plastic dowels:

1) Station 601+00 - Station 602+50	1-1/4" x 18" round dowels
2) Station 602+65 - Station 603+70	1" x 2" x 18" rectangular dowel
3) Station 603+85 - Station 604+90	1-1/2" x 18" round dowels
4) Station 605+10 - Station 606+40	3/4" x 2" x 18" rectangular dowel

The dowels were placed at mid slab and 5/8" x 30" tie bars were spaced at 30" intervals. Graphite grease was brushed onto the dowels.

The concrete was placed on June 15 from Station 601+00 - Station 606+40. The paving operations went smoothly and the concrete finished easily. The joints were sawn to a depth of 3-1/2" after 8 hours. Both the transverse and longitudinal joints were clean.

Because of the short transition areas, the location of the 4" OD cores were taken at 606+35 (0-15) and Station 601+05 (0+15) except for the 14 day core C126 which was taken in error at Station 606+45 (0-25) in the transition area for section 100205. Core results for C126 should be discarded since it was taken in the 550 psi concrete which was later removed and replaced.

The Contractor later discovered that the grade of the concrete approaching the test section was not proper so on September 11, 1995 the concrete was broken up and removed from Station 606+24 - Station 606+40 (0-20 to 0-04) leaving a four foot transition area. The 365 day core CP128 will have to be taken around Station 606+23 (-03'). Core CP133 was sent to FHWA (Ms. Marcia Simon) from a location 5' away from a construction joint where a lot of hard work was carried out.

The nuclear densities and moisture test results are shown in Table 19.

Table 25 shows that the total pavement thickness obtained by the five point levels was 18.0" versus a design thickness of 18". Table 26 compares PCC thickness: 4" cores vs. 5 Point Levels vs. Design (10.80" vs. 10.20" vs. 10.00", respectively).

DEVIATIONS FROM THE CONSTRUCTION GUIDELINES

1) Eight of the twelve SHRP test sections were located in partial shallow cuts except for section 100208 which had a cut of 5'. The Construction Guidelines state that the test sections should be in cut or fill.

   The Contract Plans show that 12" of Type 'A' borrow is required below the bases throughout the entire project. However, cut subgrades that met the Type 'A' borrow specifications were left in place. Where the subgrade did not meet the Type 'A' specification, it was excavated and back-filled with material (12" min.) meeting the requirements of Type 'A' borrow. The entire project, therefore, whether in cut or fill had a uniform subgrade meeting the Type 'A' borrow requirements.

2) The SPS-2 Construction Guidelines require that all bases (DGAB, PATB, LCB) extend for the full width of the shoulders. Figure 23-26 from the Contract Documents require the bases extend 12" from the edge of the pavement except for the outside shoulder edge of the PATB which extends 3' to the edge drain. The filter fabric shown in Figures 25 and 26 did not have to be returned back to the pavement.

3) The edge drain outlets are shown in Figure 28 and in most cases they are further apart than the 250' required.

4) In most cases, the longitudinal joint was sawn at the same time as the transverse joint except for sections 100211, 100203, 100207, 100206, 100202 and 100210. One saw broke down and the longitudinal joint was cut in 5 days. Most of the longitudinal joints, except for the test sections which were replaced, were sawn to a lesser depth than the transverse joint.

5) A construction joint was placed in test section 100212 because of the high laydown temperature of the concrete.

6) Concrete repairs were made in the form of concrete patches.

7) The joint sealing operation consisted of a performed neoprene seal in the transverse joints and the hot rubberized seal in the longitudinal joint and in the transverse joints that were rough and spalled. The Construction Guidelines require a silicon sealant. Delaware DOT joint sealing details are shown in Figure 28.

8) No joint sealant was required nor placed between the mainline concrete pavement and the asphalt paved shoulder

9) The Delaware DOT Laboratory did not acquire the tensile strength testing equipment until July 25, 1995 at which time tensile strength testing of the concrete cylinders and cores started.

10)The road was not opened to public travel but was used by the Contractor and construction staff prior to and during the joint sealing operation. The joint sealing was carried out in the second construction season.

11)Layer thickness of each layer and of the total thickness of each section is shown in Tables 25 and 26. Careful attention was given to the grades of each layer. However, some sections show more than the 1/4" or 1/2" deviation mentioned in the Construction Guidelines.

SUMMARY

The wet weather in the spring and summer of 1994 slowed construction until the fall. By the end of 1994, the subgrade was constructed to a rough grade.

Construction resumed in late March, 1995 and by the end of April, the subgrade in all of the test sections was fine graded and approved. DGAB was placed and compacted to a rough grade as soon as possible to avoid rutting of the sandy subgrade. The fine grading of the DGAB was carried out when the next layer was to be placed.

Concrete paving operations started at the south end of the project on June 15, 1995. The paving schedule was organized to lay 3 test sections each day with a 5 day period to allow for the change over of the paver from a width of 24' to 26' and then back again.

The cracking of the pavement in some test sections, some equipment problems, weather and time taken to determine the cause of the cracking, disrupted the schedule. In the end, the concrete in 5 test sections was removed and replaced. Dowels for the replacement sections were not immediately available and it took several weeks before they arrived. The first 3 sections 100205, 100210 and 100209 were replaced on October 12. Several cracks appeared mostly in the driving lane and it took several weeks again to try and determine the cause of the cracking and the responsibility for them before the final 2 sections 100206 and 100202 were placed on November 21.

The cause of the cracking is under investigation by PCS/Law Engineering for FHWA.

Joint sealing, concrete repairs and asphalt shoulder paving were carried out in 1996. The southbound lanes were opened to two-way traffic on May 13, 1996. Southbound only traffic had to await the rehabilitation of the northbound lanes.

It is not planned to take the 365 day concrete cores until the northbound lanes are rehabilitated and opened to traffic.

TABLE 1
DEL DOT SPS-2 LAYOUT - US 113 SB, MILFORD TO GEORGETOWN

CONSTR. STA.	LENGTH FT.	SECTION NO.	CONC. FLEX. STRENGTH	PAVT. THICK INS.	LANE WIDTH FT.	BASE TYPE	BASE THICK. INS.	REMARKS	MONITOR STA.	CONSTR. STA.
762+63						GABC or SCB	8"	End of Contract 88-013-04		
	6113	59	3000 Comp.	10"	12'	GABC	8"		0 5	707+50 702+50
701+50										
	675	4	900	11"	12'	GABC	6"		0 5	700+50 695+50
94+75										
	675	8	900	11"	12'	LCB	6"		0 5	694+00 689+00
388+00										
	1250	12	900	11"	12'	PATB GABC	4" 4"	Fabric Wrapped Edge Drains Trans. Underdrain	0 5	687+00 682+00
675+50										
	800	10	900	8"	14'	PATB GABC	4" 4"	Fabric Wrapped Edge Drains	0 5	673+50 668+50
367+50										
	850	2	900	8"	14'	GABC	6"		0 5	665+00 660+00
659+00										
	725	6	900	8"	14'	LCB	6"		0 5	657+75 652+75
351+75										
	675	7	550	11"	14'	LCB	6"		0 5	651+00 646+00
645+00										
637+25	775	3	550	11"	14'	GABC	6"		0 5	644+00 639+00
	750	11	550	11"	14'	PATB GABC	4" 4"	Fabric Wrapped Edge Drains Trans. Underdrain	0 5	636+00 631+00
629+75										

TABLE 1 (Cont.)
DEL DOT SPS-2 LAYOUT - US 113 SB, MILFORD TO GEORGETOWN

CONSTR. STA.	LENGTH FT.	SECTION NO.	CONC. FLEX. STRENGTH	PAVT. THICK INS.	LANE WIDTH FT.	BASE		REMARKS	MONITOR STA.	CONSTR. STA.
						TYPE	THICK. INS.			
629+75	650	9	550	8"	12'	PATB	4"	Fabric Wrapped	0	629+00
623+25						GABC	4"	Edge Drains	5	624+00
614+00	925	1	550	8"	12'	GABC	6"		0 5	622+00 617+00
606+35	765	5	550	8"	12'	LCB	6"		0 5	612+00 607+00
601+00	535	60	3000 Comp.	10"	12'	GABC	8"	Plastic Dowels	0 5	606+20 601+20
550+00	5100							Begin Contract 88-013-04		

GABC- Graded Aggregate Base Course, Type B
PATB- Permeable Asphalt Treated Base
LCB- Lean Concrete Base

TABLE 2
DEL DOT SPS-2 - SCOPE OF MATERIAL SAMPLING

Material and Sample Description	Number of Samples	Sample Locations
Portland Cement Concrete		
Coring - 102 mm (4 inc.) diameter cores	117	C19-C59, 26A, 51A, C61-C100 C102-C134, C109A
Bulk Sampling (fresh PCC)	8	FC1-FC8
Lean Concrete Base		
Bulk Sampling (fresh LCB)	2	BP1-BP2
Coring 102 mm (4 in) diameter cores	18	C1-C18 (if practical)
Permeable Asphalt Treated Base		
Bulk Sampling (45 kg [100 lb.] per sample, uncompacted)	3	BT1-BT3 from paver
Unbound Base/Subbase Layers (per layer)		
Bulk Sampling (181 kg [400 lb.] each sample)	3	B13, B14, B15
Moisture Content Samples	3	B13, B14, B15
Embankment (0.3 m select fill)		
Bulk Sampling (181 kg [400 lb] each sample)	6	B1-B6
Moisture Content Samples	6	B1-B6
Subgrade		
Thin-Walled Tube Sampling (* 2 tubes)	36*	A1-A18
Splitspoon Sampling (only if thin-wall tube cannot be obtained)	36*	A1-A18
Bulk Sampling (181 kg [400 lb] each sample)	6	B7-B12
Moisture Content Samples	6	B7-B12

TABLE 3
DEL DOT SPS-2 SCOPE OF MATERIAL SAMPLING: PRIMARY SPS-2 EXPERIMENT

Material and Sample Description	Number of Samples	Sample Locations
Portland Cement Concrete		
Coring - 102 mm (4 inc.) diameter cores	117	C19-C59, C61-C100, C102-C136
Bulk Sampling (fresh PCC)	8	FC1-FC8
Lean Concrete Base		
Bulk Sampling (fresh LCB)	2	BP1-BP2
Coring 102 mm (4 in.) diameter cores	18	C1-C18 (if practical)
Permeable Asphalt Treated Base		
Bulk Sampling (45 kg [100 lb.] per sample, uncompacted)	3	BT1-BT3 from paver
Unbound Base/Subbase Layers (per layer)		
Bulk Sampling (181 kg [400 lb] each sample)	3	B13, B14, B15
Moisture Content Samples	3	B13, B14, B15
Embankment (0.3 m select fill)		
Bulk Sampling (181 kg [400 lb] each sample)	6	B1-B6
Moisture Content Samples	6	B1-B6
Subgrade		
Thin-Walled Tube Sampling (* 2 tubes)	36*	A1-A18
Splitspoon Sampling (only if thin-wall tube cannot be obtained)	36*	A1-A18
Bulk Sampling (181 kg [400 lb] each sample)	6	B7-B12
Moisture Content Samples	6	B7-B12

TABLE 4
DEL DOT SPS-2 SCOPE OF FIELD TESTING

Material	Number of Tests	Location Designation
Portland Cement Concrete (PCC)		
Slump	8	FC1-FC8
Air Content	8	FC1-FC8
Mix Temperature	8	FC1-FC8
Lean Concrete Base (LCB)		
Slump	2	BP1-BP2
Air Content	2	BP1-BP2
Mix Temperature	2	BP1-BP2
Permeable Asphalt Treated Base (PATB)		
Plate Bearing Test	2	PB9-PB10*
Unbound Base/Subbase Layers (per layer)		
In situ density, moisture content (nuclear gauge)	33	T49-T81
Plate Bearing Test	4	PB5-PB8
Embankment < 1 2m (4 ft)		
In situ density, moisture content (nuclear gauge)	48	T1-T48
Plate Bearing Test	4	PB1-PB4
Subgrade		
Shoulder Auger Probe	14	S1-S14

* If practical with request to scheduling

TABLE 5
DEL DOT SPS-2
SAMPLES FOR THE MATERIALS REFERENCE LIBRARY (MRL)

MATERIAL DESCRIPTION	QUANTITY	PACKAGING
PORTLAND CEMENT	Approximately 23 kg (50 lbs)	Seal in heavy plastic bag and placed in a 19 liter (5 gal.) pail
FLYASH	Approximately 23 kg (50 lbs.)	Seal in heavy plastic bag and placed in a 19 liter (5 gal) pail
LIQUID ADDITIVE (each)	0.9 liter (1 quart)	Seal in a GLASS container protected from breakage
FINE AGGREGATE (from Plant)	Approximately 150 kg (300 lbs.)	Place in 4-19 liter (5 gal.) pails
COARSE AGGREGATE (from Plant)	Approximately 150 kg (300 lbs.)	Place in 4-19 liter (5 gal) pails

NOTE: - Collect material samples for both 3 8 MPa and 6 2 MPa concrete if different materials are used.

- Containers and Shipping costs are to be bourne by the MRL.

- Contact Mr. Rodney Soule - (702) 358-7574
  Mr. Jim Nichols - (702) 329-4955
  Nichols Consulting Engineers

- Address to: Materials Reference Library
  1625 Crane Way
  Sparks, NV 89431

TABLE 6
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - STATE LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
EMBANKMENT SAMPLE - TOP 12" OF FINISHED SUBGRADE												
100204	B1	BG01	695+00	1 8	2	45 kg Bulk	UG09/P48					
100212	B2	BG02	681+50	1 8	2	45 kg Bulk	UG09/P48					
100202	B3	BG03	659+50	1 8	2	45 kg Bulk	UG09/P48					
100207	B4	BG04	645+50	1 8	2	45 kg Bulk	UG09/P48					
100211	B5	BG05	630+50	1.8	2	45 kg Bulk	UG09/P48					
100201	B6	BG06	616+50	1 8	2	45 kg Bulk	UG09/P48					
SUBGRADE SAMPLE - BELOW EMBANKMENT SAMPLE												
100204	B7	BS01	695+00	1 8	2	45 kg Bulk						
100212	B8	BS02	681+50	1 8	2	45 kg Bulk						
100202	B9	BS03	659+50	1 8	2	45 kg Bulk						
100207	B10	BS04	645+50	1 8	2	45 kg Bulk						
100211	B11	BS05	630+50	1 8	2	45 kg Bulk						
100201	B12	BS06	616+50	1 8	2	45 kg Bulk						

TABLE 6A
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - FHWA-LTPP LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
EMBANKMENT SAMPLE - TOP 12" OF FINISHED SUBGRADE												
100204	B1	BG01	695+00	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100212	B2	BG02	681+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100202	B3	BG03	659+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100207	B4	BG04	645+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100211	B5	BG05	630+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100201	B6	BG06	616+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100204	B1	MG01	695+00	1 8	2	Moisture Jar	SS09/P49					
100212	B2	MG02	681+50	1 8	2	Moisture Jar	SS09/P49					
100202	B3	MG03	659+50	1 8	2	Moisture Jar	SS09/P49					
100207	B4	MG04	645+50	1 8	2	Moisture Jar	SS09/P49					
100211	B5	MG05	630+50	1 8	2	Moisture Jar	SS09/P49					
100201	B6	MG06	616+50	1 8	2	Moisture Jar	SS09/P49					
SUBGRADE SAMPLE - BELOW EMBANKMENT SAMPLE												
100204	B7	BS01	695+00	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100212	B8	BS02	681+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100202	B9	BS03	659+50	1.8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100207	B10	BS04	645+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100211	B11	BS05	630+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100201	B12	BS06	616+50	1 8	2	136 kg Bulk	SS01/P51	SS02/P42	SS03/P43	SS04/P52	SS05/P55	SS07/P46
100204	B7	MS01	695+00	1 8	2	Moisture Jar	SS09/P49					
100212	B8	MS02	681+50	1 8	2	Moisture Jar	SS09/P49					
100202	B9	MS03	659+50	1 8	2	Moisture Jar	SS09/P49					
100207	B10	MS04	645+50	1 8	2	Moisture Jar	SS09/P49					
100211	B11	MS05	630+50	1 8	2	Moisture Jar	SS09/P49					
100201	B12	MS06	616+50	1 8	2	Moisture Jar	SS09/P49					

TABLE 7
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - STATE LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
100204	A1	TS01	699+50	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
	A3	TS05	696+50	2 4	3	Thin-Wall Tube	SS04/P52	SS11/P57				
100212	A4	TS07	686+00	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
	A6	TS11	683+00	2 4	3	Thin-Wall Tube	SS04/P52					
100202	A7	TS13	664+00	2 4	3	Thin-Wall Tube	SS04/P52	SS11/P57				
	A8	TS15	662+50	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
100207	A10	TS19	650+00	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
	A12	TS23	647+00	2 4	3	Thin-Wall Tube	SS04/P52					
100211	A13	TS25	635+00	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
	A15	TS29	632+00	2 4	3	Thin-Wall Tube	SS04/P52					
100201	A16	TS31	621+00	2 4	3	Thin-Wall Tube	SS04/P52	SS08/P56	SS10/P54			
	A18	TS37	618+00	2 4	3	Thin-Wall Tube	SS04/P52	SS11/P57				
100204	A1	TS02	699+50	2 4	3	Thin-Wall Tube						
	A3	TS06	696+50	2 4	3	Thin-Wall Tube						
100212	A4	TS08	686+00	2.4	3	Thin-Wall Tube						
	A6	TS12	683+00	2 4	3	Thin-Wall Tube						
100202	A7	TS14	664+00	2.4	3	Thin-Wall Tube						
	A8	TS16	662+50	2 4	3	Thin-Wall Tube						
100207	A10	TS20	650+00	2 4	3	Thin-Wall Tube						
	A12	TS24	647+00	2.4	3	Thin-Wall Tube						
100211	A13	TS26	635+00	2 4	3	Thin-Wall Tube						
	A15	TS30	632+00	2 4	3	Thin-Wall Tube						
100201	A16	TS32	621+00	2.4	3	Thin-Wall Tube						
	A18	TS36	618+00	2 4	3	Thin-Wall Tube						

TABLE 7A
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - FHWA-LTPP LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
100204	A2	TS03	698+00	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100212	A5	TS09	684+50	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100202	A9	TS17	661+00	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100207	A11	TS21	648+50	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100211	A14	TS27	633+50	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100201	A17	TS33	619+50	2 4	3	Thin-Wall Tube	SS04/P52	SS07/P46				
100204	A2	TS04	698+00	2 4	3	Thin-Wall Tube						
100212	A5	TS10	684+50	2 4	3	Thin-Wall Tube						
100202	A9	TS18	661+00	2 4	3	Thin-Wall Tube						
100207	A11	TS22	648+50	2 4	3	Thin-Wall Tube						
100211	A14	TS28	633+50	2 4	3	Thin-Wall Tube						
100201	A17	TS34	619+50	2 4	3	Thin-Wall Tube						

TABLE 8
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - STATE LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
GRANULAR AGGREGATE BASE COURSE (GABC)												
100204	B13	BG-07	695+00	1 8	2	45 kg Bulk	UG09/P48					
100202	B14	BG-08	659+50	1 8	2	45 kg Bulk	UG09/P48					
100201	B15	BG-09	616+50	1 8	2	45 kg Bulk	UG09/P48					

TABLE 8A
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - FHWA-LTPP LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
GRANULAR AGGREGATE BASE COURSE (GABC)												
100204	B13	BG-07	695+00	1.8	2	136 kg Bulk	UG01/P41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46
100202	B14	BG-08	659+50	1 8	2	136 kg Bulk	UG01/P41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46
100201	B15	BG-09	616+50	1 8	2	136 kg Bulk	UG[illegible]41	UG02/P41	UG04/P43	UG08/P47	UG05/P44	UG07/P46
100204	B13	MG-07	695+00	1 8	2	Moisture Jar	UG10/P49					
100202	B14	MG-08	659+50	1 8	2	Moisture Jar	UG10/P49					
100201	B15	MG-09	616+50	1 8	2	Moisture Jar	UG10/P49					

TABLE 9
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SAMPLING AND LABORATORY TESTING - STATE LABORATORY

SECTION NO.	LOCATION NO.	SAMPLE NO.	APPROX. CONSTR. STA.	OFFSET m.	LAB TEST NO.	TYPE OF SAMPLE	LABORATORY TEST SEQUENCE					
							FIRST	SECOND	THIRD	FOURTH	FIFTH	SIXTH
PERMEABLE ASPHALT TREATED BASE												
100212	BT1	BT1	684+50		3	45 kg Paver	AC04/P04	AG04/P14				
100210	BT2	BT2	671+00		3	45 kg Paver	AC04/P04	AG04/P14				
100211	BT3	BT3	633+50		3	45 kg Paver	AC04/P04	AG04/P14				

TABLE 10
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
TRACKING TABLE FOR MOLDED PCC CYLINDERS & BEAMS

TEST SECTION	STATION & SAMPLE NO.	DATES MOLDED (FILL IN)	SPECIMEN NUMBER								
			14 DAY TESTS			28 DAY TESTS			365 DAY TESTS		
			P61	P62	P69	P61	P62	P69	P61	P62	69
LCB As Delivered											
100208	691+50 BP1		LX01 LX02			LY01 LY02			LZ01 LZ02		
			Test Date			**Test Date**			**Test Date**		
100206	655+25 BP2		LX03 LX04			LY03 LY04			LZ03 LZ04		
			Test Date			**Test Date**			**Test Date**		
PCC As Delivered											
100259	705+00 FC1		GX01	GX02	FX01	GY01	GY02	FY01	GZ01	GZ02	FZ01
			Test Date			**Test Date**			**Test Date**		
100208	691+50 FC2		GX03	GX04	FX02	GY03	GY04	FY02	GZ03	GZ04	FZ02
			Test Date			**Test Date**			**Test Date**		
100212	684+50 FC3		GX05	GX06	FX03	GY05	GY06	FY03	GZ05	GZ06	FZ03
			Test Date			**Test Date**			**Test Date**		
100202	662+50 FC4		GX07	GX08	FX04	GY07	GY08	FY04	GZ07	GZ08	FZ04
			Test Date			**Test Date**			**Test Date**		
100207	648+50 FC5		GX09	GX10	FX05	GY09	GY10	FY05	GZ09	GZ10	FZ05
			Test Date			**Test Date**			**Test Date**		

TABLE 10 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
TRACKING TABLE FOR MOLDED PCC CYLINDERS & BEAMS

TEST SECTION	STATION & SAMPLE NO.	DATES MOLDED (FILL IN)	SPECIMEN NUMBER								
			14 DAY TESTS			28 DAY TESTS			365 DAY TESTS		
			P61	P62	P69	P61	P62	P69	P61	P62	69
PCC As Delivered											
100211	633+50 FC6		GX11	GX12	FX06	GY11	GY12	FY06	GZ11	GZ12	FZ06
			Test Date _____			Test Date _____			Test Date _____		
100205	609+00 FC7		GX13	GX14	FX07	GY13	GY14	FY07	GZ13	GZ14	FZ07
			Test Date _____			Test Date _____			Test Date _____		
100260	603+70 FC8		GX15	GX16	FX08	GY15	GY16	FY08	GZ15	GZ16	FZ08
			Test Date _____			Test Date _____			Test Date _____		

TEST PROTOCOL

P61 - Compression testing of molded cylinders 152mm dia x 305mm

P62 - Splitting Tensile Testing of Molded Cylinders 152mm dia x 305mm

P69 - Flexural Strength (1/3 Point Loading) of Beams 152mm x 152mm x 508mm

TABLE 11
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
14	CL1	100208		3	152	LCB	694+30	1 9				PC06/P06	PC01/P61		
	CL2			3	152	LCB	694+30	0 9				PC06/P06			
			CL3	3	152	LCB	688+70	1 9				PC06/P06	PC01/P61		
			CL4	3	152	LCB	688+70	0 9				PC06/P06			
	CL5	100206		3	152	LCB	658+05	1 9				PC06/P06	PC01/P61		
	CL6			3	152	LCB	658+05	0 9				PC06/P06			
	CL7			3	152	LCB	658+05	1 9				PC06/P06	PC01/P61		
			CL8	3	152	LCB	652+45	1.4				PC06/P06			
			CL9	3	152	LCB	652+45	0 9				PC06/P06			
	CL10	100207		3	152	LCB	651+30	1 9				PC06/P06	PC01/P61		
	CL11			3	152	LCB	651+30	1 4				PC06/P06			
			CL12	3	152	LCB	645+70	0 9				PC06/P06			
			CL13	3	152	LCB	645+70	1 9				PC06/P06	PC01/P61		
			CL14	3	152	LCB	645+70	0 9				PC06/P06			
	CL15	100205		3	152	LCB	612+30	1.9				PC06/P06	PC01/P61		
	CL16			3	152	LCB	612+30	0 9				PC06/P06			
			CL17	3	152	LCB	606+70	1.9				PC06/P06	PC01/P61		
			CL18	3	152	LCB	606+70	0 9				PC06/P06			

TABLE 11 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
28	CL35	100208		3	152	LCB	694+25	2.4				PC06/P66	PC01/P61		
			CL39	3	152	LCB	688+75	2.9				PC06/P66	PC01/P61		
	CL69	100206		3	152	LCB	658+00	1.9				PC06/P66	PC01/P61		
			CL72	3	152	LCB	652+50	2.9				PC06/P66	PC01/P61		
	CL77	100207		3	152	LCB	651+25	2.4				PC06/P66	PC01/P61		
			CL81	3	152	LCB	645+75	2.4				PC06/P66	PC01/P61		
	CL118	100205		3	152	LCB	612+25	2.4				PC06/P66	PC01/P61		
			CL122	3	152	LCB	606+75	2.4				PC06/P66	PC01/P61		
365	CL37	100208		3	152	LCB	694+25	1.4				PC06/P66	PC01/P61		
			CL41	3	152	LCB	688+75	1.9				PC06/P66	PC01/P61		
			CL42	3	152	LCB	688+75	1.4				PC06/P66	PC01/P61		
	CL71	100206		3	152	LCB	658+00	0.9				PC06/P66	PC01/P61		
			CL74	3	152	LCB	652+50	1.9				PC06/P66	PC01/P61		
			CL76	3	152	LCB	652+50	0.9				PC06/P66	PC01/P61		
	CL79	100207		3	152	LCB	651+25	1.4				PC06/P66	PC01/P61		
			CL83	3	152	LCB	645+75	1.4				PC06/P66	PC01/P61		
			CL84	3	152	LCB	645+75	0.9				PC06/P66	PC01/P61		
	CL120	100205		3	152	LCB	612+30	1.4				PC06/P66	PC01/P61		
			CL124	3	152	LCB	606+70	1.4				PC06/P66	PC01/P61		
			CL125	3	152	LCB	606+70	0.9				PC06/P66	PC01/P61		

TABLE 12
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
14	CP19	100259		4	254	PCC 20 7	707+75	2 4				PC06/P66	PC01/P61		
			CP23	4	254	PCC 20 7	702+25	2 9				PC06/P66	PC02/P62		
	CP27	100204		4	279	PCC 6 2	700+75	1.9				PC06/P66	PC01/P61		
			CP31	4	279	PCC 6 2	695+25	2 9				PC06/P66	PC02/P62		
	CP35	100208		4	279	PCC 6 2	694+25	2 4				PC06/P66	PC01/P61		
			CP39	4	279	PCC 6 2	688+75	2 9				PC06/P66	PC02/P62		
	CP44	100212		5	279	PCC 6 2	687+25	2 4				PC06/P66	PC01/P61		
			CP48	5	279	PCC 6 2	681+75	2 9				PC06/P66	PC02/P62		
	CP52	100210		5	203	PCC 6.2	673+75	2.4				PC06/P66	PC01/P61		
			CP56	5	203	PCC 6.2	668+25	2 4				PC06/P66	PC02/P62		
	CP61	100202		4	203	PCC 6 2	665+25	2.4				PC06/P66	PC01/P61		
			CP65	4	203	PCC 6 2	659+75	2 4				PC06/P66	PC02/P62		
	CP69	100206		4	203	PCC 6 2	658+00	1.9				PC06/P66	PC01/P61		
			CP72	4	203	PCC 6 2	652+50	2 9				PC06/P66	PC02/P62		
	CP77	100207		4	279	PCC 3 8	651+25	2.4				PC06/P66	PC01/P61		
			CP81	4	279	PCC 3 8	645+75	2 4				PC06/P66	PC02/P62		
	CP85	100203		4	279	PCC 3 8	644+25	2 4				PC06/P66	PC01/P61		
			CP89	4	279	PCC 3 8	638+75	2 4				PC06/P66	PC02/P62		
	CP93	100211		5	279	PCC 3 8	636+25	2.4				PC06/P66	PC01/P61		
			CP97	5	279	PCC 3 8	630+75	2 4				PC06/P66	PC02/P62		
	CP102	100209		5	203	PCC 3 8	629+25	2 4				PC06/P66	PC01/P61		
			CP106	5	203	PCC 3 8	623+75	2 9				PC06/P66	PC02/P62		
	CP110	100201		4	203	PCC 3 8	622+25	2 4				PC06/P66	PC01/P61		
			CP114	4	203	PCC 3 8	616+75	2.4				PC06/P66	PC02/P62		
	CP118	100205		4	203	PCC 3.8	612+25	2.4				PC06/P66	PC01/P61		
			CP122	4	203	PCC 3 8	606+75	2.4				PC06/P66	PC02/P62		
	CP126	100260		4	254	PCC 20 7	606+45	2.4				PC06/P66	PC01/P61		
			CP130	4	254	PCC 20 7	600+95	2.9				PC06/P66	PC02/P62		

TABLE 12 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
28	CP20	100259		4	254	PCC 20 7	707+75	1 9				PC06/P66	PC01/P61	PC08/P68	
	CP22			4	254	PCC 20 7	707+75	1.3				PC06/P66	PC05/P65	PC04/P64	
			CP24	4	254	PCC 20 7	702+25	2 4				PC06/P66	PC02/P62		
			CP135	4	254	PCC 20 7	702+25	0 9				PC06/P66	PC03/P63*		
	CP28	100204		4	279	PCC 6 2	700+75	1 3				PC06/P66	PC01/P61		
			CP30	4	279	PCC 6 2	695+25	2 9				PC06/P66	PC05/P65	PC04/P64	
			CP32	4	279	PCC 6 2	695+25	1 9				PC06/P66	PC02/P62		
	CP36	100208		4	279	PCC 6 2	694+25	1 9				PC06/P66	PC01/P61		
	CP38			4	279	PCC 6 2	694+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP40	4	279	PCC 6 2	688+75	2 4				PC06/P66	PC02/P62		
			CP43	4	279	PCC 6 2	688+75	0 9				PC06/P66	PC03/P63*		
	CP45	100212		5	279	PCC 6 2	687+25	1 9				PC06/P66	PC01/P61		
	CP47			5	279	PCC 6 2	687+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP49	5	279	PCC 6 2	681+75	2 4				PC06/P66	PC02/P62		
			CP136	5	279	PCC 6 2	681+75	0.9				PC06/P66	PC08/P68		
	CP53	100210		5	203	PCC 6 2	673+75	1 9				PC06/P66	PC01/P61		
	CP55			5	203	PCC 6 2	673+75	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP57	5	203	PCC 6 2	668+25	1.9				PC06/P66	PC02/P62		
	CP62	100202		4	203	PCC 6 2	665+25	1 9				PC06/P66	PC01/P61		
	CP64			4	203	PCC 6 2	665+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP66	4	203	PCC 6 2	659+75	1.9				PC06/P66	PC02/P62		
	CP70	100206		4	203	PCC 6 2	658+00	1.4				PC06/P66	PC01/P61	PC08/P68	
			CP73	4	203	PCC 6 2	652+50	2.4				PC06/P66	PC02/P62		
			CP75	4	203	PCC 6 2	652+50	1.4				PC06/P66	PC05/P65	PC04/P64	

TABLE 12 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
28	CP78	100207		4	279	PCC 3 8	651+25	1 9				PC06/P66	PC01/P61		
	CP80			4	279	PCC 3 8	651+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP82	4	279	PCC 3 8	645+75	1 9				PC06/P66	PC02/P62		
	CP86	100203		4	279	PCC 3 8	644+25	1.9				PC06/P66	PC01/P61		
	CP88			4	279	PCC 3 8	644+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP90	4	279	PCC 3 8	638+75	1 9				PC06/P66	PC02/P62		
	CP94	100211		5	279	PCC 3 8	636+25	1.9				PC06/P66	PC01/P61		
	CP96			5	279	PCC 3 8	636+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP98	5	279	PCC 3 8	630+75	1 9				PC06/P66	PC02/P62		
			CP100	5	279	PCC 3 8	630+75	0.9				PC06/P66	PC03/P63*		
	CP103	100209		5	203	PCC 3 8	629+25	1 9				PC06/P66	PC01/P61		
	CP105			5	203	PCC 3 8	629+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP107	5	203	PCC 3 8	623+75	2.4				PC06/P66	PC02/P62		
	CP111	100201		4	203	PCC 3 8	622+25	1.9				PC06/P66	PC01/P61		
			CP115	4	203	PCC 3 8	616+75	1 9				PC06/P66	PC02/P62		
			CP117	4	203	PCC 3 8	616+75	0.9				PC06/P66	PC05/P65	PC04/P64	
	CP119	100205		4	203	PCC 3 8	612+25	1.9				PC06/P66	PC01/P61		
	CP121			4	203	PCC 3 8	612+25	0 9				PC06/P66	PC05/P65	PC04/P64	
			CP123	4	203	PCC 3 8	606+75	1 9				PC06/P66	PC02/P62		
			CP125	4	203	PCC 3 8	606+75	0 9				PC06/P66	PC03/P63*		
	CP127	100260		4	254	PCC 20 7	606+45	1.9				PC06/P66	PC01/P61		
	CP129			4	254	PCC 20.7	606+45	0.9				PC06/P66	PC05/P65	PC04/P64	
			CP131	4	254	PCC 20 7	600+95	2.4				PC06/P66	PC02/P62		
			CP133	4	254	PCC 20 7	600+95	1.4				PC06/P66	PC03/P63*		

TABLE 12 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
365	CP21	100259		4	254	PCC 20 7	707+75	1 4				PC06/P66	PC01/P61		
			CP25	4	254	PCC 20 7	702+25	1 9				PC06/P66	PC02/P62		
			CP26	4	254	PCC 20 7	702+25	1 4				PC06/P66	PC04/P64		
	CP29	100204		4	279	PCC 6 2	700+75	1 4				PC06/P66	PC01/P61		
			CP33	4	279	PCC 6 2	695+25	1 4				PC06/P66	PC02/P62		
			CP34	4	279	PCC 6 2	695+25	0 9				PC06/P66	PC04/P64		
	CP37	100208		5	279	PCC 6 2	694+25	1 4				PC06/P66	PC01/P61		
			CP41	5	279	PCC 6 2	688+75	1 9				PC06/P66	PC02/P62		
			CP42	5	279	PCC 6 2	688+75	1 4				PC06/P66	PC04/P64		
	CP46	100212		5	279	PCC 6 2	687+25	1 4				PC06/P66	PC01/P61		
			CP50	5	279	PCC 6 2	681+75	1 9				PC06/P66	PC02/P62		
			CP51	5	279	PCC 6 2	681+75	1 4				PC06/P66	PC04/P64		
	CP54	100210		4	203	PCC 6.2	673+75	1.4				PC06/P66	PC01/P61		
			CP58	4	203	PCC 6 2	668+25	1 4				PC06/P66	PC02/P62		
			CP59	4	203	PCC 6.2	668+25	0 9				PC06/P66	PC04/P64		
	CP63	100202		4	203	PCC 6.2	665+25	1.4				PC06/P66	PC01/P61		
			CP67	4	203	PCC 6 2	659+75	1 4				PC06/P66	PC02/P62		
			CP68	4	203	PCC 6 2	659+75	0 9				PC06/P66	PC04/P64		
	CP71	100206		4	203	PCC 6 2	658+00	0 9				PC06/P66	PC01/P61		
			CP74	4	203	PCC 6 2	652+50	1 9				PC06/P66	PC02/P62		
			CP76	4	203	PCC 6 2	652+50	0 9				PC06/P66	PC04/P64		
	CP79	100207		4	279	PCC 3.8	651+25	1.4				PC06/P66	PC01/P61		
			CP83	4	279	PCC 3 8	645+75	1.4				PC06/P66	PC02/P62		
			CP84	4	279	PCC 3 8	645+75	0.9				PC06/P66	PC04/P64		

TABLE 12 (Cont.)
DEL DOT SPS-2: US 113 SB, MILFORD TO GEORGETOWN
SCHEDULE FOR CORING AND TESTING OF LCB & PCC - 4" OD CORES

AGE DAYS	CORE # 0+00 END	SECTION NO.	CORE # 5+00 END	LAYER NO.	LAYER THICK. mm.	MATERIAL DESCRIP-TION	APPROX. CONSTR. STA.	OFFSET m.	DATE PLACED	TEST DATE	AGE DAYS	LAB. TEST ASSIGNMENTS FIRST	SECOND	THIRD	FOURTH
365	CP87	100203		5	279	PCC 3 8	644+25	1 4				PC06/P66	PC01/P61		
			CP91	5	279	PCC 3 8	638+75	1.4				PC06/P66	PC02/P62		
			CP92	5	279	PCC 3 8	638+75	0 9				PC06/P66	PC04/P64		
	CP95	100211		5	279	PCC 3 8	636+25	1 4				PC06/P66	PC01/P61		
			CP99	5	279	PCC 3 8	630+75	1 4				PC06/P66	PC02/P62		
			CP100	5	279	PCC 3 8	630+75	0 9				PC06/P66	PC04/P64		
	CP104	100209		4	203	PCC 3 8	629+25	1.4				PC06/P66	PC01/P61		
			CP108	4	203	PCC 3 8	623+75	1 9				PC06/P66	PC02/P62		
			CP109	4	203	PCC 3 8	623+75	1.4				PC06/P66	PC04/P64		
	CP112	100201		4	203	PCC 3 8	622+25	1 4				PC06/P66	PC01/P61		
			CP115	4	203	PCC 3 8	616+75	1 9				PC06/P66	PC02/P62		
			CP117	4	203	PCC 3 8	616+75	0 9				PC06/P66	PC04/P64		
	CP120	100205		4	203	PCC 3 8	612+25	1 4				PC06/P66	PC01/P61		
			CP124	4	203	PCC 3 8	606+75	1 4				PC06/P66	PC02/P62		
			CP125	4	203	PCC 3.8	606+75	0.9				PC06/P66	PC04/P64		
	CP128	100260		4	254	PCC 20 7	606+45	1.4				PC06/P66	PC01/P61		
			CP132	4	254	PCC 20 7	600+95	1 9				PC06/P66	PC02/P62		
			CP134	4	254	PCC 20 7	600+95	0 9				PC06/P66	PC04/P64		

* Cores CP43, 100, 133, 135 for test PC03/P63
Coefficient of Thermal Expansion are
to be shipped to -
FEDERAL HIGHWAY ADMINISTRATION
c/o Ms Marcia Simon
TFHRC, HNR-20
6300 Georgetown Pike
McLean, Virginia 22101-2296

TABLE 13
DEL DOT SPS-2 US 113 SB, MILFORD DE - 100200
Materials Reference Library Sampling

COARSE AND FINE AGGREGATE

Materials	Sample Location	Sample Size	Remarks
Course Aggregate	Stockpile	4-19 Litre Pails	Source - Arundel MD
Course Aggregate	Stockpile	4-19 Litre Pails	Source - MD materials - MD
Fine Aggregate	Stockpile	4-19 Litre Pails	Source - Miller Brothers
ADDITIVES			
Cement Type 1 L/A	Tanker Plant	1-19 Litre Pail	Source - Keystone, PA
Cement Type 1 Reg	Tanker Plant	1-19 Litre Pail	Source - Keystone, PA
New Cem (slag cement)	Tanker Plant	1-19 Litre Pail	Source - Keystone, PA
Air Entrainment M BAEA90	Concrete Plant	1-Quart	Master Buildters MBAEA 90
Water Reducing Agent POZZ 22ON	Concrete Plant	1-Quart	Master Builders POZZ 22ON

TABLE 13.1
DEL DOT SPS-2 US 113 SB, MILFORD DE
LTPP MRL SPS Material Sampling and Testing Shipment Inventory

Location	Number	Size	Type	Material	Date
Stockpile (Plant)		4-19 L. Pails	Bulk	Co. Agg. (Arundel MD)	6-14-95
Stockpile (Plant)		4-19 L. Pails	Bulk	F.A.G G. (Miller)	6-14-95
Stockpile (Plant)		4-19 L. Pails	Bulk	Co. Agg. (MD Mtls.)	7-19-95
Conc Plant Tanker	from Keystone, PA	1-19 L. Pail	Bulk	Cement Type 1 L/A	7-20-95
Conc. Plant Tanker	from Blue Circle	1-19 L. Pail	Bulk	Slag Cement NEW CEM	7-20-95
Conc. Plant Tanker	from Keystone, PA	1-19 L. Pail	Bulk	Cement Type 1 Regular	7-20-95
Conc. Plant	MBAEA -0	1-Quart	Jar	Air Entrain.	7-20-95
Conc. Plant	POZZ 220N	1-Quart	Jar	WRA	7-20-95

TABLE 14
DEL DOT SPS-2 US 113 SB, MILFORD DE
Sampling, Field Testing and Construction Dates

Activity	Test Sections													
	60	5	1	9	11	3	7	6	2	10	12	8	4	59
Subgrade														
Bulk Sample			6/15/94		6/27/94		7/11/94		7/11/94		7/13/94		not sampled	
Shoulder Probe	5/16/95													
Embankment														
Grade Approved	4/3/95	4/4/95	4/4/95	4/6/95	4/6/95	4/7/95	4/10/95	4/11/95	4/11/95	4/28/95	4/20/95	4/18/95	4/17/95	4/21/95
Bulk Sample			4/5/95		Cut		4/10/95		4/11/95		4/20/95		4/19/95	
Shelby Tube			4/6/95*		4/7/95*		4/7/95		4/12/95		4/12/95		4/13/95	
5 Pt Level	4/3/95	4/5/95	4/5/95	4/6/95	4/7/95	4/8/95	4/10/95	4/11/95	4/11/95	4/28/95	4/21/95	4/19/95	4/19/95	4/21/95
Moist & Dens	4/3/95	4/4/95	4/5/95	4/6/95	4/7/95	4/8/95	4/10/95	4/11/95	4/11/95	4/28/95	4/21/95	4/18/95	4/18/95	4/21/95
FWD	4/6/95	4/6/95	4/5/95	4/6/95	4/7/95	4/10/95	4/10/95	4/11/95	4/11/95		4/20/95	4/20/95		
Plate Load		4/11/95*					4/18/95	4/18/95				4/19/95		
Bases														
DGAB														
Depth (ins)	8		6	4	4	6			6	4	4		6	8
1st Lift	4/10/95		4/10/95	4/11/95	4/12/95	4/11/95			4/12/95	4/29/95	4/21/95		4/19/95	4/22/95
2nd Lift	4/12/95												4/20/95	4/26/95
Bulk Samples			4/10/95						6/6/95				4/20/95	
Grade Approved	6/3/95		6/3/95	4/26/95	4/27/95	6/8/95			6/6/95	5/30/95	5/30/95		6/19/95	6/19/95
5 Pt Level	6/3/95		6/3/95	4/27/95	4/27/95	6/8/95			6/6/95	5/30/95	5/30/95		6/19/95	6/19/95
Moist & Dens	6/3/95		6/3/95	4/27/95	4/27/95	6/8/95			6/5/95	5/30/95	5/30/95		6/17/95	6/19/95
DGAB Re-worked			9/13/95	9/12/95					10/12/95					
Grade Re-approved			9/15/95	9/13/95					10/13/95					
5 Pt. Level			9/15/95	9/13/95					10/13/95					
Moist. & Dens			9/15/95	9/13/95					10/13/95					
FWD			6/6/95	5/4/95	5/4/95	4/20/95			6/6/95				4/21/95	5/4/95
Plate Load			4/20/95			4/19/95							5/4/95	5/4/95

TABLE 14 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD DE
Sampling, Field Testing and Construction Dates

Activity	Test Sections													
	60	5	1	9	11	3	7	6	2	10	12	8	4	59
PATB - 4"														
Placed				6/5/95	6/5/95					6/5/95	6/5/95			
5 Pt Level				6/6/95	6/6/95					6/6/95	6/6/95			
Replaced				9/19/95										
5 Pt Level				9/19/95										
Bulk Sample					6/5/95					6/5/95	6/5/95			
FWD				6/6/95	6/6/95					6/7/95	6/7/95			
Plate Load					6/7/95						6/7/95			
LCB - 6"														
Placed		5/24/95					5/25/95	5/25/95				5/24/95		
5 Pt Level		5/30/95					5/31/95	5/31/95				5/25/95		
FWD		6/6/95					6/6/95	6/6/95				6/7/95		
Edge Drain	Oct-94			4/18/95	4/19/95					5/4/95	4/27/95			4/19/95
PCC														
Depth	10	8	8	8	11	11	11	8	8	8	11	11	11	10
Placed	6/15/95	6/16/95	6/16/95	6/16/95	6/28/95	6/28/95	6/28/95	6/29/95	6/29/95	6/29/95	7/17/95	7/17/95	7/18/95	7/20/95
5 Pt Level	6/21/95	6/21/95	6/21/95	6/21/95	7/6/95	7/6/95	7/6/95	7/6/95	7/6/95	7/6/95	7/24/95	7/24/95	7/24/95	7/24/95
Replaced		10/12/95	10/12/95	10/12/95				11/21/95	11/21/95					
5 Pt Level		10/13/95	10/13/95	10/13/95				12/6/95	12/6/95					
Repairs		4/18/96	4/19/96	4/19/96						8/30/95				
Profile Index **	2.1	2.7	2.1	1 1	0 5	0 0	0.0	0 0	0 0	2 1	2 1	3.7	2 1	3 7

* Subgrade (Cut) Sample

** Single run 3' from outer edge of pavement

TABLE 15
DEL DOT SPS-2 US 113 SB, MILFORD DE
Bulk Samples - Subgrade

Test Section	Date Sampled	Sample Data			Stations		Depth - Top of Pvmt.	
		Loc.	No.	Size	Const.	SHRP	to Sub. (ins.)	to Emb. (ins.)
100201	6/15/94	B12	BS06 MS06	6 bags 1 jar	622+50	0-50	29	14
100211	6/27/94	B11	BS05 MS05	6 bags 1 jar	636+50	0-50	19	19*
100207	7/11/94	B10	BS04 MS04	8 bags 1 jar	645+75	5+25	33	17
100202	7/11/94	B9	BS03 MS03	8 bags 1 jar	659+85	5+15	50	14
100212	7/13/94	B8	BS02 MS02	8 bags 1 jar	681+75	5+25	48	19
100204	not sampled	B7					60	42

* Cut subgrade met Type 'A' Borrow specification

TABLE 16
DEL DOT SPS-2 US 113 SB, MILFORD DE
Bulk Samples - Embankment

Test Section	Date Sampled	Sample Data			Stations		Depth - Top of Pvmt.	
		Loc.	No.	Size	Const.	SHRP	to Sub. (ins.)	to Emb. (ins.)
100201	4/5/95	B6	BG06 MG06	8 bags 4 jars	622+50	0-50	14	14
100211	6/27/94	B5* (see B11)					19*	19
100207	4/10/95	B4	BG04 MG04	8 bags 4 jars	645+75	5+25	17	17
100202	4/11/95	B3	BG03 MG03	8 bags 3 jars	659+50	5+50	14	14
100212	4/20/95	B2	BG02 MG02	8 bags 3 jars	681+75	5+50	19	19
100204	4/19/95	B1	BG01 MG01	8 bags 3 jars	695+50	5+50	17	17

* Cut subgrade

TABLE 17
DEL DOT SPS-2 US 113 SB, MILFORD DE
Shelby Tube Data

Test Section	Stations	Bore Hole Data			Tube Depth	Material		Sample for FHWA	Remarks
		Station	Loc.	Samp. No.	Recovered (ins.)	Cut	Fill (ins.)		
100201	617+00 - 622+00	621+00	A16	TS31	24	yes			Cut 620+00 - 621+50, subgrade
4/6/95				TS32	23				met Type 'A' Borrow specs
		619+50	A17	TS33	21		24	yes	
				TS34	24			yes	
		618+00	A18	TS36	24		34		
				TS37	24				
100211	631+00 - 636+00	635+00	A13	TS25	24		24		
4/7/95				TS26	24				
		633+50	A14	TS27	24	yes		yes	Cut 632+50 - 634+00, subgrade
				TS28	24			yes	met Type 'A' Borrow specs
		632+00	A15	TS29	24		12		
				TS30	24				
100207	646+00 - 651+00	650+00	A10	TS19	24		12		Cut 649+00 - 651+00, subgrade
4/7/95				TS20	24				did not meet Type 'A' specs
		648+50	A11	TS21	24		12	yes	
				TS22	21			yes	
		647+00	A12	TS23	24		19		
				TS24	24				

TABLE 17 (Cont.)
DEL DOT SPS-2 US 113 SB, MILFORD DE
Shelby Tube Data

Test Section	Stations	Bore Hole Data			Tube Depth Recovered (ins.)	Material		Sample for FHWA	Remarks
		Station	Loc.	Samp. No.		Cut	Fill (ins.)		
100202	660+00 - 665+00	664+00	A7	TS13	13		36+		
4/12/95				TS14					did not take Split Spoon
		662+50	A8	TS15	16		36+		
				TS16					Split Spoon 16-48"
		661+00	A9	TS17			36+	yes	Split Spoon
				TS18				yes	Split Spoon
100212	682+00 - 687+00	686+00	A4	TS07			12		Split Spoon
4/12/95				TS08					Split Spoon
		684+50	A5	TS09			60+	yes	Split Spoon
				TS10				yes	Split Spoon
		683+00	A6	TS11	20		60+		
				TS12					Split Spoon 24-48"
100204	695+50 - 700+50	699+50	A1	TS01	22		12		Scratch cut 697+00 - 700+00
4/12/95				TS02	19				Subgrade did not meet
		698+00	A2	TS03	15		18	yes	Type 'A' Borrow spec
				TS04	19			yes	
		696+50	A3	TS05	21		18		
				TS06	24				

TABLE 18
DEL DOT SPS-2 US 113, MILFORD DE
Bulk Samples - Dense Graded Aggregate Base

Test Section	Date of Sample	Sample Data			Stations		Remarks
		Location	No.	Size	Const.	SHRP	
100201*	4/10/95	B15	BG09 MG09	8 bags 3 jars	616+50	5+50	DGAB surface re-worked 9/15/95
100202*	6/6/95	B14	BG08 MG08	8 bags 4 jars	659+50	5+50	DGAB surface re-worked 10/13/95
100204	4/20/95	B13	BG07 MG07	8 bags 3 jars	695+00	5+50	

* Original concrete was replaced

TABLE 19
DEL DOT SPS 2 US 113, MILFORD DE
Nuclear Density and Moisture Test Results
Subgrade, Embankment and Dense Granular Base Course

Test Section	Subgrade			Embankment					DGAB		Remarks
	Bulk Sample			Bulk Samples			Test Section		Test Section		
	Loc.	Dens. #/cu. ft.	Moist. %	Loc.	Dens. #/cu. ft.	Moist. %	Dens. #/cu. ft.	Moist. %	Dens. #/cu. ft.	Moist %	
100260*							133 3	6 7	147 5	4 0	
100205*							129 7	8 3			Cut and Fill
100201*	B12	124 7	5 2	B6	123 2	4 5	122 5	4 6	150.0	4.2	Cut and Fill DGAB placed
									154.8	5 9	6/3/95 Re-worked 9/15/95
100209*							125.0	5 3	149 9	5 0	DGAB placed 4/27/95
									147 8	5 9	Re-worked 9/13/95
100211*	B11	131 1	7 1	B5			124 5	6 7	148 6	5 6	Sample B11 and B5 in Cut
100203**							126 9	6 1	151 4	5 0	
100207**	B10	133.9	10 9	B4	127 1	6 7	124 5	6 1			
100206							128 0	9 0			
100202	B9	121 3	9.2	B3	121 0	6.2	125 5	8 0	150 0	4 5	DGAB placed 6/6/95
									148.1	4.8	Re-worked 10/13/95
100210							127.0	8 9	146 5	4 3	
100212	B8	127 2	9 8	B2	128 3	9 8	123 5	9 2	151 6	4.2	
100208*							122 6	9 3			Cut and Fill section
100204**	B7	---	---	B1	123 9	9.7	125 7	8 5	150.7	4.5	
100259							127 6	11 2	152 5	5.4	

* The subgrade material of cuts within these test sections met Type 'A' Borrow specifications

** Cut materials that did not meet the Type 'A' Borrow requirements were excavated to accommodate 12" of Type 'A' Borrow and are considered to be embankment

TABLE 20
DEL DOT SPS-2 US 113, MILFORD DE
PATB - Placement and Sampling Data

Test Section	Place Date	Nominal Thickness (ins.)	Air Temp.	Mix Temp. Avg.	Lay Temp. Avg.	Bulk Samples
100210	6/5/95	4.2	75	250	223	2-5 gallon pails BT2
100211	6/5/95	4 2	75	250	225	2-5 gallon pails BT3
100212	6/5/95	4.2	75	250	220	2-5 gallon pails BT1
100209	9/19/95	5.0	70	250	245	

TABLE 21
DEL DOT SPS-2 US 113, MILFORD DE
Plate Load Bearing Test

Test Section	Material Type	Test Data		Test Date	Remarks
		Loc. No.	Station		
100205	Embankment (subgrade)	PB4	609+50	4/11/95	20' loading beam slipped and bent. Test was completed
100207	Embankment (subgrade)	PB3	648+50	4/18/95	New reinforced 16' beam. Shaved 2" off subgrade to accommodate jack
100206	Embankment (subgrade)	PB2	655+25	4/18/95	Trucks partly unloaded for jack to clear
100208	Embankment (subgrade)	PB1	691+50	4/19/95	
100203	DGAB	PB7	641+50	4/19/95	Contractor fine graded and compacted a 50' stretch for the plate load test
100201	DGAB	PB8	619+50	4/20/95	Contractor fine graded and compacted a 50' stretch for the plate load test
100204	DGAB	PB6	698+00	5/4/95	Contractor fine graded and compacted a 50' stretch for the plate load test, also trucks had to be completely unloaded to get clearance for the jack
100259	DGAB	PB5	705+00	5/4/95	Contractor fine graded and compacted a 50' stretch for the plate load test, also trucks had to be completely unloaded to get clearance for the jack
100212	PATB	PB9	684+50	6/7/95	PATB was placed 6/5/95. Only 2 days before plate load test
100211	PATB	PB10	633+50	6/7/95	PATB was placed 6/5/95. Only 2 days before plate load test

TABLE 22
DEL DOT SPS-2 US 113, MILFORD DE
Concrete Test Results - LCB and PCC - Cylinders and Beams

Test Section	Station & Sample Number	Date of Sample	Type of Concrete	Field Tests				Laboratory Tests								
				Air %	Slmp ins.	Conc. Temp. Deg. (F)	Air Temp. Deg. (F)	Flexural P69			Compression P61			Tensile P62		
								14 Days	28 Days	365 Days	14 Days	28 Days	365 Days	14 Days	28 Days	365 Days
LCB 100208	691+50 BP1	5/24/95	LCB L/A cement	5 8	1	77	86				(1160)	(1280)				
100206	655+25 BP2	5/25/95	LCB L/A cement	7 6	1-1/2	76	88				(1010)	(1150)				
PCC 100260	603+70 FC8	6/15/95	3000 Comp	5 9	1-1/4	79	80	710	730		(3870)	(4040)				
100205	609+00 FC7	10/12/95	DEL DOT Type B	5 8	1-1/2	75	76	(750)	(885)		3630	4370		396 64	446 73	
100211	633+50 FC6	6/28/95	DEL DOT Type B	5 6	1-1/4	77	66	(640)	(730)		(3920)					
100207	648+50 FC5	6/28/95	DEL DOT Type B	6 7	2-1/4	74	73	(600)	(655)		(3590)	4000				
100202	622+50 FC4	11/21/95	900 PSI	5 3	1-1/2	66	55	(930)	(1125)		5730	7250		516 30	517 94	
100212	684+85 FC3	7/17/95	900 PSI	5 0	1	90	84	(695)	(765)		4430	5190			459	
100208	691+50 FC2	7/17/95	900 PSI	5 8	2	85	80	(665)	(725)		4060	4300		442	461	
100259	705+25 FC1	7/20/95	3000 Comp	5 2	1-1/2	86	85	(725)	(810)		3080	4270				

( ) Average of 2

TABLE 23
DEL DOT SPS-2 US 113, MILFORD DE
LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Dates Placed		Comp. Strength PSI			Remarks
			LCB	PCC	14 Days	28 Days	365 Days	
100208	CL1	694+30	5/24/95		1110			
	CL2	694+30	5/24/95		1170			
	CL3	688+70	5/24/95		1380			
	CL4	688+70	5/24/95		1430			
	CL35	694+25	5/24/95	7/17/95		1140 (69)		14 day PCC core
	CL39	688+75	5/24/95			1660 (69)		14 day PCC core
	CL36	694+25	5/24/95			1220 (81)		28 day PCC core
	CL38	694+25	5/24/95			1070 (81)		28 day PCC core
	CL40	688+75	5/24/95			1480 (81)		28 day PCC core
	CL43	688+75	5/24/95			1290 (81)		28 day PCC core
	CL37	694+25	5/24/95					365 day cores
	CL41	688+75	5/24/95					365 day cores
	CL42	688+75	5/24/95					365 day cores
100206	CL5	658+05	5/25/95		1070			
	CL6	658+05	5/25/95		1030			
	CL7	658+05	5/25/95		1090			
	CL8	652+45	5/25/95		1110			
	CL9	652+45	5/25/95		1180			
	CL69	658+00	5/25/95	11/21/95*		1690 (196)		14 day PCC core
	CL72	652+50	5/25/95					14 day PCC core
	CL70	658+00	5/25/95					28 day PCC core
	CL73	652+50	5/25/95			890 (210)		28 day PCC core
	CL75	652+50	5/25/95					28 day PCC core
	CL71	658+00	5/25/95					365 day cores
	CL74	652+50	5/25/95					365 day cores
	CL76	652+50	5/25/95					365 day cores

* Replaced PCC
( ) Age, Days

TABLE 23 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Dates Placed		Comp. Strength PSI			Remarks
			LCB	PCC	14 Days	28 Days	365 Days	
100207	CL10	651+30	5/25/95		1440			
	CL11	651+30	5/25/95		1540			
	CL12	645+70	5/25/95		1200			
	CL13	645+70	5/25/95		1020			
	CL14	645+70	5/25/95		1130			
	CL77	651+25	5/25/95	6/28/95		1240 (48)		14 day PCC core
	CL81	645+75	5/25/95			1350 (48)		14 day PCC core
	CL78	651+25	5/25/95			1220 (62)		28 day PCC core
	CL80	651+25	5/25/95			1310 (62)		28 day PCC core
	CL82	645+75	5/25/95			1360 (62)		28 day PCC core
	CL79	651+25	5/25/95					365 day cores
	CL83	645+75	5/25/95					365 day cores
	CL84	645+75	5/25/95					365 day cores
100205	CL15	612+30	5/24/95		1070			
	CL16	612+30	5/24/95		910			
	CL17	606+70	5/24/95		1360			
	CL18	606+70	5/24/95		1140			
	CL118	612+25	5/24/95	10/12/95*		no core		14 day PCC core
	CL122	606+75	5/24/95					14 day PCC core
	CL123	606+75	5/24/95					28 day PCC core
	CL125	606+75	5/24/95			FHWA		28 day PCC core
	CL121	612+25	5/24/95					28 day PCC core
	CL119	612+25	5/24/95			1370 (169)		28 day PCC core
	CL120	612+25	5/24/95					365 day cores
	CL124	606+75	5/24/95					365 day cores

* Replaced PCC
( ) Age, Days

TABLE 24
DEL DOT SPS-2 US 113, MILFORD DE
PCC & LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Date Placed	Type & Conc. Flex. Str.	Comp. Str. P61			Tensile Str. P62			Thermal Exp. P63	Modulus Elast. P64	Unit Wt. P65	Core Thick. P66 (ins.)	Air Cont. P68 %	Remarks
					14 Days	28 Days	365 Days	14 Days	28 Days	365 Days						
100260	CP126	606+45	6/15/95	3000	1710											Disregard
	CP130	601+05	6/15/95	Comp.	3090											
	CP127	606+35	6/15/95			3630										
	CP129	606+35	6/15/95			4030										
	CP131	601+05	6/15/95			3260										
	CP133	601+05	6/15/95													FHWA
	CP128	606+35	6/15/95													
	CP132	601+05	6/15/95													
	CP134	601+05	6/15/95													
100205	CP118	612+25	10/12/95	DEL DOT	4550											
	CP122	606+75	10/12/95	Type 'B'				505.11								
	CP119	612+25	10/12/95	±650		5270								8 55		
	CP121	612+25	10/12/95	PSI										8.70		
	CP123	606+75	10/12/95	with					436.96					8 45		
	CP125	606+75	10/12/95	NEWCEM										8.48		FHWA
	CP120	612+25	10/12/95													
	CP124	606+75	10/12/95													

TABLE 24 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
PCC & LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Date Placed	Type & Conc. Flex. Str.	Comp. Str. P61			Tensile Str. P62			Thermal Exp. P63	Modulus Elast. P64	Unit Wt. P65	Core Thick. P66 (ins.)	Air Cont. P68 %	Remarks
					14 Days	28 Days	365 Days	14 Days	28 Days	365 Days						
100201	CP110	622+25	10/12/95	DEL DOT	4710											
	CP114	616+75	10/12/95	Type 'B'				716.33								
	CP111	622+25	10/12/95	± 650		5050								8 44		
	CP113	622+25	10/12/95	PSI with												No core
	CP115	616+75	10/12/95	NEWCEM					437.07					8 14		
	CP117	616+75	10/12/95											8 30		
	CP112	622+25	10/12/95													
	CP116	616+75	10/12/95													
100209	CP102	629+25	10/12/95	DEL DOT	4180											
	CP106	623+75	10/12/95	Type 'B'				574.70								
	CP103	629+25	10/12/95	± 650		5020								8 83		
	CP105	629+25	10/12/95	PSI Reg.										8 64		
	CP107	623+75	10/12/95	Type 1					437.75					8 35		
	CP104	629+25	10/12/95	Cement												
	CP108	623+75	10/12/95	with												
	CP109	623+75	10/12/95	NEWCEM												
100211	CP93	636+25	6/28/95	DEL DOT	4520											
	CP97	630+75	6/28/95	Type 'B'	3980											
	CP94	636+25	6/28/95	± 650			3910									
	CP96	636+25	6/28/95	PSI									140 9 (41)			
	CP98	630+75	6/28/95	No					499							
	CP100	630+75	6/28/95	NEWCEM												FHWA
	CP95	636+25	6/28/95													
	CP99	630+75	6/28/95													

( ) Age, Days

TABLE 24 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
PCC & LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Date Placed	Type & Conc. Flex. Str.	Comp. Str. P61			Tensile Str. P62			Thermal Exp. P63	Modulus Elast. P64	Unit Wt. P65	Core Thick. P66 (ins.)	Air Cont. P68 %	Remarks
					14 Days	28 Days	365 Days	14 Days	28 Days	365 Days						
100203	CP85	644+25	6/28/95	DEL DOT	4150											
	CP89	638+75	6/28/95	Type 'B'	4830											
	CP86	644+25	6/28/95	±650		3880										
	CP88	644+25	6/28/95	PSI									139 1 (41)			
	CP90	638+75	6/28/95	no					600							
	CP87	644+25	6/28/95	NEWCEM												
	CP91	638+75	6/28/95													
	CP92	638+75	6/28/95													
100207	CP77	651+25	6/28/95	DEL DOT	3750											
	CP81	645+75	6/28/95	Type 'B'	4170											
	CP78	651+25	6/28/95	±650		4110										
	CP80	651+25	6/28/95	PSI									136 6 (41)			
	CP82	645+75	6/28/95	no					422							
	CP79	651+25	6/28/95	NEWCEM												
	CP83	645+75	6/28/95													
	CP84	645+75	6/28/95													
100206	CP69	658+00	11/21/95	900	4790 (16)									8.03		
	CP72	652+50	11/21/95	PSI				488 99 (16)						8 03		
	CP70	658+00	11/21/95	with		5600			521.11					8 63		
	CP73	652+50	11/21/95	NEWCEM										8 50		
	CP75	652+50	11/21/95											8 64		
	CP71	658+00	11/21/95													
	CP74	652+50	11/21/95													
	CP76	652+50	11/21/95													

( ) Age, Days

TABLE 24 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
PCC & LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Date Placed	Type & Conc. Flex. Str.	Comp. Str. P61			Tensile Str. P62			Thermal Exp. P63	Modulus Elast. P64	Unit Wt. P65	Core Thick. P66 (ins.)	Air Cont. P68 %	Remarks
					14 Days	28 Days	365 Days	14 Days	28 Days	365 Days						
100202	CP61	665+25	11/21/95	900	6410 (16)									8 04		
	CP65	659+75	11/21/95	PSI				492 48 (16)						8 08		
	CP62	665+25	11/21/95	with		6020								8 52		
	CP64	665+25	11/21/95	NEWCEM										8 50		
	CP66	659+75	11/21/95						501.96					8 62		
	CP63	665+25	11/21/95													
	CP67	659+75	11/21/95													
	CP68	659+75	11/21/95													
100210	CP52	673+75	6/29/95	900	4140											
	CP56	668+25	6/29/95	PSI	4210											
	CP53	673+75	6/29/95	no		4660										FHWA
	CP55	673+75	6/29/95	NEWCEM									143 4			
	CP57	668+25	6/29/95						597							
	CP54	673+75	6/29/95													
	CP58	668+25	6/29/95													
	CP59	668+25	6/29/95													
100212	CP44	687+25	7/17/95	900	5260											
	CP48	681+75	7/17/95	PSI				627								
	CP45	687+25	7/17/95	no		4690								11 50		
	CP47	687+25	7/17/95	NEWCEM								4,804,412 (72)		11 40		
	CP49	681+75	7/17/95						552 (33)					10 57		
	CP136	681+75	7/17/95											11.12	3.1	
	CP46	687+25	7/17/95													
	CP50	681+75	7/17/95													
	CP51	681+75	7/17/95													

( ) Age, Days

TABLE 24 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
PCC & LCB 4" OD Core Samples and Test Results

Test Section	Core No.	Station	Date Placed	Type & Conc. Flex. Str.	Comp. Str. P61			Tensile Str. P62			Thermal Exp. P63	Modulus Elast. P64	Unit Wt P65	Core Thick. P66 (ins.)	Air Cont. P68 %	Remarks
					14 Days	28 Days	365 Days	14 Days	28 Days	365 Days						
100208	CP35	694+25	7/18/95	900	3670											
	CP39	688+75	7/18/95	PSI				539								
	CP36	694+25	7/18/95	no		4640						4,718,570		11 61		
	CP38	694+25	7/18/95	NEWCEM										11 74		
	CP40	688+75	7/18/95						530					10 94		
	CP43	688+75	7/18/95											11 38		FHWA
	CP37	694+25	7/18/95													
	CP41	688+75	7/18/95													
	CP42	688+75	7/18/95													
100204	CP27	700+75	7/18/95	900	4710											
	CP31	695+25	7/18/95	PSI				578 (15)								
	CP28	700+75	7/18/95	no		4540								10 60		
	CP30	695+25	7/18/95	NEWCEM								4,491,812		10 10		
	CP32	695+25	7/18/95						519 (33)					10 42		
	CP29	700+75	7/18/95													
	CP33	695+25	7/18/95													
	CP34	695+25	7/18/95													
100259	CP19	707+75	7/20/95	3000	4440											
	CP23	702+25	7/20/95	Comp				557								
	CP20	707+75	7/20/95			4880								10 21	4 8	
	CP22	707+75	7/20/95									5,473,137 (69)		10 50		
	CP24	702+25	7/20/95						686 (33)					10 26		
	CP135	702+25	7/20/95													FHWA
	CP21	707+75	7/20/95													
	CP25	702+25	7/20/95													
	CP26	702+25	7/20/95													

( ) Age. Days

TABLE 24.1
DEL DOT SPS-2 US 113, MILFORD DE
4" OD PCC Cores sent to FHWA Laboratory
Coefficient of Thermal Expansion Test (P63)

Core No.	Test Section	Dates			Remarks
		Concrete Placed	Core Obtained	Core sent to FHWA	
CP43	100208	7/17/95	8/10/95	8/22/95	Core locations for Test P63 are shown in Table 12
CP100	100211	6/28/95	7/22/95	7/25/95	
CP133	100260	6/15/95	7/6/95	7/10/95	
CP135	100259	7/20/95	8/20/95	8/22/95	
CP125	100205	10/12/95	11/6/95	11/6/95	
CP53*	100210	6/29/95	7/22/95	8/2/95	

* Core CP70 for the P68 test (100206) was moved to CP53 (100210) because concrete pavement was under consideration for removal Core CP53 ended up for the P63 test inadvertently.

TABLE 25
DEL DOT SPS-2 US 113, MILFORD DE
Layer Thickness (ins.) - 5 Point Levels - 100200

Test Section	GABC		PATB		LCB		PCC		Total		Remarks
	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	
100259	8	7 89					10	10 20	18	18 1	
100204	6	6 24					11	11 04	17	17 3	
100208					6	6 00	11	12 00	17	18 0	
100212	4	3 72	4	3 72			11	12 40	19	19 8	
100210	4	4 32	4	3 84			8	8 30	16	16 5	
100202	6	6 48					8	8 76	14	15.2	Replaced PCC
100206					6	6 12	8	8 88	14	15 0	Replaced PCC
100207					6	6 84	11	11 34	17	18 3	
100203	6	6 12					11	11.74	17	17.9	
100211	4	3 84	4	3 72			11	11 75	19	19.3	
100209	4	3.36	4	4 75			8	8 22	16	16 3	Replaced PATB & PCC
100201	6	6 19					8	8 28	14	14 5	Replaced PCC
100205					6	5.52	8	9 12	14	14.6	Replaced PCC
100260	8	7.80					10	10.20	18	18.0	

TABLE 26
DEL DOT SPS-2 US 113, MILFORD DE
Comparison of LCB and PCC Thicknesses (ins.)
4" Cores, 5 Point Levels and Design

Test Section	LCB (6")		PCC			Remarks
	4" Cores	5 Pt. Levels	4" Cores	5 Pt. Levels	Design	
100259			10.75	10.20	10	
100204			10.47	11.04	11	
100208	5.99	6.00	11.08	12.00	11	
100212			11.71	12.40	11	
100210			8.02	8.30	8	
100202			8.45	8.76	8	Replaced PCC
100206	6.16	6.12	8.55	8.88	8	Replaced PCC
100207	6.05	6.84	11.42	11.34	11	
100203			11 55	11.74	11	
100211			11.14	11.75	11	
100209			8.51	8.22	8	Replaced PCC
100201			8.00	8.28	8	Replaced PCC
100205	6.06	5.52	8.59	9.12	8	Replaced PCC
100560			10.80	10.20	10	

TABLE 27
DEL DOT SPS-2 US 113, MILFORD DE
Concrete Mix Designs - Per Cubic Yard

Test Section	Type of Conc. & Flex Strength	Date Conc. Placed	Co. Agg. #57 ST Lbs.	Fine Agg. Lbs.	Cement Type		Water Gal.	W/C Ratio	Air %	Slmp (ins.)	Additives OZ./SK		Remarks
					LBS	SKS					AEA 90	WRA220N	
100205 100206 100207 100208	LCB	5/24/95 5/25/95 5/25/95 5/24/95	1600	1595	321 (L/A)	3 4	37 7	0 98	6 5 ± 2 5		0 8		
100260	3000 Comp	6/15/95	1899	1281	564 (L/A)	6	30.5	0 45	5 5			2	DEL DOT Type 'B' Concrete Mix
100205 100201	550 PSI and	6/16/95 and	1875	1470	400 (L/A)	4	30.0	0 63	6.5 ± 1 5	2	0.7	3 0	550 PSI Conc on these 3 sections
100209	+ 650 PSI	10/12/95	1812	1257	367 R 197 N	6	30 5	0 45	6 5			2	was replaced on 10/12/95
100211 100203 100207	3000 Comp + 650 PSI	6/28/95	1899	1281	564 (L/A)	6	30.5	0.45	5.5			2	same as 100260
100206 100202 100210	900 PSI	6/29/95	1838	1239	397 (L/A) 214 N	6 5	30.5	0 42	6 5 ± 1 5			3	100206, 100202 were replaced on 11/21/95 100210 remained
100206 100202	900 PSI	11/21/95	1945	1114	487 R 257 N	7.5	32.0	0.36	6.5 ± 1.5	2	1.9	2.5	35% NEWCEM

TABLE 27 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
Concrete Mix Designs - Per Cubic Yard

Test Section	Type of Conc. & Flex Strength	Date Conc. Placed	Co. Agg. #57 ST Lbs.	Fine Agg. Lbs.	Cement Type		Water Gal.	W/C Ratio	Air %	Slmp (ins.)	Additives OZ./SK		Remarks
					LBS	SKS					AEA 90	WRA220N	
Trial	900 PSI	7/7/95	1945	1114	735 L/A	7 5	32 0	0 36	6 5 ± 1 5	2	1 9	2 5	No NEWCEM
100212 100208 100204	900 PSI	7/17/95 and 7/18/95	1945	1114	735 L/A	7 5	32 0	0 36	6 5 ± 1 5	2	1 9	2 5	No NEWCEM
100259	3000 Comp ±650 PSI	7/20/95	1812	1257	367 R 197 N	6	30 5	0.45	6.5			2	35% NEWCEM also used on 100205, 100201 and 100209

Cement L/A - Low Alkali
R - Regular
N - NEWCEM (slag)

TABLE 27.1

CONCRETE MIX DESIGN

A:Milford Lean [6] LCB 05/23/95

CONTRACTOR :	Greggo and Ferrara Inc.
PROJECT :	DeDOT - Lean Concrete Base Course - Rt13
SOURCE OF CONCRETE :	W.C.I., Milford Plant
CONSTRUCTION TYPE :	Highway Paving, Sub-Base
PLACEMENT : :	Paving Machine

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

			YIELD, CU FT
Keystone - Type I, Low Alkali, LB	321		1.63
Miller Bros. - Sand, LB	1595		9.83
Arundel Corp. - #57 Stone, LB	1600		8.81
WATER, GAL-US (GAL-US)	37.7	(37.7)	5.04
AIR ENTRAINMENT, %	6.5	+/- 2.5	1.76
		TOTAL	27.08
M.B. - AE 90 (0.8/100), OZ-US	2.6		
WATER/CEMENT RATIO, LBS/LB	0.98		
SLUMP, IN	2.00		
CONCRETE UNIT WEIGHT, PCF	141.5		

Field Data: Slump 2.0	7 Day: 559		Cyl Broke on Monday
5-15-95 Air 6.2	590		5-22-95 8:30AM
TB6 C. Temp. 65			by DeDOT. Mix APPROVED
A. Temp. 70	AVG.: 575		

PREPARED BY :

C.J. Nolton, CCT, Quality Control

Note: used on Test Sections
100205
100206
100207
100208

TABLE 27.2

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
BUREAU OF MATERIALS AND RESEARCH

CONCRETE BATCH WEIGHTS
Used on Test Section 100260

Yield...1.0 C.Y. Class...B 501 SLIP-FORM
Date...10-20-94 Design Form...B-7
Furnished by...WYO CONC. IND. MILFORD

Portland Cement...KEYSTONE L/A Type...I
lbs... 564 Sacks... 6.0 bbls/C.Y...1.500

Fine Aggregate...MILLER BROS. HOUSTON S.G...2.60
SSD...1281 lbs.

2 %...1307 lbs.	4 %...1332 lbs.	6 %...1358 lbs.
3 %...1319 lbs.	5 %...1345 lbs.	7 %...1371 lbs.

Coarse Aggregate...ARUNDEL # 57 S.G...2.85
SSD...1899 lbs. 1 %...1919 lbs. 2 %...1938 lbs.

Total Water..30.5 gals. W/C Ratio...0.450 gals/Sack...5.08

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2 % FA-SSD CA...27.4 gals.	3 % FA-SSD CA...25.9 gals.
1 %CA...25.1 gals.	1 %CA...23.6 gals.
2 %CA...22.8 gals.	2 %CA...21.3 gals.
4 % FA-SSD CA...24.3 gals.	5 % FA-SSD CA...22.8 gals.
1 %CA...22.0 gals.	1 %CA...20.5 gals.
2 %CA...19.8 gals.	2 %CA...18.2 gals.
6 % FA-SSD CA...21.2 gals.	7 % FA-SSD CA...19.7 gals.
1 %CA...19.0 gals.	1 %CA...17.4 gals.
2 %CA...16.7 gals.	2 %CA...15.1 gals.

Sand/Stone Ratio...1:1.35 (42.5 - 57.5 %)

Air Entrainment... 5.5% as required.

2.0 oz/sack WRA Type A or D (E only if required by the Dept.)

Designed by...BILL BRODE

REMARKS: _____

LB-14 (8-89)

Note: used on Test Sections
100260 - June 15, 1995
100211 - June 28, 1995
100203 - June 28, 1995

TABLE 27.3

CONCRETE MIX DESIGN

A:Milford 550F1 [10] 550 PSI 05/23/95

CONTRACTOR :	Greggo and Ferrara Inc.
PROJECT :	DeDOT - S.H.R.P. Program - Route 13
SOURCE OF CONCRETE :	W.C.I., Milford Plant
CONSTRUCTION TYPE :	Highway Paving
PLACEMENT :	Paving Machine

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

			YIELD, CU FT
Keystone - Type I, Low Alkali, LB	400		2.04
Miller Bros. - Sand, LB	1470		9.06
Arundel Corp. - #57 Stone, LB	1875		10.33
WATER, GAL-US (GAL-US)	30.0	(30.0)	4.01
AIR ENTRAINMENT, %	6.5	+/- 1.5	1.77
		TOTAL	27.20
M.B. - Pozz. 220N (3.0/100), OZ-U	12.0		
M.B. - AE90 (0.7/100), OZ-US	2.8		
WATER/CEMENT RATIO, LBS/LB	0.63		
SLUMP, IN	2.00		
CONCRETE UNIT WEIGHT, PCF	146.9		

Design Approved on 5-10-95	TB1 520	TB2 529	TB3 463
Field Data: Slump 1.25" - 1.75"	487	530	530
Air 6.8 - 7.4, Conc. Temp. 64	539	523	501
Avg of Avg = 516	Avg 520	Avg 529	Avg 498

PREPARED BY :

C.J. Nolton, CCT, Quality Control

Note: used on Test Sections 100205, 100201 and 100209 on June 16, 1995. The concrete was later removed and replaced

TABLE 27.4

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
BUREAU OF MATERIALS AND RESEARCH

CONCRETE BATCH WEIGHTS

Yield...1.0 C.Y. Class...B-501 SLIP-FORM
Date....10-20-9 Design Form...B-7-35
Furnished by...WYOMING-MILFORD

Portland Cement...KEYSTONE Type...I
lbs... 367 Sacks... 6.0 * bbls/C.Y...1.500

Slag....NEWCEM Grade...120
lbs... 197 Percent Slag (by weight of cement)...35.0

Fine Aggregate...MILLER BROS. S.G...2.60
SSD...1257 lbs.

2 %...1282 lbs.	4 %...1307 lbs.	6 %...1333 lbs.
3 %...1295 lbs.	5 %...1320 lbs.	7 %...1345 lbs.

Coarse Aggregate...MD. MATERIALS # 57 S.G...2.77
SSD...1812 lbs. 1 %...1830 lbs. 2 %...1848 lbs.

Total Water..30.5 gals. W/C Ratio...0.450 gals/Sack...5.08

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2 % FA-SSD CA...27.4 gals.	3 % FA-SSD CA...25.9 gals.
1 %CA...25.3 gals.	1 %CA...23.8 gals.
2 %CA...23.1 gals.	2 %CA...21.6 gals.
4 % FA-SSD CA...24.4 gals.	5 % FA-SSD CA...22.9 gals.
1 %CA...22.3 gals.	1 %CA...20.7 gals.
2 %CA...20.1 gals.	2 %CA...18.6 gals.
6 % FA-SSD CA...21.4 gals.	7 % FA-SSD CA...19.9 gals.
1 %CA...19.2 gals.	1 %CA...17.7 gals.
2 %CA...17.1 gals.	2 %CA...15.6 gals.

Sand/Stone Ratio...1:1.35 (42.5 - 57.5 %)

Air Entrainment... 6.5% as required.

2.0 oz/sack WRA Type A or D (E only if required by the Dept.)

Designed by...BILL BRODE

REMARKS: _____

* a SACK as used here means 94 lbs of cementious material.

LB-14 (8-89)

Note: used on Test Section 100259 - July 20, 1995
and on 100205, 100201, 100209 - October 12, 1995

TABLE 27.5

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
BUREAU OF MATERIALS AND RESEARCH

CONCRETE BATCH WEIGHTS

Yield...1.0 C.Y. Class...B SLIP-FORM
Date...06-23-95 Design Form...900 FLEX SHRP
Furnished by...WYO. CONC. MILFORD

Portland Cement...KEYSTONE L/A Type...I
lbs... 397 Sacks... 6.5 * bbls/C.Y...1.625

Slag....NEWCEM Grade...120
lbs... 214 Percent Slag (by weight of cement)...35.0

Fine Aggregate...MILLER BROS. S.G...2.60
SSD...1239 lbs.

2 %...1265 lbs.	4 %...1289 lbs.	6 %...1314 lbs.
3 %...1277 lbs.	5 %...1302 lbs.	7 %...1327 lbs.

Coarse Aggregate...ARUNDEL # 57 S.G...2.85
SSD...1838 lbs. 1 %...1857 lbs. 2 %...1876 lbs.

Total Water..30.5 gals. W/C Ratio...0.416 gals/Sack...4.69

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2 % FA-SSD CA...27.5 gals.	3 % FA-SSD CA...26.0 gals.
1 %CA...25.3 gals.	1 %CA...23.8 gals.
2 %CA...23.1 gals.	2 %CA...21.6 gals.
4 % FA-SSD CA...24.6 gals.	5 % FA-SSD CA...23.1 gals.
1 %CA...22.4 gals.	1 %CA...20.9 gals.
2 %CA...20.1 gals.	2 %CA...18.7 gals.
6 % FA-SSD CA...21.6 gals.	7 % FA-SSD CA...20.1 gals.
1 %CA...19.4 gals.	1 %CA...17.9 gals.
2 %CA...17.2 gals.	2 %CA...15.7 gals.

Sand/Stone Ratio...1:1.35 (42.5 - 57.5 %)

Air Entrainment... 6.5% as required.

3.0 oz/sack WRA Type A or D (E only if required by the Dept.)

Designed by...BILL BRODE

REMARKS: _____

_____

_____

*** a SACK as used here means 94 lbs of cementious material.**

LB-14 (8-89)

Note: This mix was used on 100206, 100202 and 100210 - June 29, 1995. The concrete in 100206 and 100202 was later removed and replaced. 100210 remained

TABLE 27.6

CONCRETE MIX DESIGN

A:Milford 900F1 [5] 900 PSI 05/23/95

CONTRACTOR : Greggo and Ferrara Inc.
PROJECT : DeDOT - Route 13 S.H.R.P. Program
SOURCE OF CONCRETE : W.C.I., Milford Plant
CONSTRUCTION TYPE : Highway Paving
PLACEMENT : Paving Machine

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

			YIELD, CU FT
Keystone - Type I, Regular (478), NEWCEM (257)	735		3.74
Miller Bros. - Sand, LB	1114		6.87
Arundel Corp. - #57 Stone, LB	1945		11.29
WATER, GAL-US (GAL-US)	32.0	(32.0)	4.28
AIR ENTRAINMENT, %	6.5	+/- 1.5	1.82
		TOTAL	28.00
M.B. - Pozz. 220N (2.5/100), OZ-U	18.4		
M.B. - MB-AE 90 (1.9/100), OZ-US	14.0		
WATER/CEMENT RATIO, LBS/LB	0.36		
SLUMP, IN	2.00		
CONCRETE UNIT WEIGHT, PCF	145.0		

Design Approved on 5-22-95	TB1 867	TB2 871	TB3 842
Field Data: Slump 1.5"-1.75"	787	844	818
Air 5.5-6.4, Conc. Temp. 65	808	898	925
Avg of Avg = 851	Avg 820	Avg 871	Avg 862

PREPARED BY :

C.J. Nolton, CCT, Quality Control

Note: used on Test Sections 100206, 100202 - November 21, 1995

TABLE 27.7

CONCRETE MIX DESIGN

A:Milford 900F1 [5] 900 PSI 05/23/95

CONTRACTOR :	Greggo and Ferrara Inc.
PROJECT :	DeDOT - Route 13 S.H.R.P. Program
SOURCE OF CONCRETE :	W.C.I., Milford Plant
CONSTRUCTION TYPE :	Highway Paving
PLACEMENT :	Paving Machine

WEIGHTS PER CUBIC YARD (SATURATED, SURFACE-DRY)

		YIELD, CU FT
Keystone - Type I, Low Alkali, LB	735	3.74
Miller Bros. - Sand, LB	1114	6.87
Arundel Corp. - #57 Stone, LB	1945	11.29
WATER, GAL-US (GAL-US)	32.0 (32.0)	4.28
AIR ENTRAINMENT, %	6.5 +/- 1.5	1.82
	TOTAL	28.00
M.B. - Pozz. 220N (2.5/100), OZ-U	18.4	
M.B. - MB-AE 90 (1.9/100), OZ-US	14.0	
WATER/CEMENT RATIO, LBS/LB	0.36	
SLUMP, IN	2.00	
CONCRETE UNIT WEIGHT, PCF	145.0	

Design Approved on 5-22-95	TB1 867	TB2 871	TB3 842
Field Data: Slump 1.5"-1.75"	787	844	818
Air 5.5-6.4,Conc.Temp. 65	808	898	925
Avg of Avg = 851	Avg 820	Avg 871	Avg 862

PREPARED BY :

C.J. Nolton, CCT, Quality Control

Note: used on Trial Section on July 7 and on 100212, 100208 and 100204 on July 17-18, 1995

TABLE 28
DEL DOT SPS-2 US 113, MILFORD DE
4" Edge Drain and 6" Outlet Locations

Test Section	Stations	Date of Installation	6" - Outlet		
			Station	Inside	Outside
100260	601+20 - 606+20	10/19/94	603+00	yes	yes
100209	424+00 - 429+00	4/18/95	626+12	yes	yes
			629+75	yes	yes
100211	631+00 - 636+00	4/18/95	635+25	yes	yes
100210	668+50 - 673+50	5/8/95	669+98	yes	yes
			672+95	yes	yes
100212	682+00 - 687+00	4/27/95	676+20	yes	yes
			678+03	yes	yes
			682+05	yes	yes
			685+00	yes	yes
100259	702+50 - 707+50	4/19/95	704+05	yes	yes
			707+03	yes	yes

TABLE 29

STYLE-4552

We wish to advise that **Amoco Style 4552** meets the following minimum roll averages:

Property	Test Method	Minimum Roll Average Value
Grab Tensile, lbs	ASTM-D-4632	180
Grab Elongation, %	ASTM-D-4632	50
Mullen Burst, psi	ASTM-D-3786	350
Puncture, lbs	ASTM-D-4833	105
Trapezoidal Tear, lbs	ASTM-D-4533	70
UV Resistance, %SR/hrs	ASTM-D-4355	70/500
AOS, US Sieve #	ASTM-D-4751	100
Permittivity, 1/sec	ASTM-D-4491	1.5
gal/min/ft^2		105

Amoco Fabrics and Fibers Company purchased Phillips Fibers Corporation in October, 1993. Amoco Fabrics and Fibers Company manufactures Style 4552 in the USA. Style 4552 is the equivalent to Phillips 7NP (L17007).

The values listed are a result of testing conducted in on-site laboratories. A letter certifying the minimum average roll values will be issued from the manufacturing plant by the Quality Control Manager at the time shipment is made.

DATE ISSUED: 05/12/95

TABLE 30
DEL DOT SPS-2 US 113, MILFORD DE
Asphalt Plant Inspectors Daily Report - PATB

Sieve Size	Gradation JM Tolerance % Passing	Test Sections and Dates		
		100210, 100211, 100212 - June 5, 1995		100209 - Sept. 19, 1995
		Extractions	Bin & Belt Cuts	Extraction
1-1/2	100	100	100	100
1	95-100	100	99.4	95.3
1/2	25-60	41.6	41.2	32.2
#4	0-10	3.6	3.8	1.0
#8	0-5	2.4	1.9	0.2
#200	0-2	1.6	1.0	1.0
% AC	2-2.5	2.25		2.10
Type AC		AC20		AC20

Source AC - Sun Marketing, Philadelphia, PA

Aggregate - #57 Stone, Downington, PA

Plant - Tilcon #4, Horse Pond Road

TABLE 31
DEL DOT SPS-2 US 113, MILFORD DE
Concrete Repairs - Patches and Slabs

Patch No.	Test Section		Repair Locations		Length	Repair Dates 1996			Remarks
	No.	Stations	From	To	Ft.	Saw	Remove	Pour	
1	100205	607+00 - 612+00	607+09 0	607+26 0	17 0	4/4	4/5	4/18	Stations
2	LCB Base		607+76 3	607+86 1	9 8	4/4	4/5	4/18	including transitions
3			607+95 7	608+03 3	7 8	4/4	4/5	4/18	606+24 - 614+00
4			608+29 2	608+38 9	9 6	4/4	4/5	4/18	
5			608+57 1	608+63 1	6 0	4/4	4/5	4/18	Test Section
6			609+47 2	609+53 2	6 0	4/4	4/5	4/18	2 slabs - 881 sq ft
7			609+62 1	609+68 1	6 0	4/4	4/5	4/18	15 patches - 2724 sq ft
8			609+92 1	609+98 2	6 0	4/4	4/5	4/18	
9			610+07 1	610+13 1	6 0	4/4	4/5	4/18	
10			610+22 2	610+28 2	6 0	4/4	4/5	4/18	Transition
11			610+61 9	610+71 1	9 2	4/5	4/6	4/18	4 patches - 576 sq ft
12			610+96 8	611+02 8	6 0	4/5	4/6	4/18	
13			611+11 5	611+17 5	6 0	4/5	4/8	4/18	
14			611+28 6	611+45.7	17 1	4/5	4/5	4/18	
15			611+56 6	611+62.6	6 0	4/5	4/6	4/18	
16			611+71 7	611+77 7	6 0	4/5	4/6	4/18	
17			611+88 6	612+08 3	19 7	4/5	4/6	4/18	
18			612+17 3	612+23 3	6 0	4/5	4/8	4/18	
19			612+47 2	612+53 2	6 0	4/5	4/6	4/19	
20			612+87 1	612+93 1	6 0	4/5	4/6	4/19	
21			613+07 1	612+13.1	6.0	4/5	4/6	4/19	
					T=150.2				

TABLE 31 (Cont.)
DEL DOT SPS-2 US 113, MILFORD DE
Concrete Repairs - Patches and Slabs

Patch	Test Section		Repair Locations		Length	Repair Dates 1996			Remarks
No.	No.	Stations	From	To	Ft.	Saw	Remove	Pour	
22	100201	617+00 - 622+00	614+67 8	614+73 8	6 0	4/5	4/6	4/19	Stations including
23	GABC Base		615+07 6	615+13 7	6 1	4/5	4/6	4/19	transitions
24			615+87 7	615+93 7	6.0	4/5	4/6	4/19	614+00 - 623+25
25			616+27 6	616+33 6	6 0	4/5	4/8	4/19	
26			616+76 7	616+83 7	7.0	4/5	4/8	4/19	Test Section
27			617+37 6	617+43 6	6 0	4/6	4/13	4/19	6 patches - 874 sq ft
28			617+52 6	617+58 7	6 1	4/6	4/13	4/19	
29			617+82 6	617+88 7	6 1	4/8	4/16	4/19	Transitions
30			618+12 7	618+18 6	6.1	4/8	4/16	4/19	5 patches - 890 sq ft
31			618+42 6	618+48 6	6 0	4/8	4/17	4/19	
32			619+62 4	619+68 5	6.1	4/8	4/17	4/19	
33			622+87 0	622+93.0	6.0	4/8	4/17	4/19	
					T=73 5				
34	100209	624+00 - 629+00	623+46 8	623+52.8	6.0	4/8	4/17	4/19	Stations including
35	PATB Base		623+92 1	623+98 1	6.0	4/8	4/17	4/19	transitions
36			624+52 2	624+58 2	6 0	4/8	4/17	4/19	623+25 - 629+75
37			624+97 0	625+03 0	6.0	4/8	4/17	4/19	Test Section
38			626+77 0	626+83 0	6 0	4/8	4/17	4/19	3 patches - 432 sq ft
					T=30				Transition
									2 patches - 288 sq. ft.

TABLE 32

STATE OF DELAWARE
DEPARTMENT OF TRANSPORTATION
BUREAU OF MATERIALS AND RESEARCH

CONCRETE BATCH WEIGHTS

Yield...1.0 C.Y. Class... B
Date...1-18-96 Design Form...B-3-35
Furnished by...WYOMING-LONGPOINT

Portland Cement... KEYSTONE Type...I
lbs... 367 Sacks... 6.0 * bbls/C.Y...1.500

Slag....NEWCEM Grade...120
lbs... 197 Percent Slag (by weight of cement)...35.0

Fine Aggregate...TILCON/TARBURTON S.G...2.60
SSD...1200 lbs.

2 %...1225 lbs.	4 %...1249 lbs.	6 %...1273 lbs.
3 %...1237 lbs.	5 %...1261 lbs.	7 %...1285 lbs.

Coarse Aggregate...MD. MATERIALS # 57 S.G...2.85
SSD...1974 lbs. 1 %...1994 lbs. 2 %...2014 lbs.

Total Water..30.5 gals. W/C Ratio...0.450 gals/Sack...5.08

---

2 % FA-SSD CA...27.6 gals.	3 % FA-SSD CA...26.1 gals.
1 %CA...25.2 gals.	1 %CA...23.8 gals.
2 %CA...22.8 gals.	2 %CA...21.4 gals.
4 % FA-SSD CA...24.7 gals.	5 % FA-SSD CA...23.3 gals.
1 %CA...22.3 gals.	1 %CA...20.9 gals.
2 %CA...20.0 gals.	2 %CA...18.5 gals.
6 % FA-SSD CA...21.8 gals.	7 % FA-SSD CA...20.4 gals.
1 %CA...19.4 gals.	1 %CA...18.0 gals.
2 %CA...17.1 gals.	2 %CA...15.6 gals.

Sand/Stone Ratio...1:1.50 (40.0 - 60.0 %)

Air Entrainment... 5.5% as required.

2.0 oz/sack WRA Type A or D (E only if required by the Dept.)

Designed by...BILL BRODE

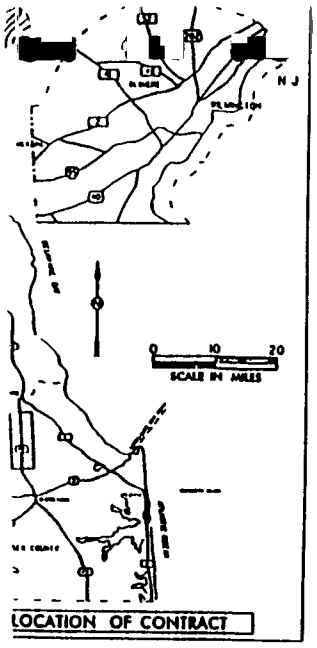
REMARKS: _____

_____

_____

* a SACK as used here means 94 lbs of cementious material

LB-14 (8-89)



COPY

DEPARTMENT OF TRANSPORTATION

FINAL PLAN

DATE JUN 16 1993

SPECIFICATION AND CONSTRUCTION PLANS FOR

U.S. 113

S224 TO MILFORD

CONTRACT NUMBER 88-013-04

FEDERAL AID PROJECT NUMBER NH-S113 (2)

ROADWAY LENGTH 21241 FEET= 4.023 MILES

STRUCTURE LENGTH 20 FEET= 0.0037 MILES

TOTAL LENGTH 21261 FEET= 4.027 MILES

NOTE: RIGHT OF WAY ACQUISITION UNDER CONTRACT 88-013-02

DESIGNATION

ADT CURRENT 10,700

ADT PROJECTED 17,300 (2008)

ADT PROJECTED 16,400 (2028)

DESIGN SPEED 50 MPH

% TRUCKS 11

DIRECTION DISTRIBUTION % 53

CLEAR ZONE ON 24 AND 36

SCALES

PLAN SHEET 1" = 200'

PROFILE SHEETS

Horizontal 1" = 20'

Vertical 1" = 5'

DETAIL SHEETS 1" = ___'

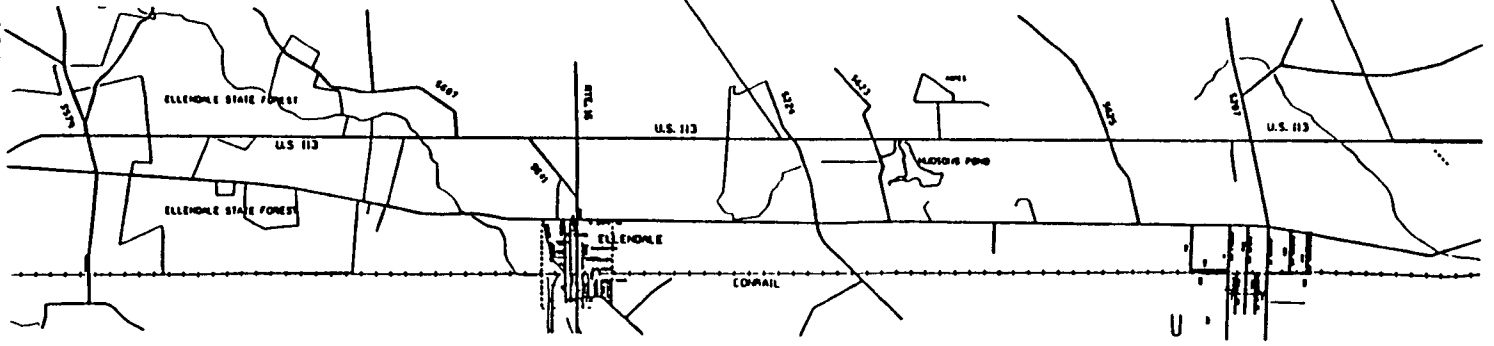
* AS SHOWN

INDEX OF SHEETS

SHEET No.	TABLE OF CONTENTS
1	TITLE SHEET
2	GENERAL NOTES AND PLAN LEGEND
3	PROJECT NOTES
4 - 9	QUANTITY SHEETS
10 - 11	TYPICAL SECTIONS
12	SHOP 1(S1 SECTION SCHEMATIC
13 - 16	SHOP TYPICAL SECTIONS
17 - 39	PLAN SHEETS
40 - 49	PROFILE SHEETS
50 - 57	GRADES AND GEOMETRICS SHEETS
58	CONSTRUCTION POINT NUMBERS
59	SCHEDULES
59 - 65	DETAILS
66 - 70	MAINTENANCE OF TRAFFIC
71 - 78	EROSION AND SEDIMENT CONTROL
79 - 82	BRIDGE SHEETS
83 - 105	SIGNING STRIPING COORDINATION PLANS
106	SIGNAL PLANS
107 - 108	TRAFFIC STANDARDS
109	DETOURS
110 - 114	ESMRIDGE BORROW SITE PLANS
115 - 121	SOIL BORING DATA
	STANDARDS: C2 C3 D1L D86 D23 D36 G29 G35 G47, G8
MILEPOST	29.21 to 33.31

BEGIN CONTRACT 88-013-04
STA. 550+00

END CONTRACT 88-013-04
STA 762+63



UTILITIES

DST	DIAMOND STATE TELEPHONE
DEC	DELAWARE ELECTRIC COOPERATIV
CME	CITY OF MILFORD ELECTRIC
SCC	STONER CABLE ••••ABANDONED IN PLACE••••
DP&L	DELMARVA POWER ELEC.
UG	UNDERGROUND INSTALLATION

DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

DIVISION ADMINISTRATOR

APPROVED _____ 19 ____

DEPARTMENT OF TRANSPORTATION

ED

ENGINEER

19 93

SEAL

RECOMMENDED

STORMWATER ENGINEER

RECOMMENDED 4/20 19 93

SEAL

RECOMMENDED

ROAD DESIGN ENGINEER

RECOMMENDED 4/21 19 93

SEAL

RECOMMENDED

BRIDGE ENGINEER

RECOMMENDED 4.21. 19 93

SEAL

RECOMMENDED

DESIGN ENGINEER

RECOMMENDED 4/21 19 93

SEAL

APPROVED

CHIEF ENGINEER

APPROVED April 21 19 93

SEAL

Figure 1

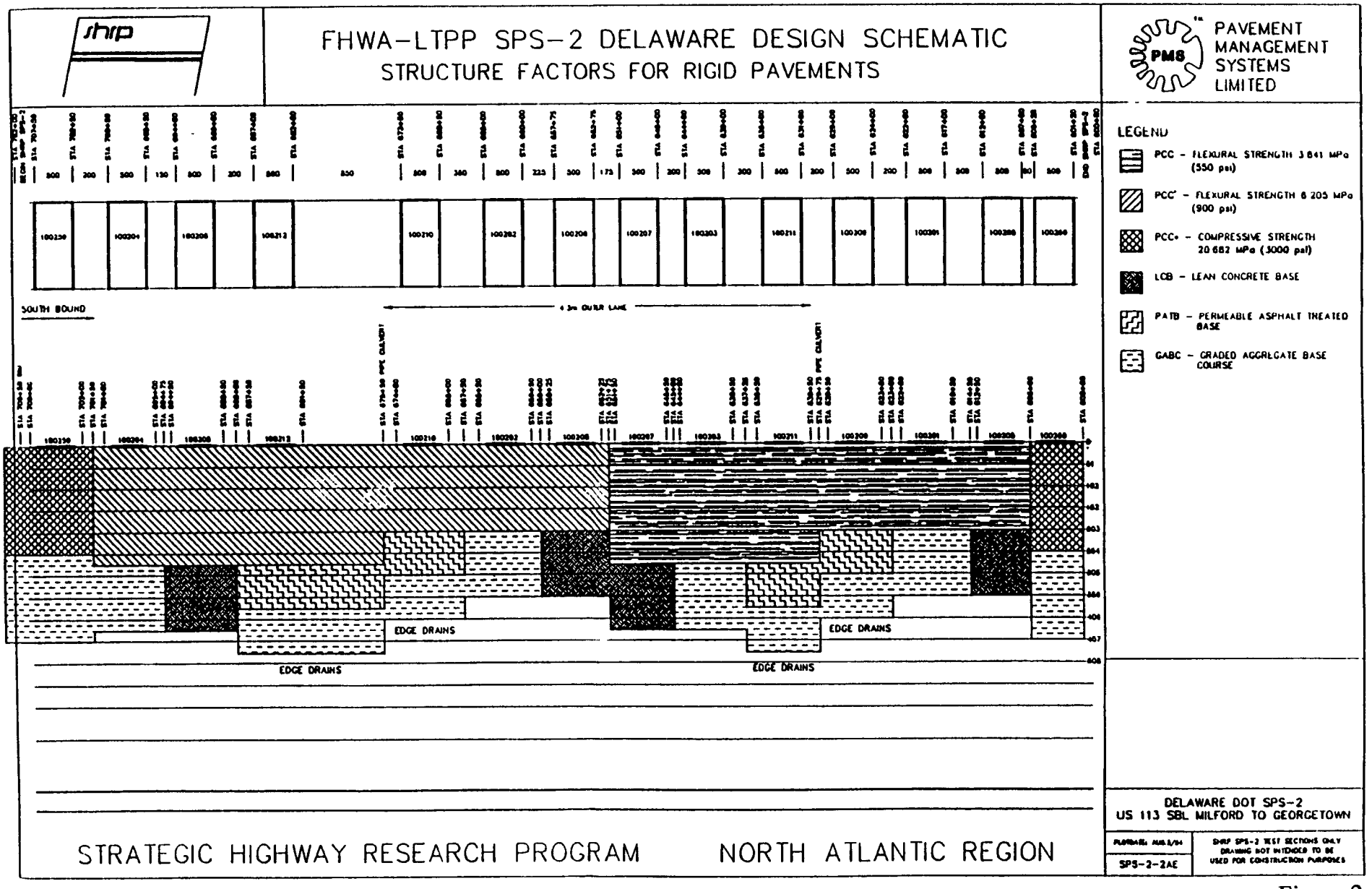
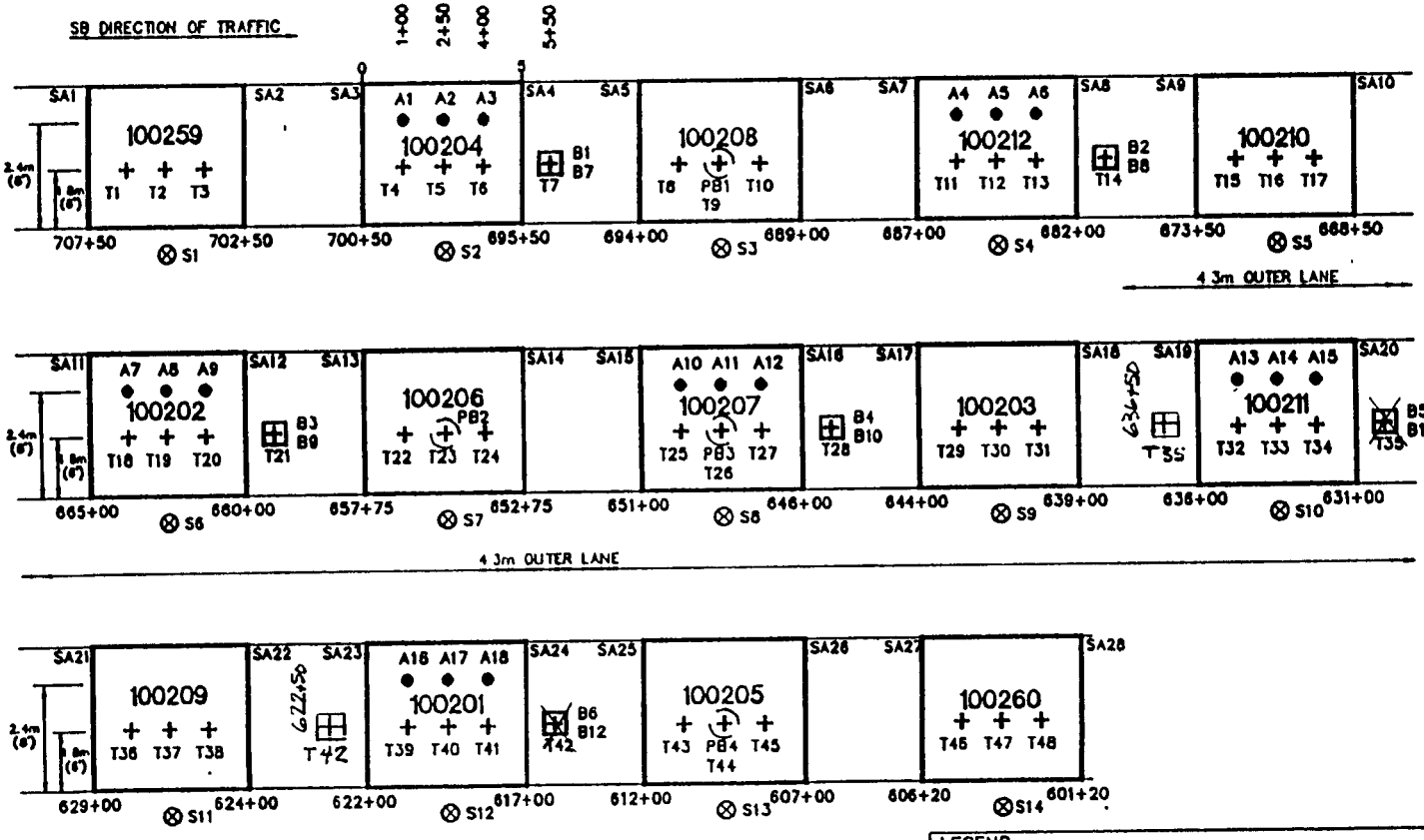

shrp
FHWA–LTPP SPS–2 DELAWARE DESIGN SCHEMATIC
STRUCTURE FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
LEGEND
PCC – FLEXURAL STRENGTH 3.841 MPa (550 psi)
PCC' – FLEXURAL STRENGTH 6.205 MPa (900 psi)
PCC* – COMPRESSIVE STRENGTH 20.682 MPa (3000 psi)
LCB – LEAN CONCRETE BASE
PATB – PERMEABLE ASPHALT TREATED BASE
GABC – GRADED AGGREGATE BASE COURSE
SOUTH BOUND
4.3m OUTER LANE
EDGE DRAINS
EDGE DRAINS
EDGE DRAINS
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN
SPS–2–2AE
SHRP SPS–2 TEST SECTIONS ONLY
DRAWING NOT INTENDED TO BE USED FOR CONSTRUCTION PURPOSES
STRATEGIC HIGHWAY RESEARCH PROGRAM
NORTH ATLANTIC REGION

Figure 2

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED

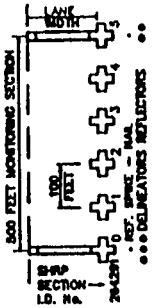
SB DIRECTION OF TRAFFIC



LEGEND

- ⊞ 0.5m–0.9m BULK EMBANKMENT SAMPLE TO 0.3m DEPTH (B1–B6) AND BULK SUBGRADE SAMPLE FROM 0.3m–0.6m BELOW TOP OF EMBANKMENT (B7–B12)
- ● SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF EMBANKMENT (A1–A18)
- \+ LOCATION OF NUCLEAR MOISTURE/DENSITY TESTS (T1–T48)
- ⊗ SHOULDER PROBE (S1–S14)
- (+) PLATE LOAD BEARING TEST (PB1–PB4)

TYPICAL SITE SIGNING & MARKING



FIELD MATERIALS SAMPLING AND TESTING
SUBGRADE/EMBANKMENT- LAYERS 1 and 2

DELAWARE DOT SPS-2
US 113 SBL MILFORD TO GEORGETOWN

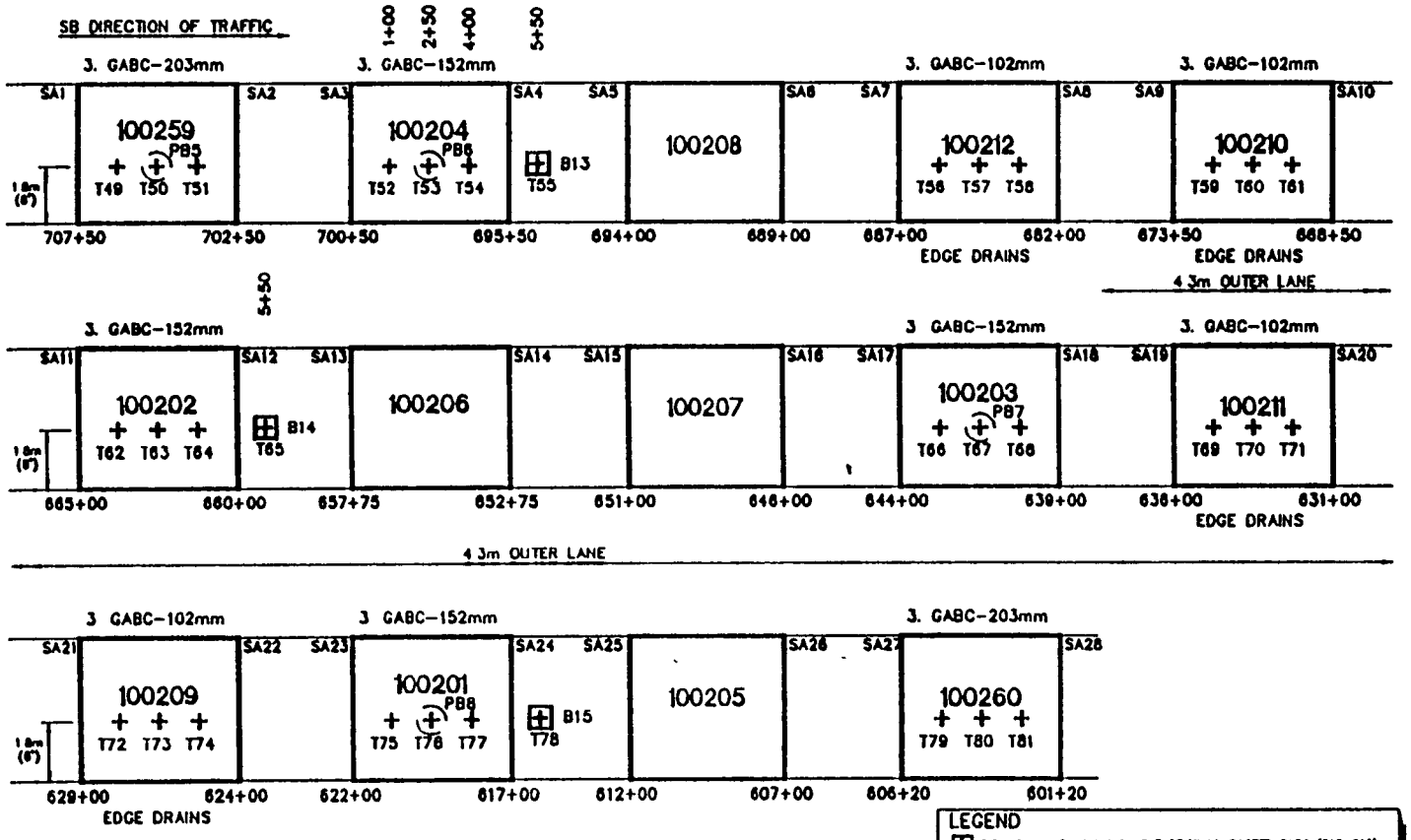
PLOTTED: JULY 16/94 | FHWA SPS-2 TEST SECTIONS ONLY
SPS-2-2 | DIMENSIONAL DETAILS ONLY DRAWING NOT TO SCALE

Figure 3

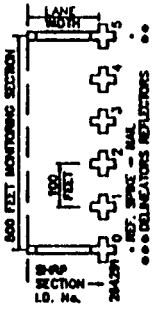
shrp

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED



TYPICAL SITE SIGNING & MARKING



FIELD MATERIALS SAMPLING AND TESTING - GRADED AGGREGATE BASE COURSE - LAYER 3

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

SPS-2-3

FHWA SPS-2 TEST SECTIONS ONLY DIMENSIONAL DETAILS ONLY DRAWING NOT TO SCALE

Figure 4

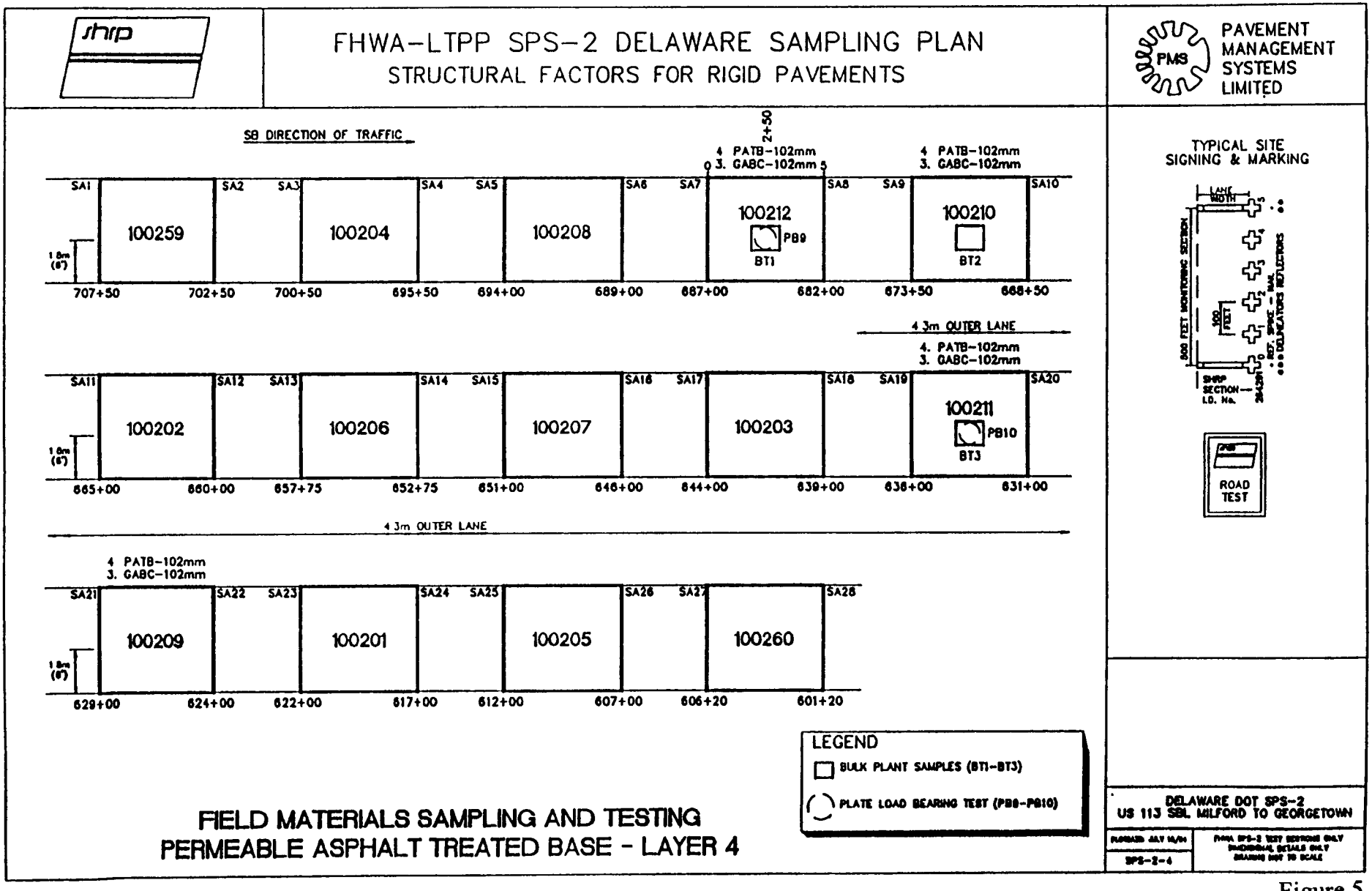
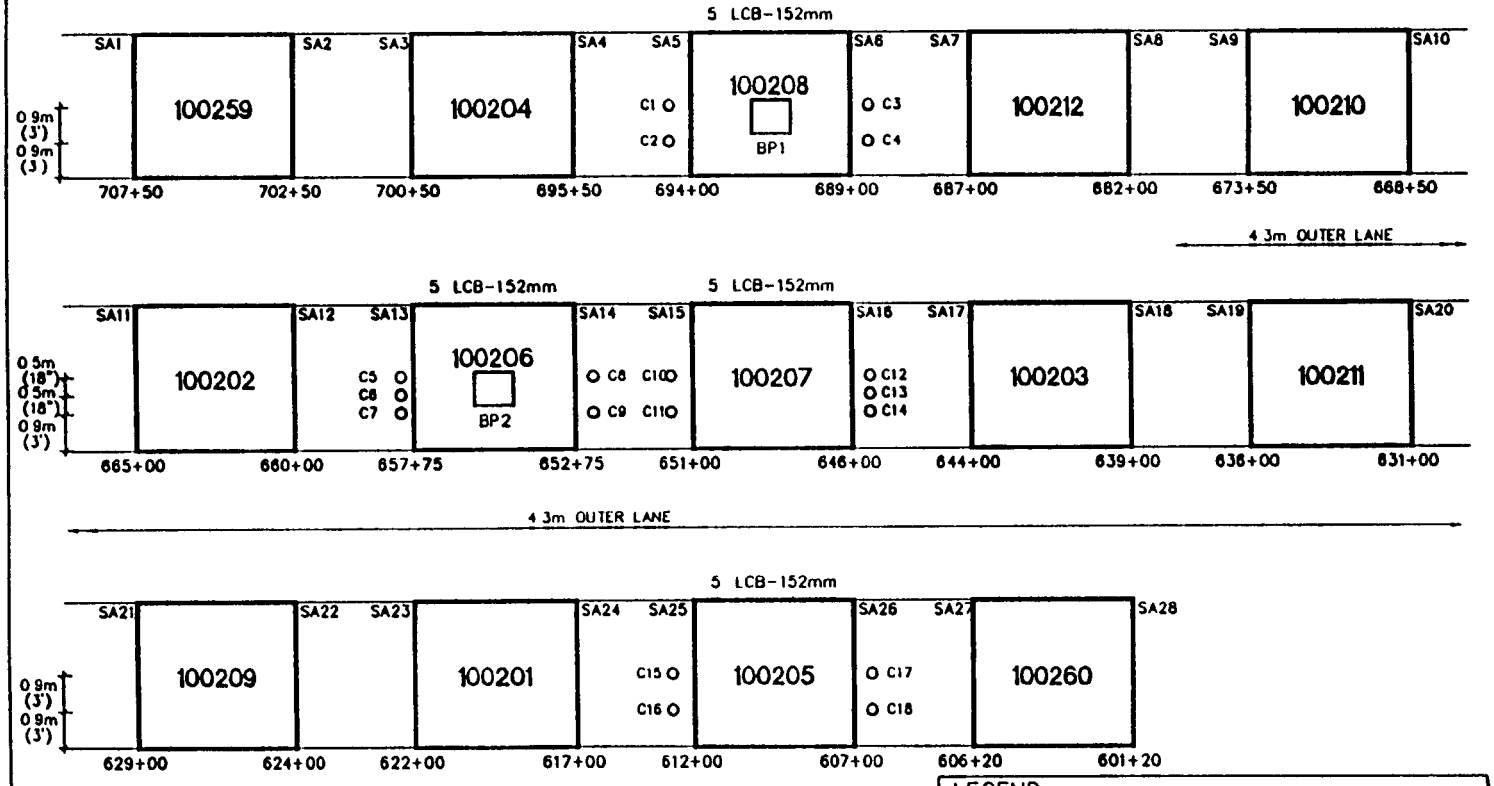

shrp
FHWA-LTPP SPS-2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
2+50
4 PATB-102mm
3. GABC-102mm
4 PATB-102mm
3. GABC-102mm
SA1 SA2 SA3 SA4 SA5 SA6 SA7 SA8 SA9 SA10
100259
100204
100208
100212
PB9
BT1
100210
BT2
1.8m (6')
707+50 702+50 700+50 695+50 694+00 689+00 687+00 682+00 673+50 668+50
4.3m OUTER LANE
4. PATB-102mm
3. GABC-102mm
SA11 SA12 SA13 SA14 SA15 SA16 SA17 SA18 SA19 SA20
100202
100206
100207
100203
100211
PB10
BT3
1.8m (6')
665+00 660+00 657+75 652+75 651+00 646+00 644+00 639+00 636+00 631+00
4.3m OUTER LANE
4 PATB-102mm
3. GABC-102mm
SA21 SA22 SA23 SA24 SA25 SA26 SA27 SA28
100209
100201
100205
100260
1.8m (6')
629+00 624+00 622+00 617+00 612+00 607+00 606+20 601+20
LEGEND
BULK PLANT SAMPLES (BT1-BT3)
PLATE LOAD BEARING TEST (PB9-PB10)
FIELD MATERIALS SAMPLING AND TESTING
PERMEABLE ASPHALT TREATED BASE - LAYER 4
TYPICAL SITE SIGNING & MARKING
LANE WIDTH
500 FEET MONITORING SECTION
100 FEET
SHRP SECTION — L.O. No.
ROAD TEST
DELAWARE DOT SPS-2
US 113 SBL MILFORD TO GEORGETOWN
SPS-2-4

Figure 5

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED

SB DIRECTION OF TRAFFIC

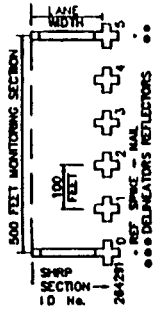


LEGEND

- ☐ BULK SAMPLES OF LCB AS-DELIVERED (BP1–BP2) (CAST 6–152mm DIAx305mm CYCLINDERS FROM EACH BULK SAMPLE)
- ○ 102mm OD CORE OF LCB TAKEN 7–12 DAYS AFTER PLACEMENT AND HOLES PATCHED PRIOR TO PLACEMENT OF PCC (C1–C18)

FIELD MATERIALS SAMPLING AND TESTING - LEAN CONCRETE BASE - LAYER 5

TYPICAL SITE SIGNING & MARKING



ROAD TEST

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

PLOTTED JUNE 13/96 | FHWA SPS–2 TEST SECTIONS ONLY DIMENSIONAL DETAILS ONLY DRAWING NOT TO SCALE

SPS–2–5

Figure 6

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED

SB DIRECTION OF TRAFFIC

SA1	SA2 SA3	SA4 SA5	SA6 SA7	SA8 SA9	SA10
6 PCC*–254mm 3 GABC–203mm	6 PCC'–279mm 3 GABC–152mm	6 PCC –279mm 5 LCB–152mm	6 PCC'–279mm 4 PATB–102mm 3 GABC–102mm		6 PCC'–203mm 4 PATB–102mm 3 GABC–102mm
0.5m (18") C19 O 0.5m (18") C20 O 0.5m (18") C21 O 0.5m (18") C22 O 0.9m (3')	O C23 O C24 O C25 C27 O O C26 C28 O O C135 C29 O	O C30 O C31 C35 ● O C32 C36 ● O C33 C37 ● O C34 C38 ●	● C39 ● C40 C44 O ● C41 C45 O ● C42 C46 O ● C43 C47 O	O C48 O C49 C52 O O C50 C53 O O C51 C54 O O C136 C55 O	O C56 O C57 O C58 O C59
FC1 100259	100204	FC2 100208	FC3 100212	100210	
707+50 702+50	700+50 695+50	694+00 689+00	687+00 682+00	673+50 668+50	

4.3m OUTER LANE

SA11	SA12 SA13	SA14 SA15	SA16 SA17	SA18 SA19	SA20
6 PCC'–203mm 3 GABC–152mm	6 PCC'–203mm 5 LCB–152mm	6 PCC–279mm 5 LCB–152mm	6 PCC–279mm 3 GABC–152mm		6 PCC–279mm 4 PATB–102mm 3 GABC–102mm
0.5m (18") C61 O 0.5m (18") C62 O 0.5m (18") C63 O 0.5m (18") C64 O 0.9m (3')	O C65 O C66 C69 ● O C67 C70 ● O C68 C71 ●	● C72 ● C73 C77 ● ● C74 C78 ● ● C75 C79 ● ● C76 C80 ●	● C81 C85 O ● C82 C86 O ● C83 C87 O ● C84 C88 O	O C89 C93 O O C90 C94 O O C91 C95 O O C92 C96 O	O C97 O C98 O C99 O C100
FC4 100202	100206	FC5 100207	100203	FC6 100211	
665+00 660+00	657+75 652+75	651+00 646+00	644+00 639+00	636+00 631+00	

4.3m OUTER LANE

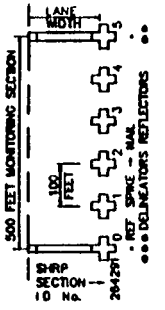
SA21	SA22 SA23	SA24 SA25	SA26 SA27	SA28
6 PCC–203mm 4 PATB–102mm 3 GABC–102mm	6 PCC–203mm 3 GABC–152mm	6 PCC–203mm 5 LCB–152mm	6 PCC*–254mm 3 GABC–203mm	
0.5m (18") C102 O 0.5m (18") C103 O 0.5m (18") C104 O 0.5m (18") C105 O 0.9m (3')	O C106 C110 O O C107 C111 O O C108 C112 O O C109 C113 O	O C114 C118 ● O C115 C119 ● O C116 C120 ● O C117 C121 ●	● C122 C126 O ● C123 C127 O ● C124 C128 O ● C125 C129 O	O C130 O C131 O C132 O C133 O C134
100209	100201	FC7 100205	FC8 100260	
629+00 624+00	622+00 617+00	612+00 607+00	606+20 601+20	

LEGEND

- O 102mm OD CORES OF PCC SURFACE ONLY (C19–C34,C44–C68,C85–C117 C126–C136)
- ● 102mm OD CORES OF PCC SURFACE AND LCB (C35–C43,C69–C84,C118–C125)
- □ BULK SAMPLES OF FRESH AS–DELIVERED PCC (FC1–FC8)
  (CAST 6–152mm DIA.x305mm CYLINDERS AND 3–152mmx152mmx508mm BEAMS FOR EACH SAMPLE)

PCC – FLEXURAL STRENGTH – 3.861 MPa (550psi)
PCC' – FLEXURAL STRENGTH – 6.205 MPa (900psi)
PCC* – COMPRESSIVE STRENGTH – 20.682 MPa (3000psi)

TYPICAL SITE SIGNING & MARKING



FIELD MATERIALS SAMPLING AND TESTING
PORTLAND CEMENT CONCRETE – LAYER 6

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

SPS–2–1

FHWA SPS–2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 7

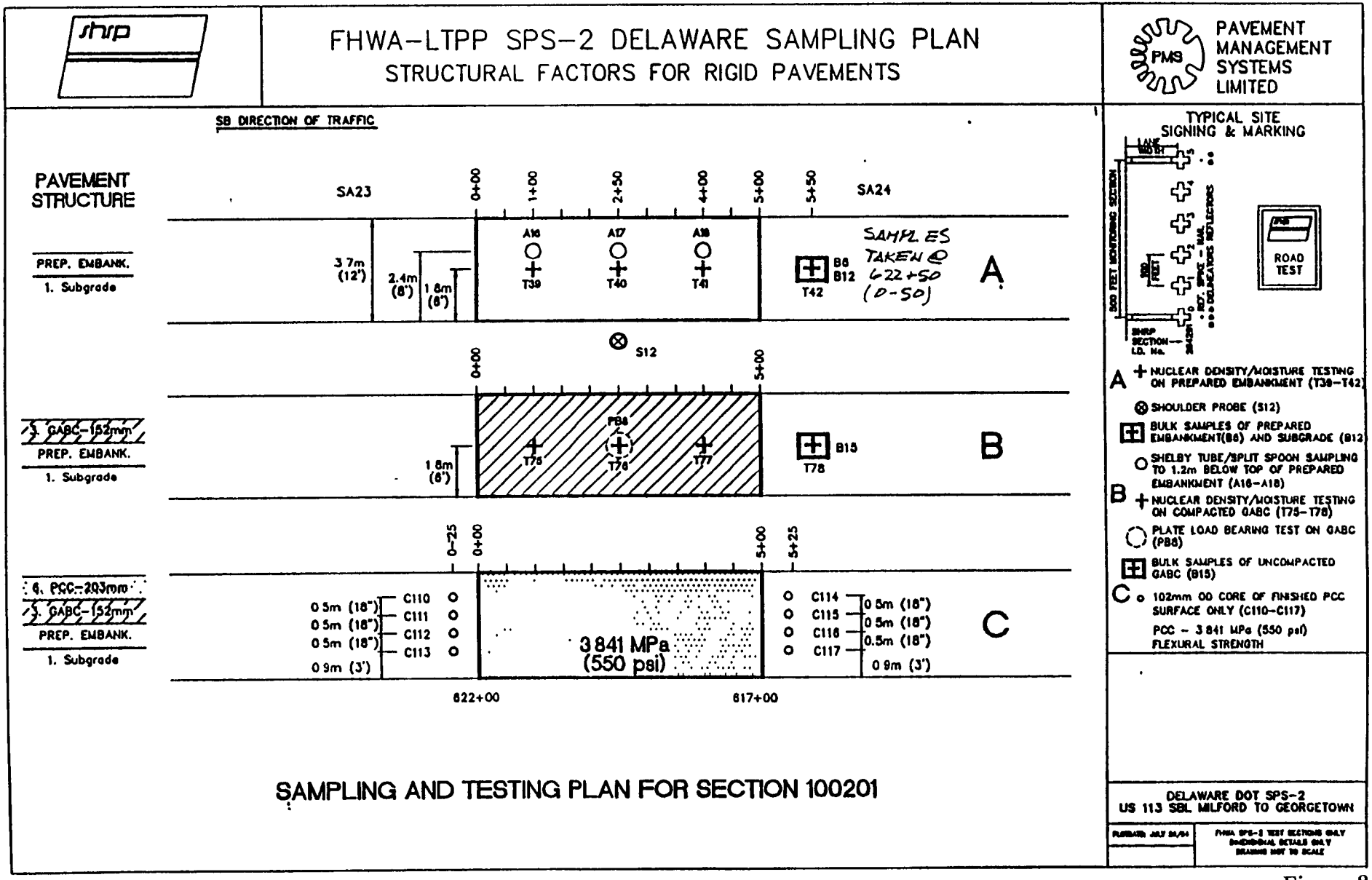
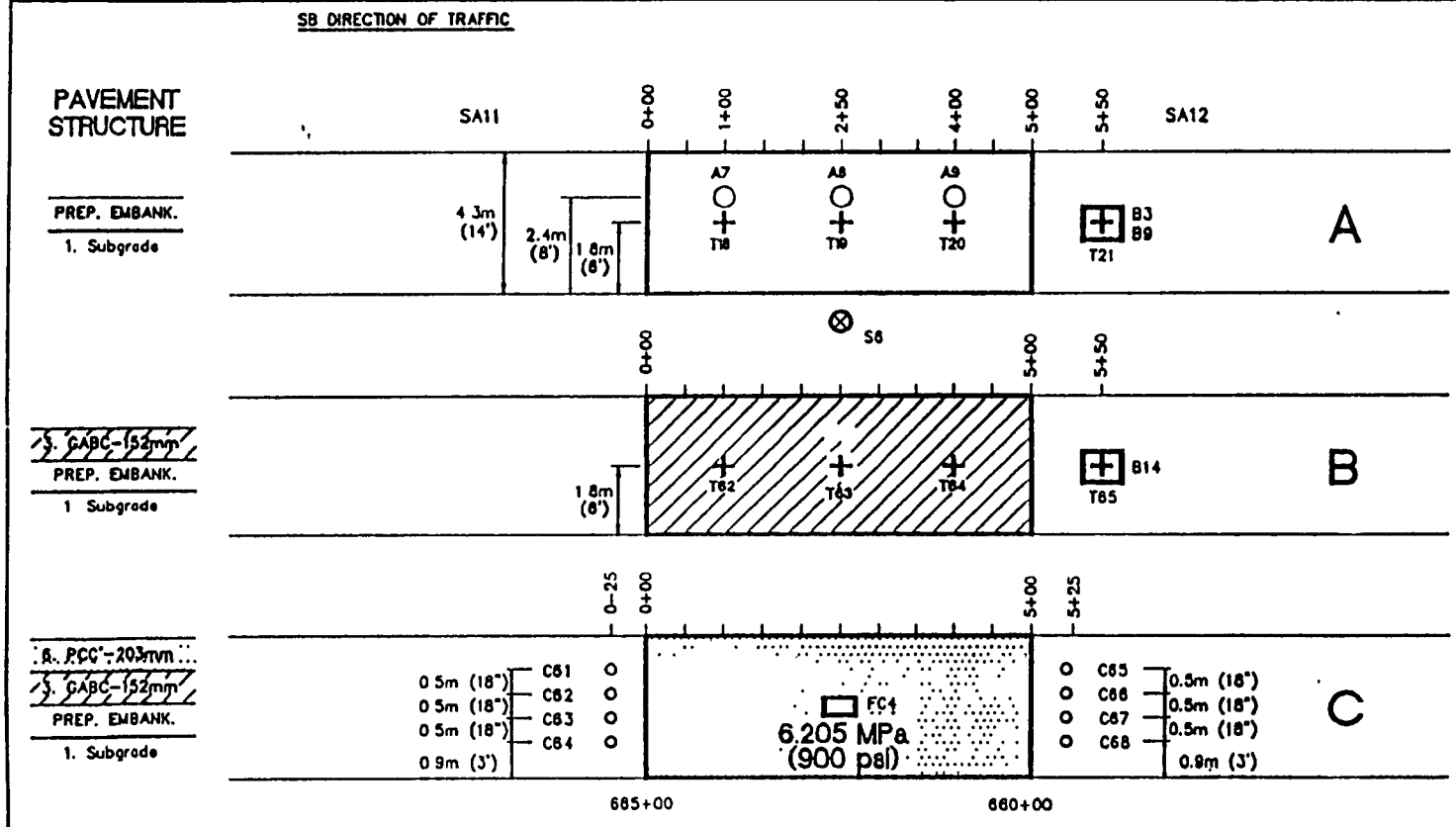

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
PAVEMENT STRUCTURE
SA23
SA24
0+00
1+00
2+50
4+00
5+00
5+50
PREP. EMBANK.
1. Subgrade
3.7m (12')
2.4m (8')
1.8m (8')
A16
A17
A18
T39
T40
T41
T42
B6
B12
SAMPLES TAKEN @ 622+50 (0-50)
A
S12
3. GABC–152mm
PREP. EMBANK.
1. Subgrade
T75
T76
T77
T78
PB8
B15
B
0–25
5+25
6. PCC–203mm
3. GABC–152mm
PREP. EMBANK.
1. Subgrade
0.5m (18")
0.5m (18")
0.5m (18")
0.9m (3')
C110
C111
C112
C113
3 841 MPa
(550 psi)
C114
C115
C116
C117
C
622+00
617+00
SAMPLING AND TESTING PLAN FOR SECTION 100201
TYPICAL SITE SIGNING & MARKING
LANE WIDTH
500 FEET MONITORING SECTION
300 FEET
RED. SPACE – MAG. DELINEATORS REFLECTORS
ROAD TEST
SHRP SECTION — I.D. No.
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT (T39–T42)
SHOULDER PROBE (S12)
BULK SAMPLES OF PREPARED EMBANKMENT(B6) AND SUBGRADE (B12)
SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A16–A18)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T75–T78)
PLATE LOAD BEARING TEST ON GABC (PB8)
BULK SAMPLES OF UNCOMPACTED GABC (B15)
C 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C110–C117)
PCC – 3 841 MPa (550 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN
FHWA SPS–2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

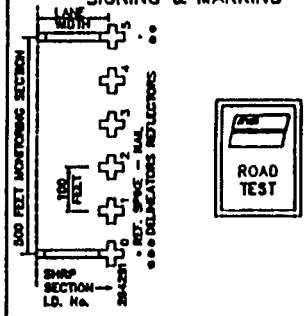
Figure 8

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PAVEMENT MANAGEMENT SYSTEMS LIMITED



TYPICAL SITE SIGNING & MARKING



A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T18–T21)

⊗ SHOULDER PROBE (S6)

⊞ BULK SAMPLES OF PREPARED EMBANKMENT(B3) AND SUBGRADE(B9)

○ SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A7–A9)

B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T62–T65)

⊞ BULK SAMPLES OF UNCOMPACTED GABC (B14)

C o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C61–C68)

▭ BULK SAMPLES OF FRESH PCC AS-DELIVERED (FC4)
PCC* – 6.205 MPa (900 psi) FLEXURAL STRENGTH

SAMPLING AND TESTING PLAN FOR SECTION 100202

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

PLOTTED JULY 30/94

FHWA SPS-2 TEST SECTIONS ONLY
INDIVIDUAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 9

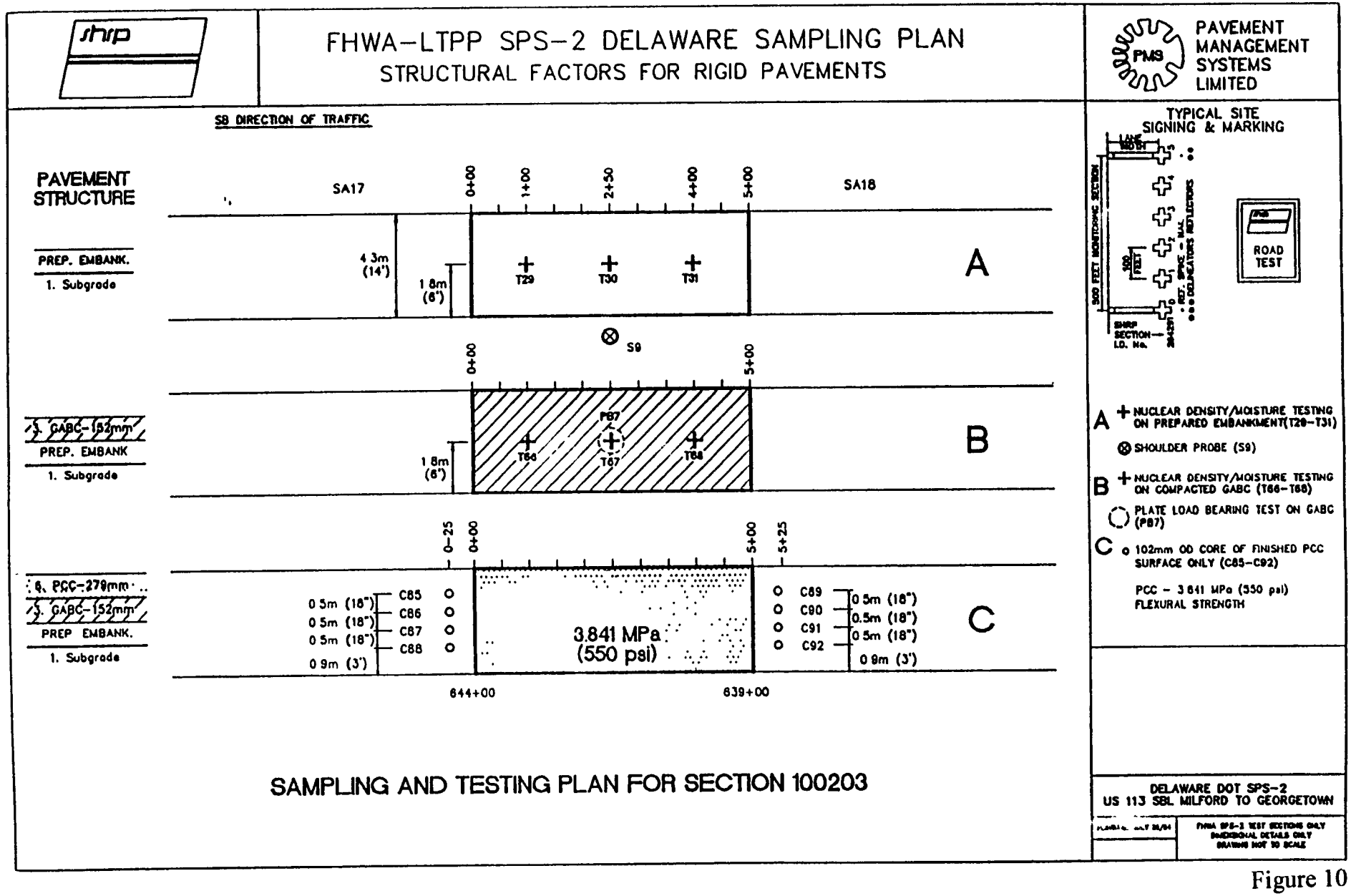

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
PAVEMENT STRUCTURE
SA17
SA18
0+00
1+00
2+50
4+00
5+00
PREP. EMBANK.
1. Subgrade
4.3m (14')
1.8m (6')
T29
T30
T31
A
S9
3. GABC-152mm
PREP. EMBANK
1. Subgrade
T66
T67
T68
PB7
B
6. PCC-279mm
3. GABC-152mm
PREP EMBANK.
1. Subgrade
0-25
5+25
0.5m (18")
0.9m (3')
C85
C86
C87
C88
C89
C90
C91
C92
3.841 MPa (550 psi)
C
644+00
639+00
TYPICAL SITE SIGNING & MARKING
ROAD TEST
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T29–T31)
SHOULDER PROBE (S9)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T66–T68)
PLATE LOAD BEARING TEST ON GABC (PB7)
C o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C85–C92)
PCC – 3.841 MPa (550 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS-2
US 113 SBL MILFORD TO GEORGETOWN
SAMPLING AND TESTING PLAN FOR SECTION 100203

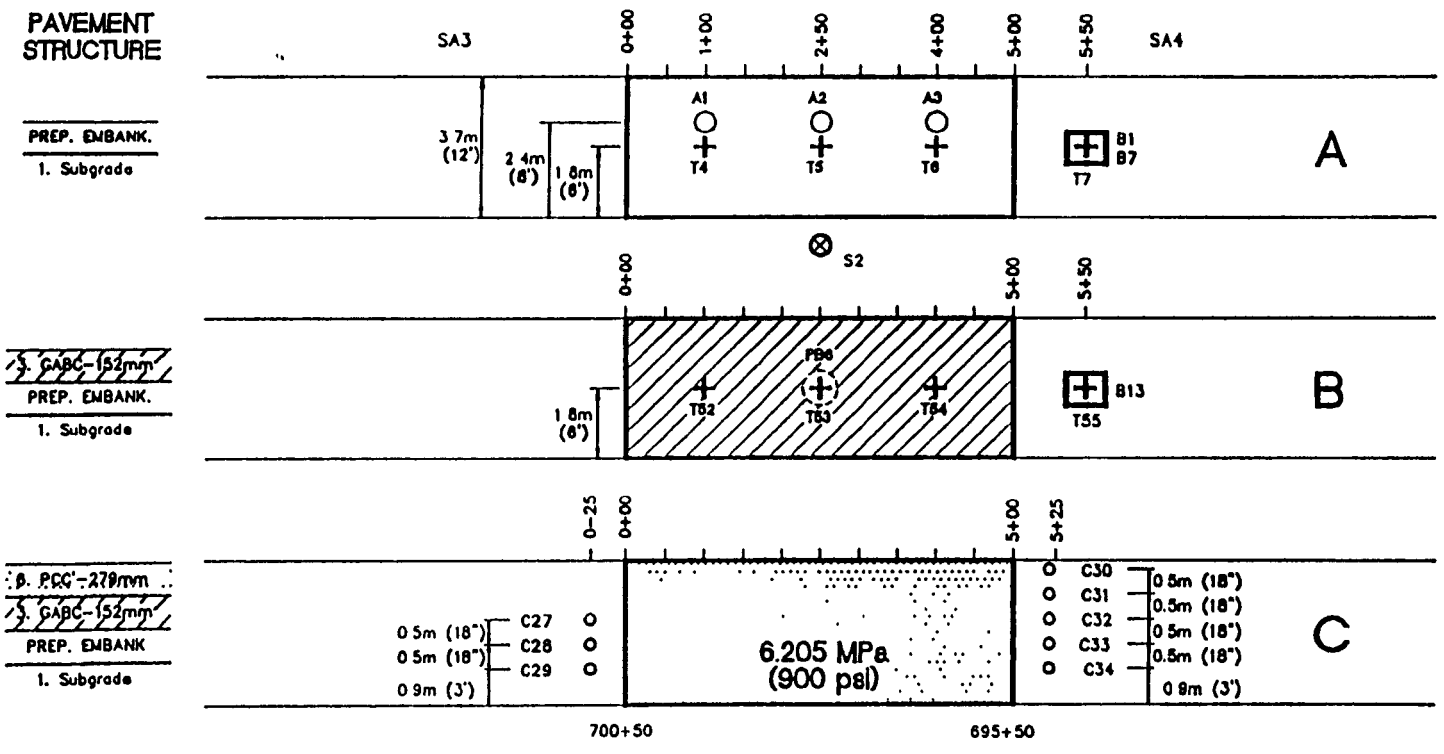
Figure 10

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

shrp

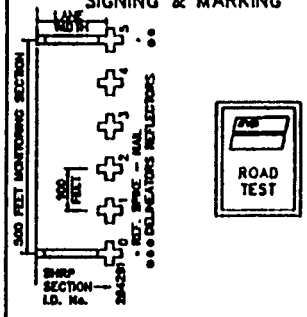
PMS PAVEMENT MANAGEMENT SYSTEMS LIMITED

SB DIRECTION OF TRAFFIC



SAMPLING AND TESTING PLAN FOR SECTION 100204

TYPICAL SITE SIGNING & MARKING



A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T4–T7)

⊗ SHOULDER PROBE (S2)

⊞ BULK SAMPLES OF PREPARED EMBANKMENT(B1) AND SUBGRADE(B7)

○ SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A1–A3)

B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T52–T55)

◌ PLATE LOAD BEARING TEST ON GABC (PB6)

⊞ BULK SAMPLE OF UNCOMPACTED GABC (B13)

C o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C27–C34)

PCC' – 6.205 MPa (900 psi) FLEXURAL STRENGTH

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

Figure 11

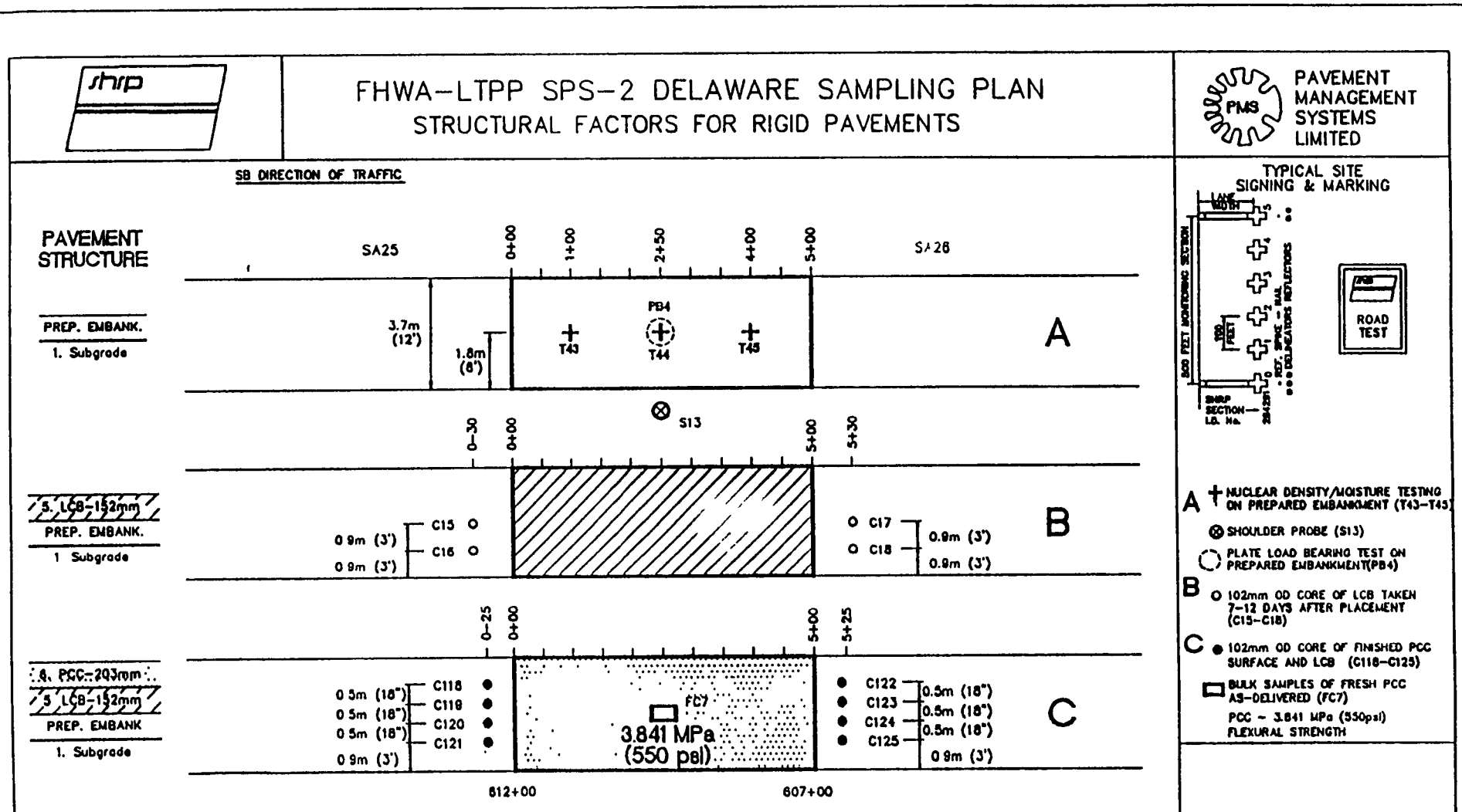
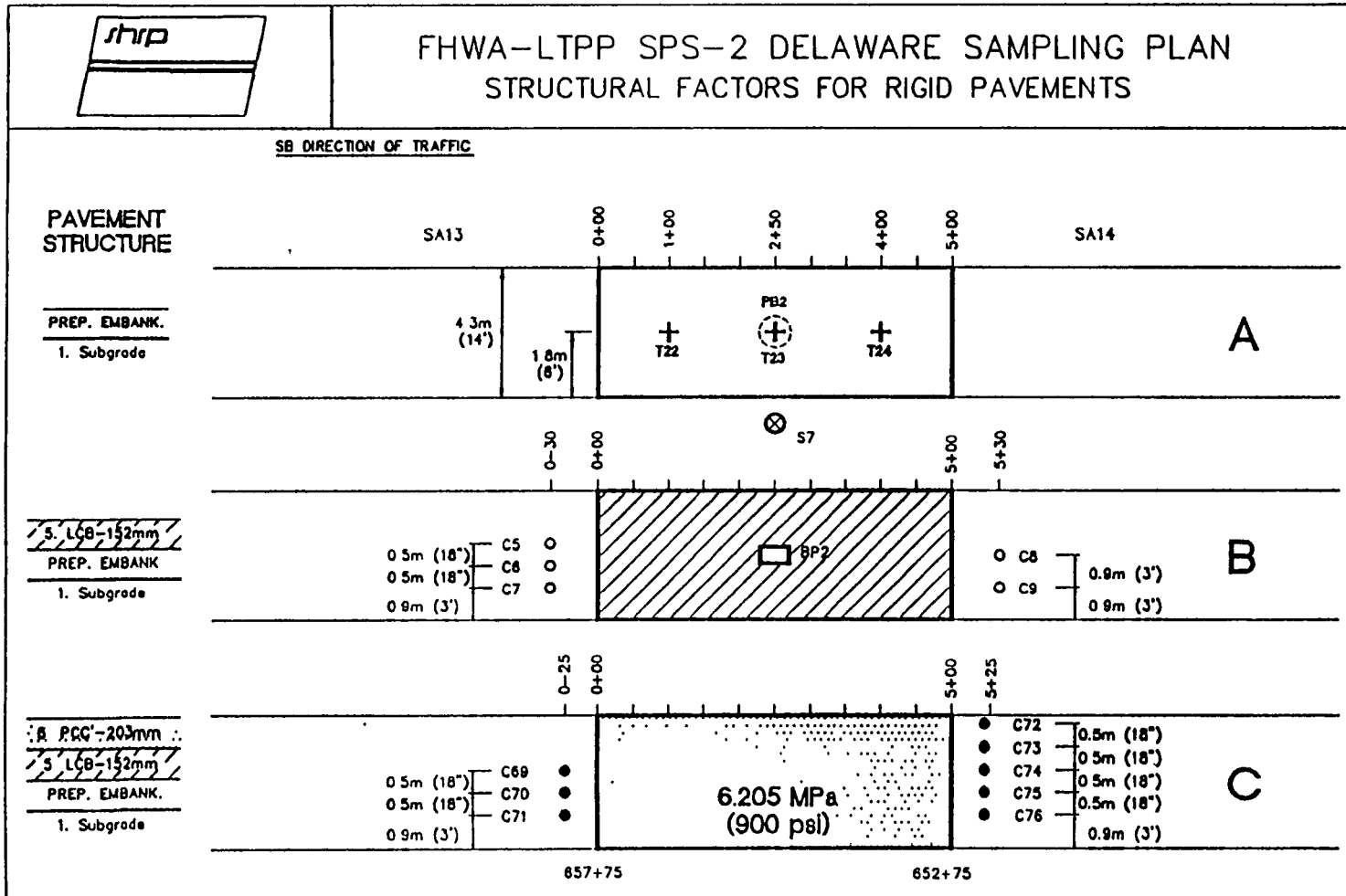

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
PAVEMENT STRUCTURE
SA25
SA26
0+00
1+00
2+50
4+00
5+00
PREP. EMBANK.
1. Subgrade
3.7m (12')
1.8m (6')
PB4
T43
T44
T45
A
S13
0–30
5+30
5. LCB–152mm
0.9m (3')
C15
C16
C17
C18
B
0–25
5+25
4. PCC–203mm
0.5m (18")
C118
C119
C120
C121
C122
C123
C124
C125
FC7
3.841 MPa
(550 psi)
C
812+00
607+00
TYPICAL SITE SIGNING & MARKING
ROAD TEST
A NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT (T43–T45)
SHOULDER PROBE (S13)
PLATE LOAD BEARING TEST ON PREPARED EMBANKMENT(PB4)
B 102mm OD CORE OF LCB TAKEN 7–12 DAYS AFTER PLACEMENT (C15–C18)
C 102mm OD CORE OF FINISHED PCC SURFACE AND LCB (C118–C125)
BULK SAMPLES OF FRESH PCC AS–DELIVERED (FC7)
PCC – 3.841 MPa (550psi) FLEXURAL STRENGTH
SAMPLING AND TESTING PLAN FOR SECTION 100205
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

Figure 12

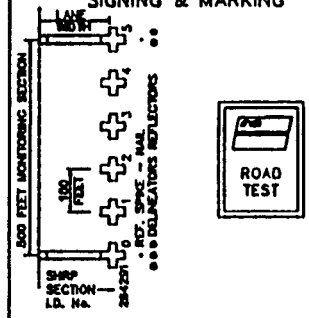
shrp

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PMS PAVEMENT MANAGEMENT SYSTEMS LIMITED



TYPICAL SITE SIGNING & MARKING



A ✚ NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT (T22–T24)

⊗ SHOULDER PROBE (S7)

◯ PLATE LOAD BEARING TEST ON PREPARED EMBANKMENT(PB2)

B ▭ BULK SAMPLES OF FRESH LCB AS-DELIVERED (BP2)

○ 102mm OD CORE OF LCB TAKEN 7–12 DAYS AFTER PLACEMENT (C5–C9)

C ● 102mm OD CORE OF FINISHED PCC SURFACE AND LCB (C69–C76)
PCC - 6.205 MPa (900psi) FLEXURAL STRENGTH

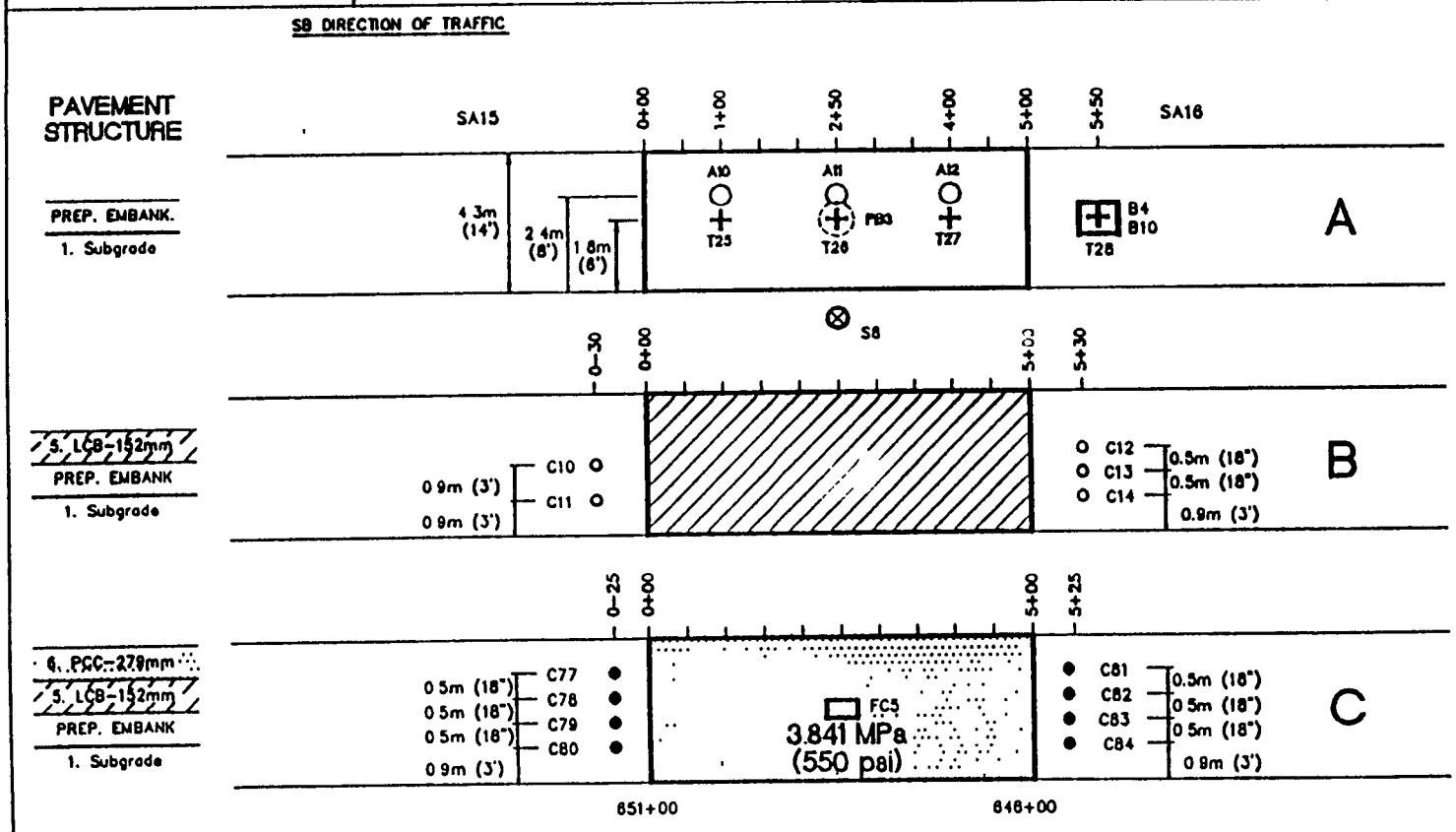
SAMPLING AND TESTING PLAN FOR SECTION 100206

DELAWARE DOT SPS-2
US 113 SBL MILFORD TO GEORGETOWN

FHWA SPS-2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 13

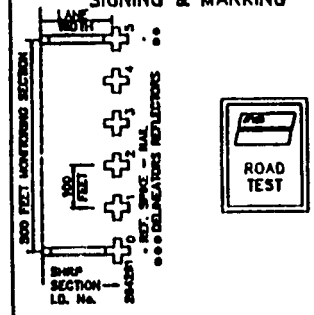
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS



SAMPLING AND TESTING PLAN FOR SECTION 100207

PAVEMENT MANAGEMENT SYSTEMS LIMITED

TYPICAL SITE SIGNING & MARKING



A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT (T25–T28)

⊗ SHOULDER PROBE (S8)

⊞ BULK SAMPLES OF PREPARED EMBANKMENT(B4) AND SUBGRADE (B10)

◯ PLATE LOAD BEARING TEST ON PREPARED EMBANKMENT (PB3)

O SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A10–A12)

B o 102mm OD CORE OF LCB TAKEN 7–12 DAYS AFTER PLACEMENT (C10–C14)

C ● 102mm OD CORE OF FINISHED PCC SURFACE AND LCB (C77–C84)

▭ BULK SAMPLES OF FRESH PCC AS–DELIVERED (FC5)

PCC – 3.844 MPa (550 psi) FLEXURAL STRENGTH

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

PLOTTED: JULY 24/94

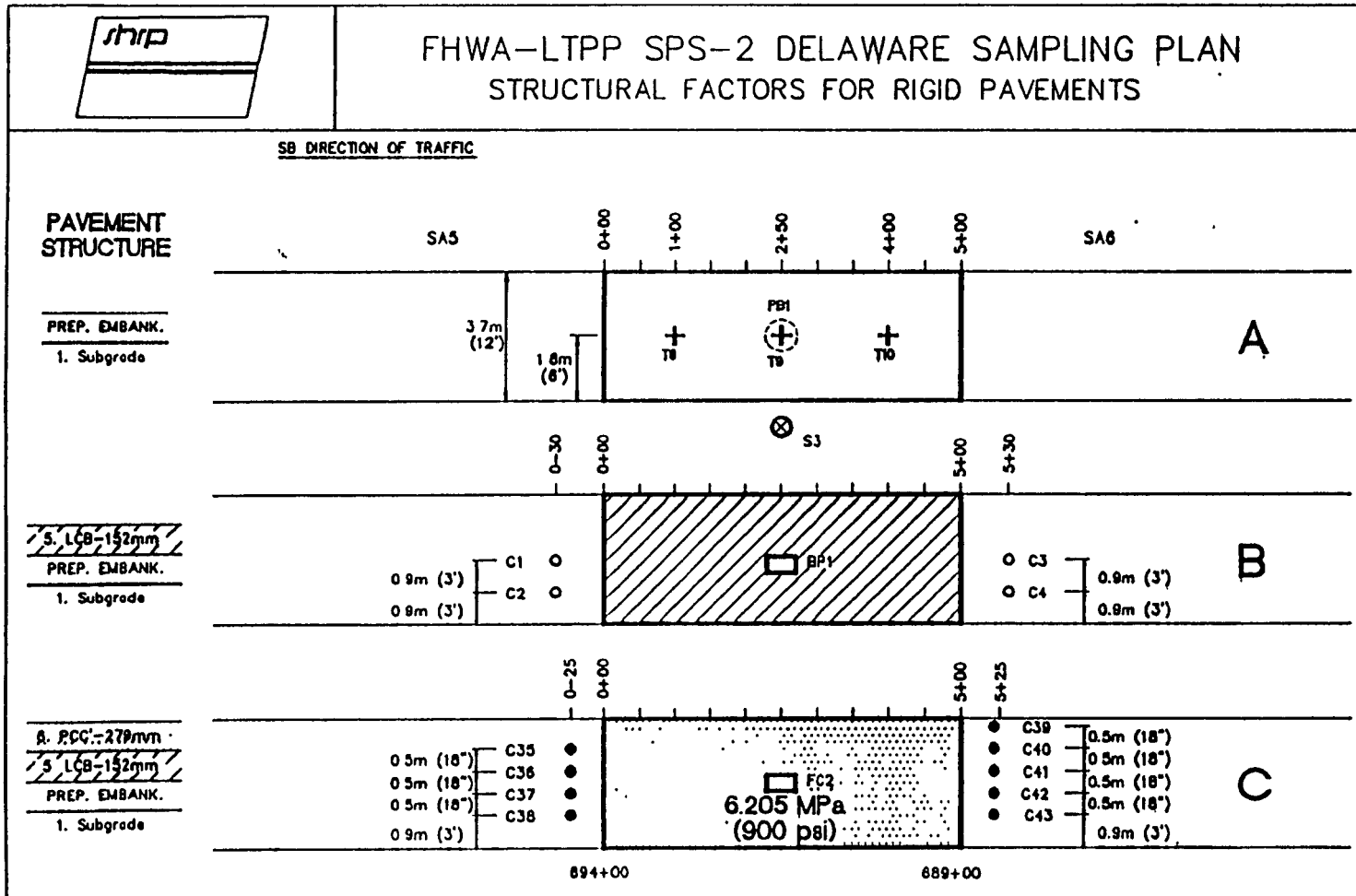
FHWA SPS–2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 14

shrp

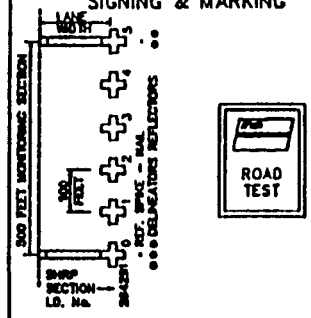
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PMS PAVEMENT MANAGEMENT SYSTEMS LIMITED



SAMPLING AND TESTING PLAN FOR SECTION 100208

TYPICAL SITE SIGNING & MARKING



A ✝ NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T8–T10)

⊗ SHOULDER PROBE (S3)

◯ PLATE LOAD BEARING TEST ON PREPARED EMBANKMENT (PB1)

B ○ 102mm OD CORE OF LCB TAKEN 7–12 DAYS AFTER PLACEMENT (C1–C4)

▭ BULK SAMPLES OF FRESH LCB AS–DELIVERED (BP1)

C ● 102mm OD CORE OF FINISHED PCC SURFACE AND LCB (C35–C43)

▭ BULK SAMPLES OF FRESH PCC AS–DELIVERED (FC2)

PCC – 6.205 MPa (900psi) FLEXURAL STRENGTH

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

Figure 15

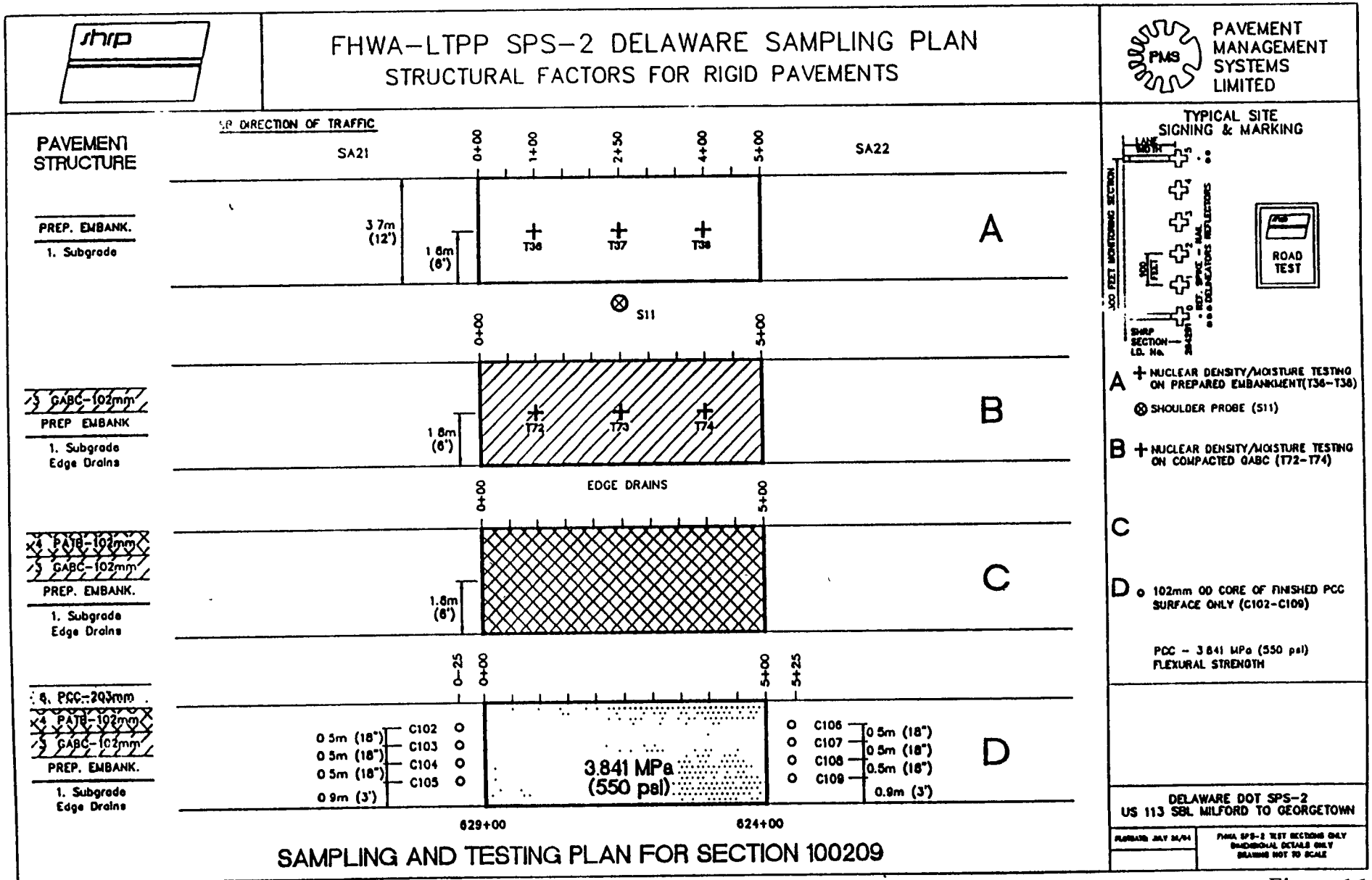

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
PAVEMENT STRUCTURE
DIRECTION OF TRAFFIC
SA21
SA22
0+00
1+00
2+50
4+00
5+00
PREP. EMBANK.
1. Subgrade
3.7m (12')
1.8m (6')
T36
T37
T38
A
S11
3 GABC-102mm
PREP EMBANK
1. Subgrade
Edge Drains
T72
T73
T74
B
EDGE DRAINS
4 PATB-102mm
3 GABC-102mm
PREP. EMBANK.
C
6. PCC-203mm
0-25
5+25
0.5m (18")
0.9m (3')
C102
C103
C104
C105
C106
C107
C108
C109
3.841 MPa (550 psi)
D
629+00
624+00
SAMPLING AND TESTING PLAN FOR SECTION 100209
TYPICAL SITE SIGNING & MARKING
LANE WIDTH
100 FEET MONITORING SECTION
100 FEET
REF. SPACE - MAX. 3 DELINEATORS REFLECTORS
SHRP SECTION — L.O. No.
ROAD TEST
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T36–T38)
⊗ SHOULDER PROBE (S11)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T72–T74)
C
D o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C102–C109)
PCC – 3.841 MPa (550 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS-2
US 113 SBL MILFORD TO GEORGETOWN
FLORIDATA JULY 31/94
FHWA SPS-2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 16

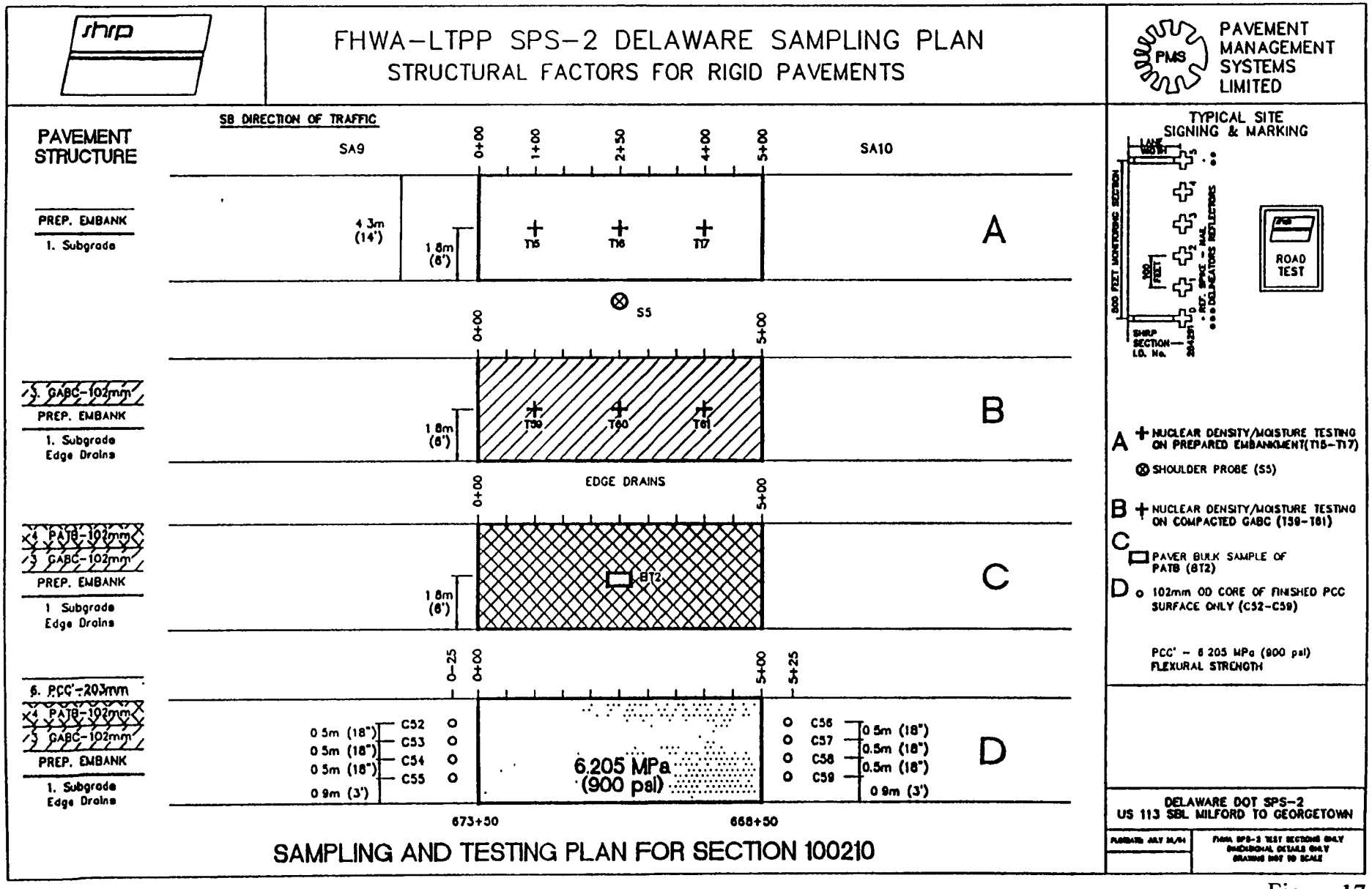

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
PAVEMENT STRUCTURE
SB DIRECTION OF TRAFFIC
SA9
SA10
0+00
1+00
2+50
4+00
5+00
PREP. EMBANK
1. Subgrade
4.3m (14')
1.8m (6')
T15
T16
T17
A
S5
3. GABC–102mm
PREP. EMBANK
1. Subgrade
Edge Drains
T59
T60
T61
B
EDGE DRAINS
4. PATB–102mm
3. GABC–102mm
PREP. EMBANK
1. Subgrade
Edge Drains
BT2
C
6. PCC'–203mm
4. PATB–102mm
3. GABC–102mm
PREP. EMBANK
1. Subgrade
Edge Drains
0–25
5+25
0.5m (18")
0.9m (3')
C52
C53
C54
C55
C56
C57
C58
C59
6,205 MPa (900 psi)
D
673+50
668+50
TYPICAL SITE SIGNING & MARKING
500 FEET MONITORING SECTION
100 FEET
ROAD TEST
SHRP SECTION — I.D. No.
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T15–T17)
⊗ SHOULDER PROBE (S5)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T59–T61)
C PAVER BULK SAMPLE OF PATB (BT2)
D o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C52–C59)
PCC' – 6.205 MPa (900 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN
SAMPLING AND TESTING PLAN FOR SECTION 100210

Figure 17

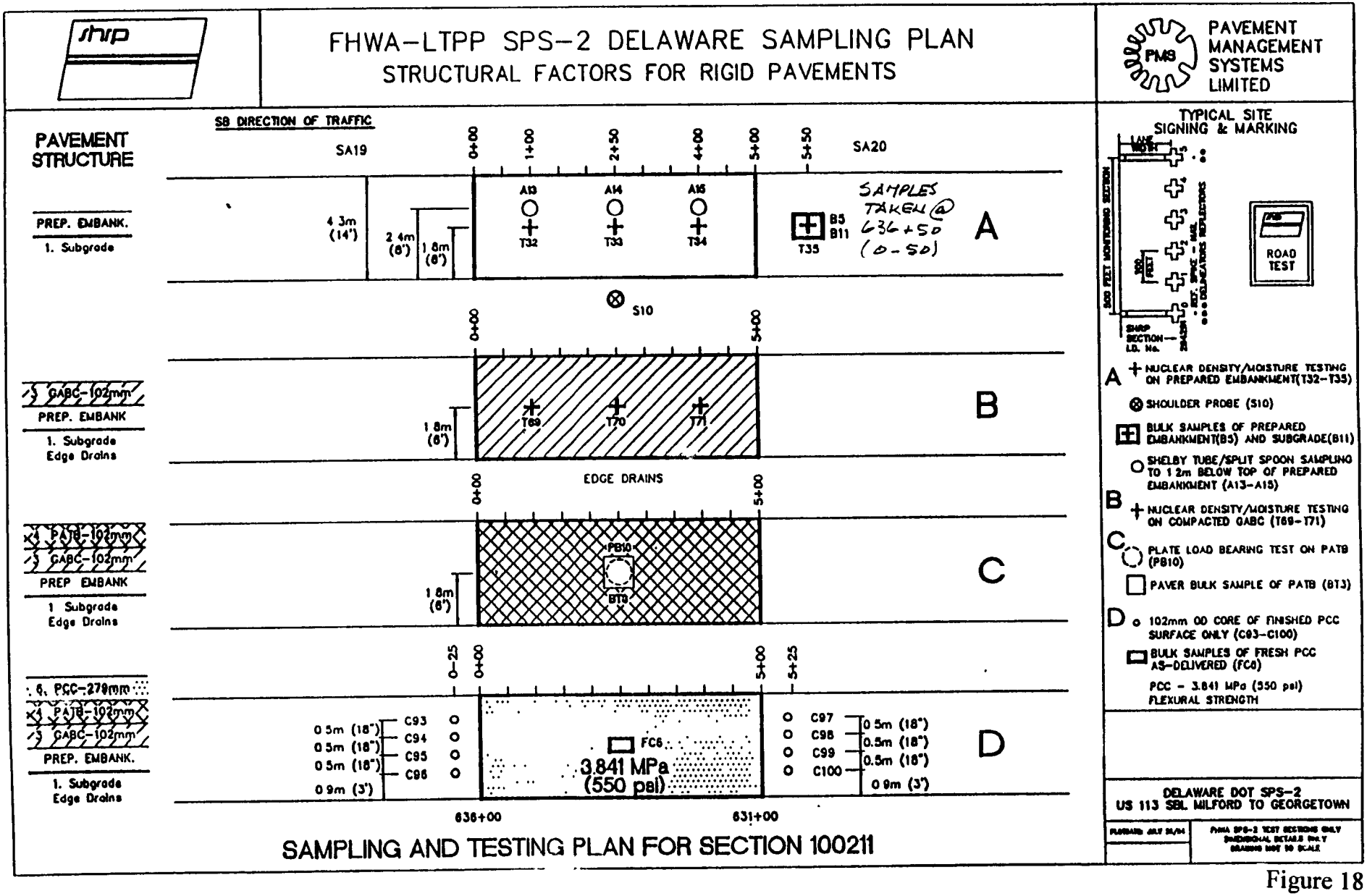

FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
PAVEMENT STRUCTURE
SA19
SA20
0+00
1+00
2+50
4+00
5+00
5+50
PREP. EMBANK.
1. Subgrade
4.3m (14')
2.4m (8')
1.8m (6')
A13
A14
A15
T32
T33
T34
B5
B11
T35
SAMPLES TAKEN @ 636+50 (0-50)
A
S10
5" GABC-102mm
PREP. EMBANK
1. Subgrade
Edge Drains
T69
T70
T71
B
EDGE DRAINS
4" PATB-102mm
5" GABC-102mm
PREP EMBANK
1 Subgrade
Edge Drains
PB10
BT9
C
6" PCC-279mm
4" PATB-102mm
5" GABC-102mm
PREP. EMBANK.
1. Subgrade
Edge Drains
0-25
5+25
0.5m (18")
0.9m (3")
C93
C94
C95
C96
C97
C98
C99
C100
FC6
3.841 MPa
(550 psi)
D
636+00
631+00
SAMPLING AND TESTING PLAN FOR SECTION 100211
TYPICAL SITE SIGNING & MARKING
LANE WIDTH
500 FEET MONITORING SECTION
300 FEET
ROAD TEST
SHARP SECTION I.D. No.
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T32–T35)
SHOULDER PROBE (S10)
BULK SAMPLES OF PREPARED EMBANKMENT(B5) AND SUBGRADE(B11)
SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A13–A15)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T69–T71)
C PLATE LOAD BEARING TEST ON PATB (PB10)
PAVER BULK SAMPLE OF PATB (BT3)
D 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C93–C100)
BULK SAMPLES OF FRESH PCC AS–DELIVERED (FC6)
PCC – 3.841 MPa (550 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

Figure 18

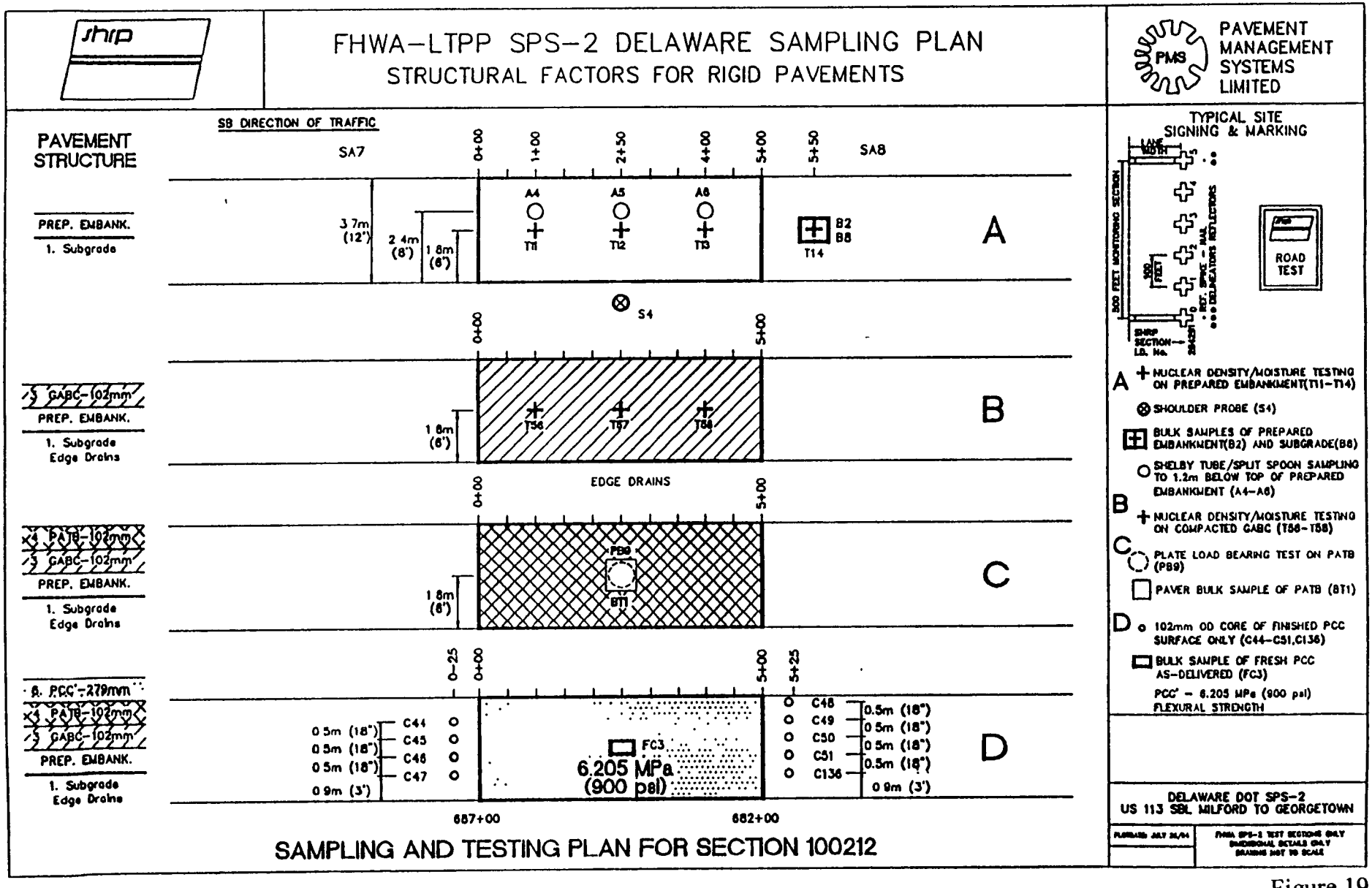
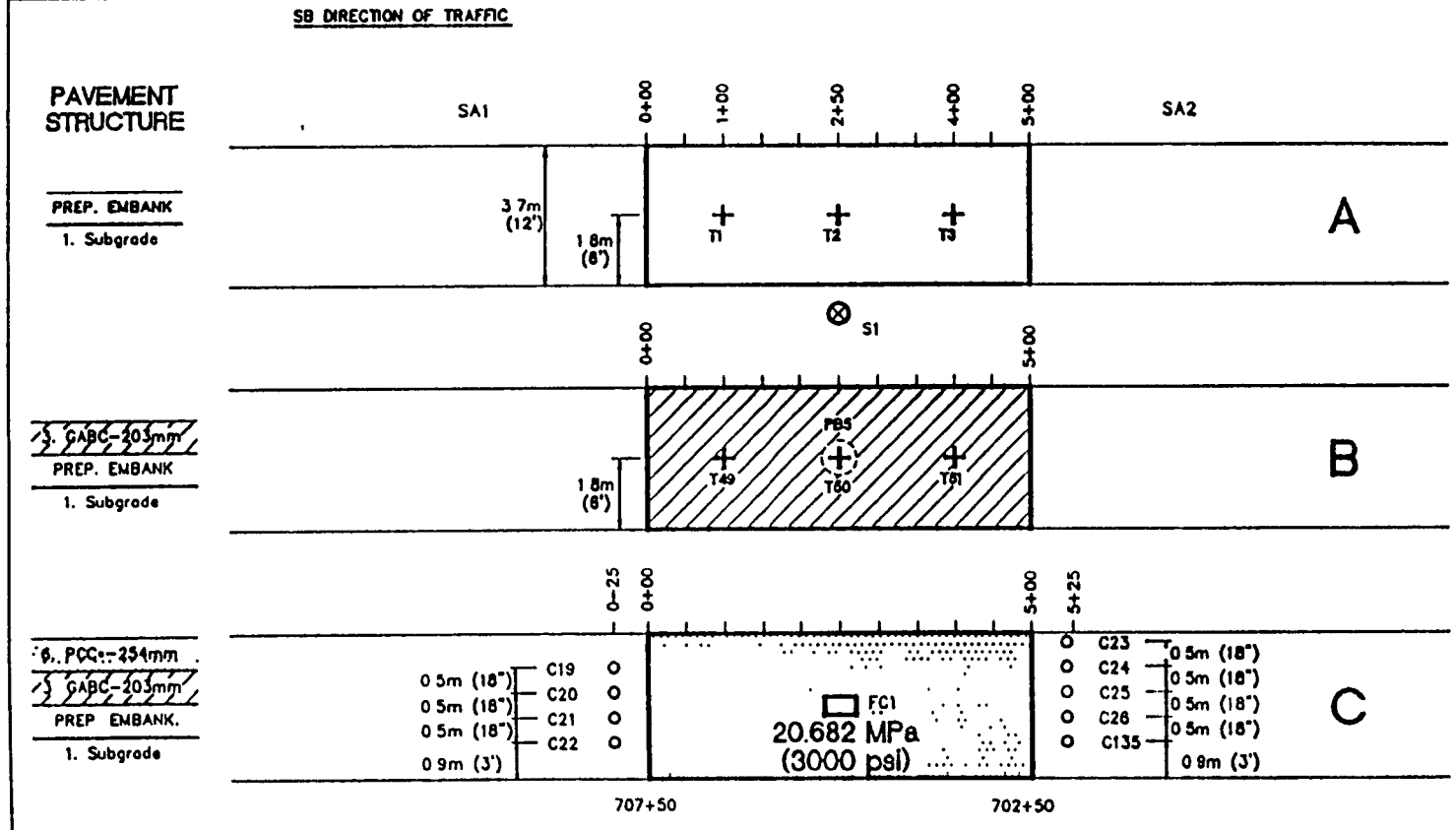

shrp
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS
PMS
PAVEMENT MANAGEMENT SYSTEMS LIMITED
SB DIRECTION OF TRAFFIC
PAVEMENT STRUCTURE
SA7
SA8
0+00
1+00
2+50
4+00
5+00
5+50
PREP. EMBANK.
1. Subgrade
3.7m (12')
2.4m (8')
1.8m (6')
A4
A5
A6
T11
T12
T13
B2
B8
T14
A
S4
5 GABC–102mm
PREP. EMBANK.
1. Subgrade
Edge Drains
T56
T57
T58
B
EDGE DRAINS
4 PATB–102mm
5 GABC–102mm
PREP. EMBANK.
1. Subgrade
Edge Drains
PB9
BT1
C
0–25
6. PCC–279mm
4 PATB–102mm
5 GABC–102mm
PREP. EMBANK.
1. Subgrade
Edge Drains
0.5m (18")
0.5m (18")
0.5m (18")
0.9m (3')
C44
C45
C46
C47
FC3
6.205 MPa
(900 psi)
C48
C49
C50
C51
C136
0.5m (18")
0.5m (18")
0.5m (18")
0.5m (18")
0.9m (3')
D
687+00
682+00
SAMPLING AND TESTING PLAN FOR SECTION 100212
TYPICAL SITE SIGNING & MARKING
LANE WIDTH
300 FEET MONITORING SECTION
100 FEET
ROAD TEST
SHRP SECTION — I.D. No.
A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T11–T14)
⊗ SHOULDER PROBE (S4)
⊞ BULK SAMPLES OF PREPARED EMBANKMENT(B2) AND SUBGRADE(B8)
○ SHELBY TUBE/SPLIT SPOON SAMPLING TO 1.2m BELOW TOP OF PREPARED EMBANKMENT (A4–A6)
B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T56–T58)
C ◌ PLATE LOAD BEARING TEST ON PATB (PB9)
□ PAVER BULK SAMPLE OF PATB (BT1)
D ○ 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C44–C51,C136)
▭ BULK SAMPLE OF FRESH PCC AS–DELIVERED (FC3)
PCC – 6.205 MPa (900 psi) FLEXURAL STRENGTH
DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN
PLOTTED: JULY 26/94
THIS SPS–2 TEST SECTIONS ONLY DIMENSIONAL DETAILS ONLY DRAWING NOT TO SCALE

Figure 19

shrp

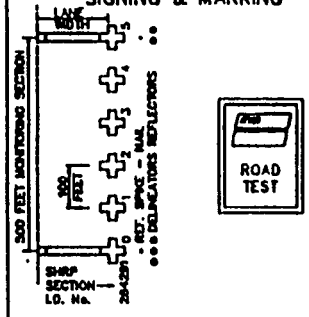
FHWA–LTPP SPS–2 DELAWARE SAMPLING PLAN
STRUCTURAL FACTORS FOR RIGID PAVEMENTS

PMS PAVEMENT MANAGEMENT SYSTEMS LIMITED



SAMPLING AND TESTING PLAN FOR SECTION 100259

TYPICAL SITE SIGNING & MARKING



A + NUCLEAR DENSITY/MOISTURE TESTING ON PREPARED EMBANKMENT(T1–T3)

⊗ SHOULDER PROBE (S1)

B + NUCLEAR DENSITY/MOISTURE TESTING ON COMPACTED GABC (T49–T51)

◯ PLATE LOAD BEARING TEST ON GABC (PBS)

C o 102mm OD CORE OF FINISHED PCC SURFACE ONLY (C19–C26,C135)

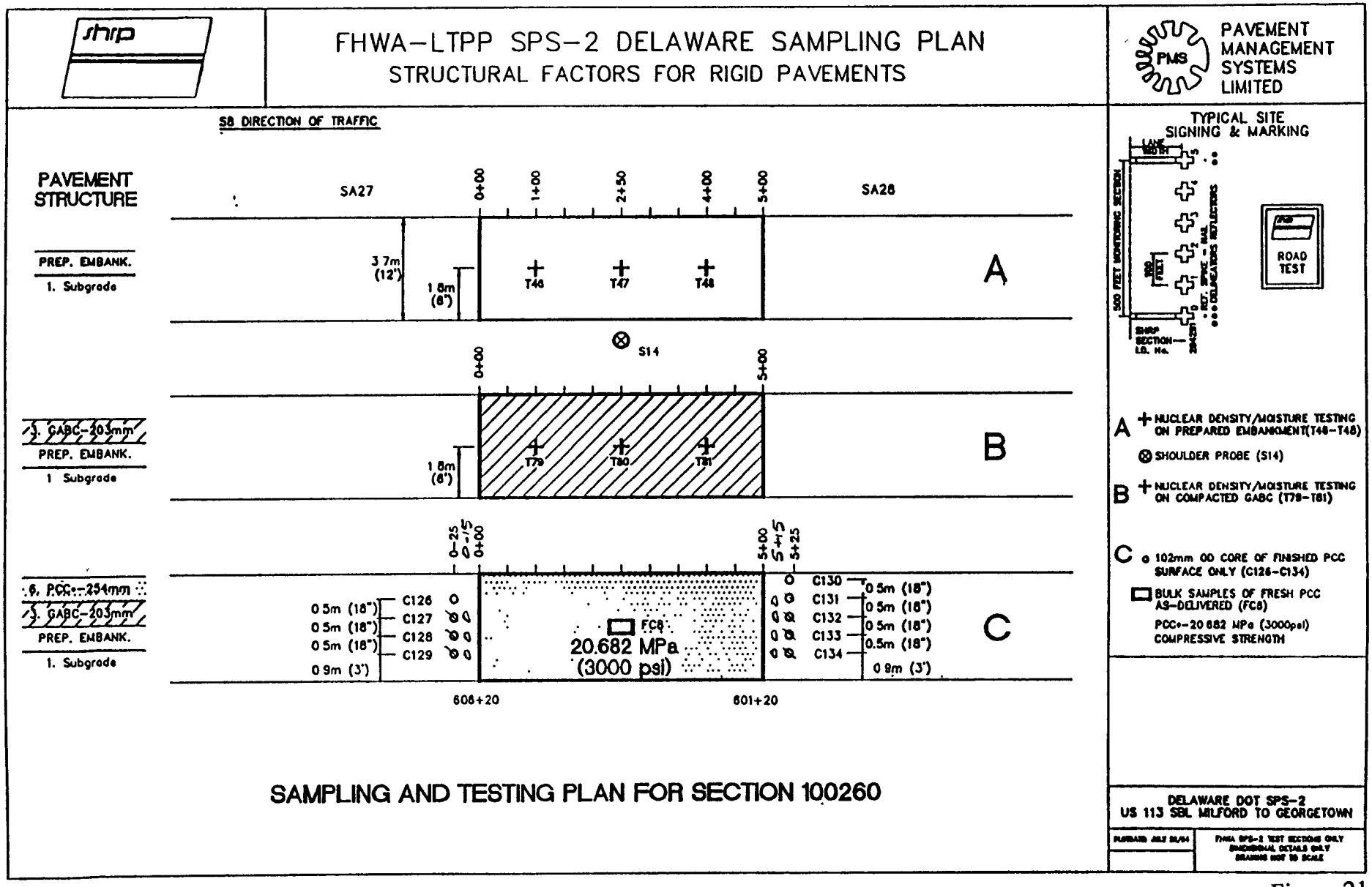
▭ BULK SAMPLES OF FRESH PCC AS–DELIVERED (FC1)
PCC=20.682 MPa (3000psi) COMPRESSIVE STRENGTH

DELAWARE DOT SPS–2
US 113 SBL MILFORD TO GEORGETOWN

PLOTTED JULY 22/94

FHWA SPS–2 TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

Figure 20



SAMPLING AND TESTING PLAN FOR SECTION 100260

Figure 21

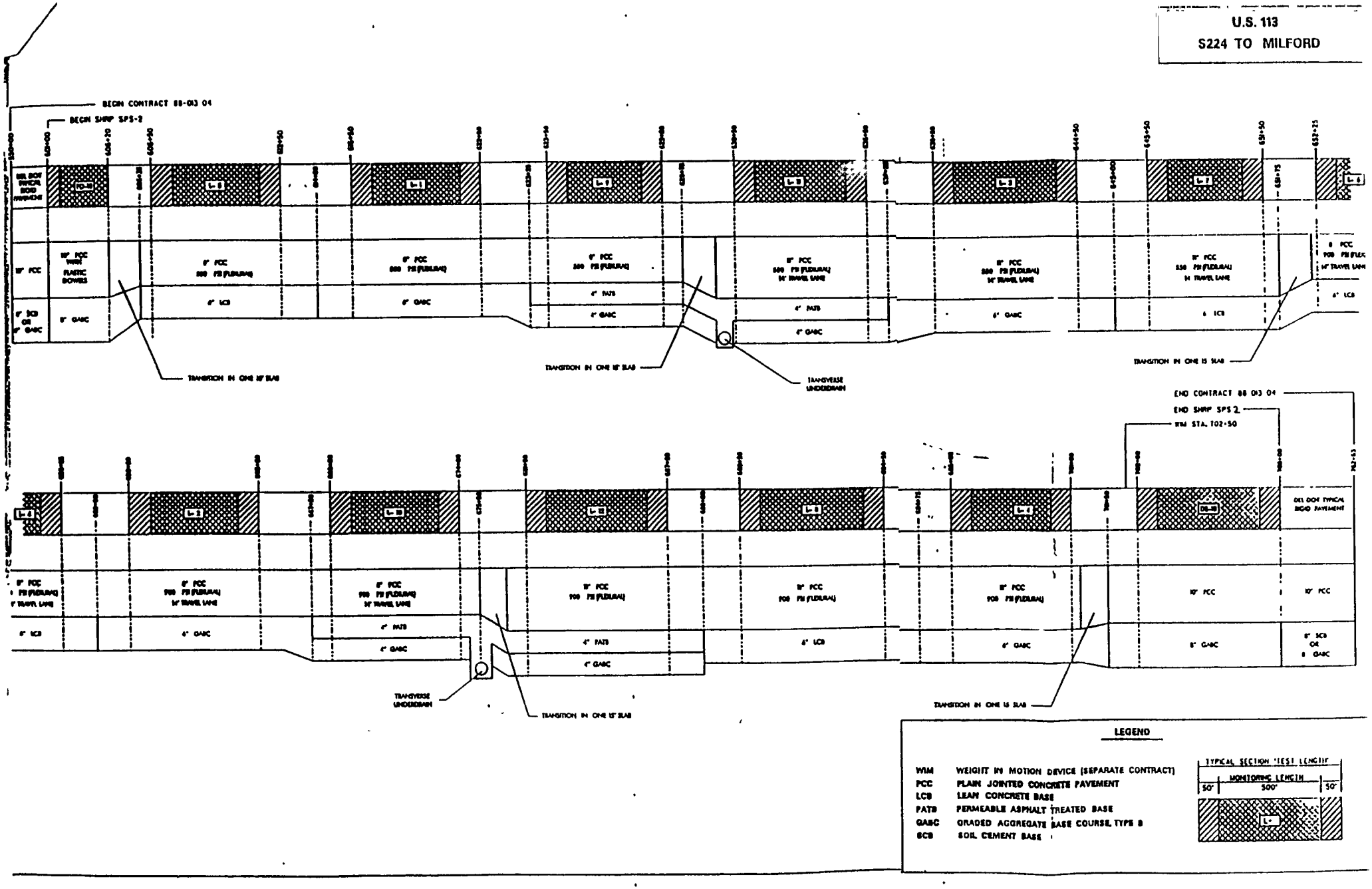
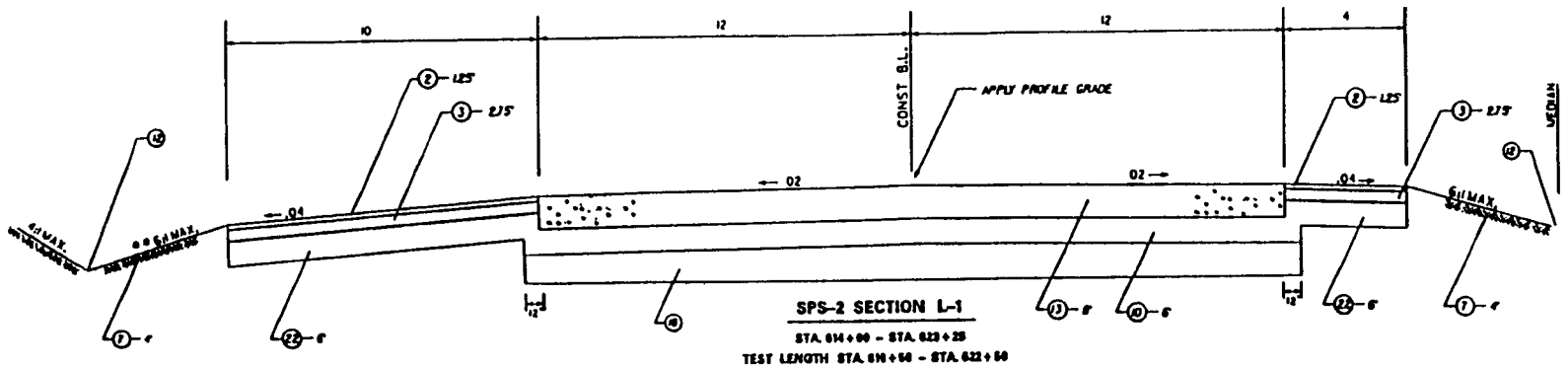

U.S. 113
S224 TO MILFORD
BEGIN CONTRACT 88-013 04
BEGIN SHRP SPS-2
TRANSITION IN ONE 15' SLAB
TRANSVERSE UNDERDRAIN
END CONTRACT 88 013 04
END SHRP SPS 2
WIM STA. 702+50
LEGEND
WIM WEIGHT IN MOTION DEVICE (SEPARATE CONTRACT)
PCC PLAIN JOINTED CONCRETE PAVEMENT
LCB LEAN CONCRETE BASE
PATB PERMEABLE ASPHALT TREATED BASE
GABC GRADED AGGREGATE BASE COURSE, TYPE B
SCB SOIL CEMENT BASE
TYPICAL SECTION (TEST LENGTH)
MONITORING LENGTH
50'
500'
50'

Figure 22

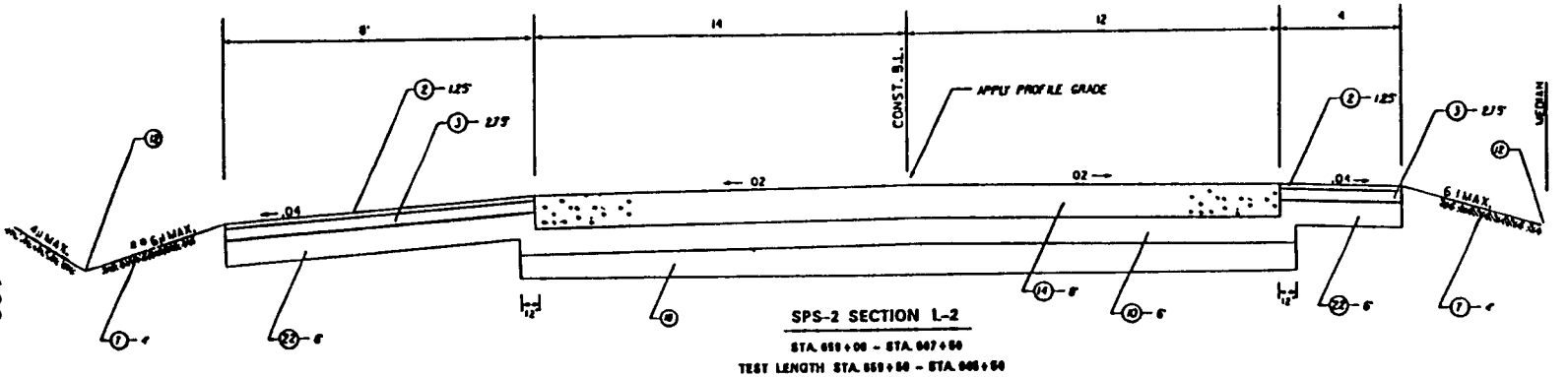
U.S. 113
24 TO MILFORD
REVISIONS



SPS-2 SECTION L-1

STA. 614+00 – STA. 623+25

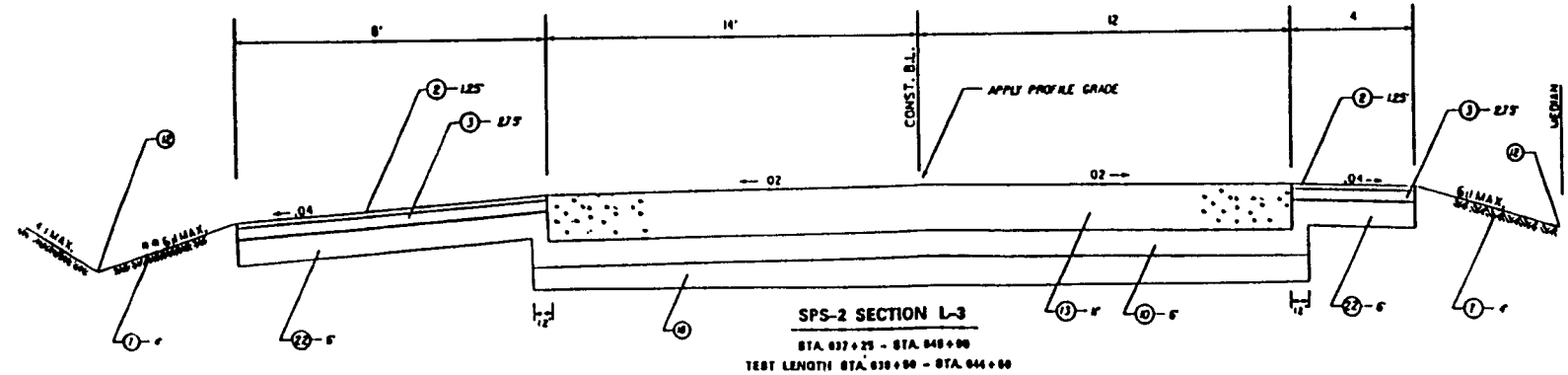
TEST LENGTH STA. 616+50 – STA. 622+50



SPS-2 SECTION L-2

STA. 659+00 – STA. 667+50

TEST LENGTH STA. 659+50 – STA. 666+50



SPS-2 SECTION L-3

STA. 637+25 – STA. 645+00

TEST LENGTH STA. 638+50 – STA. 644+50

LEGEND

1. OPEN GRADED HOT MIX
2. HOT MIX HOT LAID BIT CONC PAVT TYPE C
3. HOT MIX HOT LAID BIT CONC PAVT TYPE B
4. EXISTING HOT MIX OVERLAY (APPROX 6")
5. BITUMINOUS CONCRETE BASE COURSE
6. REINFORCED ASPHALTIC MEMBRANE (F)
7. TOPSOIL SEED AND MULCH TO LOC.
8. MILL PAVEMENT TO CONC SURFACE (WIDTH 5')
9. PORTLAND CEMENT CONCRETE PAVT
10. GRADED AGGREGATE BASE COURSE TYPE B
11. P.C.C. PARKWAY CURB TYPE I MODIFIED
12. SEE PLAN GRADE AND OFFSET
13. PLAIN JOINTED CONCRETE PAVT 11½" SLABS, 550 PSI FLEXURAL STRENGTH)
14. PLAIN JOINTED CONCRETE PAVT 11½" SLABS, 900 PSI FLEXURAL STRENGTH)
15. LEAN CONCRETE BASE
16. PERMEABLE ASPHALT TREATED BASE
17. UNDERDRAIN 4" (SEE DETAIL)
18. BORROW TYPE A (MAX. 2' 6" LIFTS)
19. MILL PAVEMENT (4' WIDE X 1.5' DEEP)
20. REMOVE EXISTING LANE AND SHOULDER
21. P.C.C. SIDEWALK 6"
22. ALTERNATE SOIL CEMENT BASE OR GRADED AGGREGATE BASE COURSE TYPE B

Figure 23

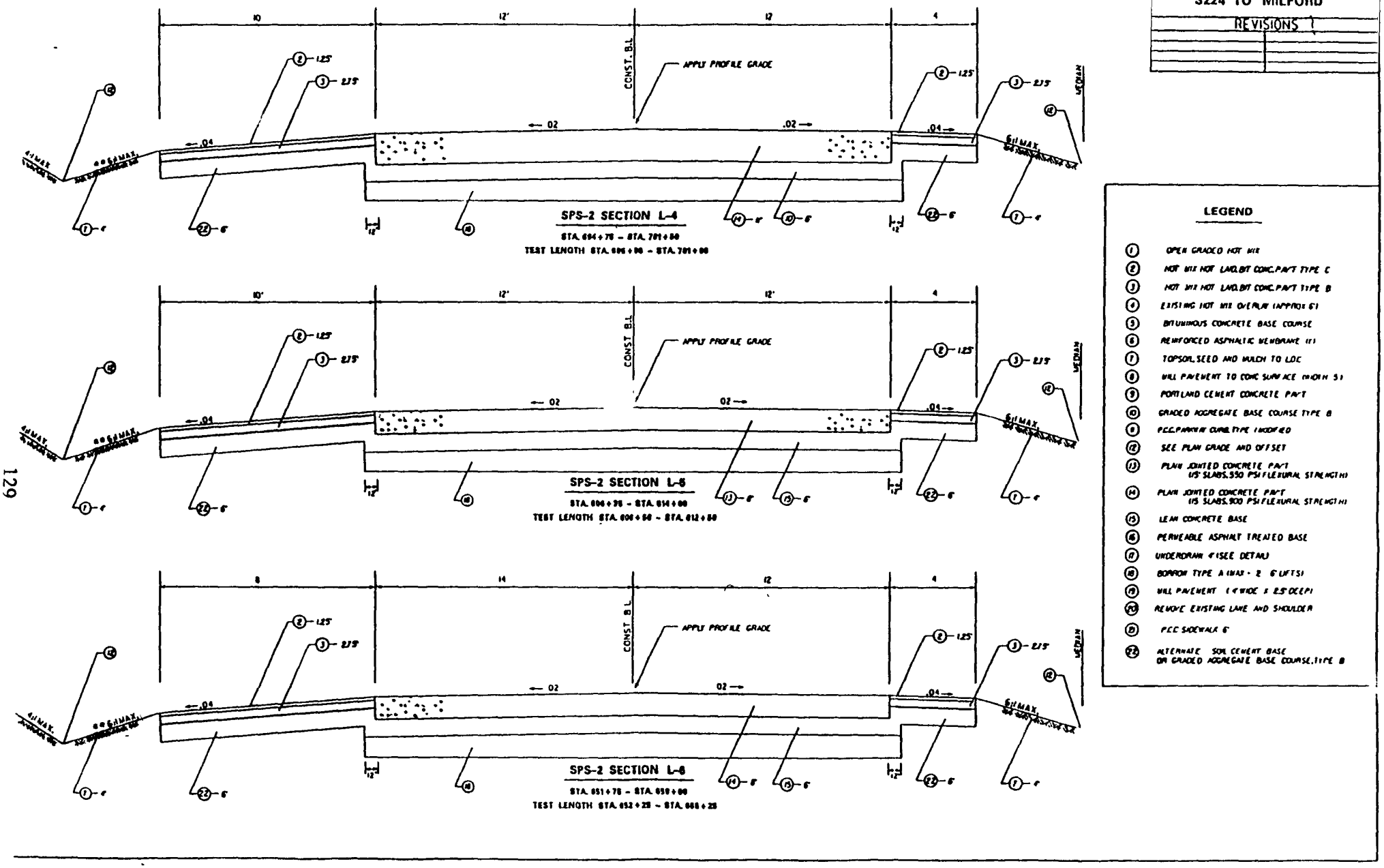
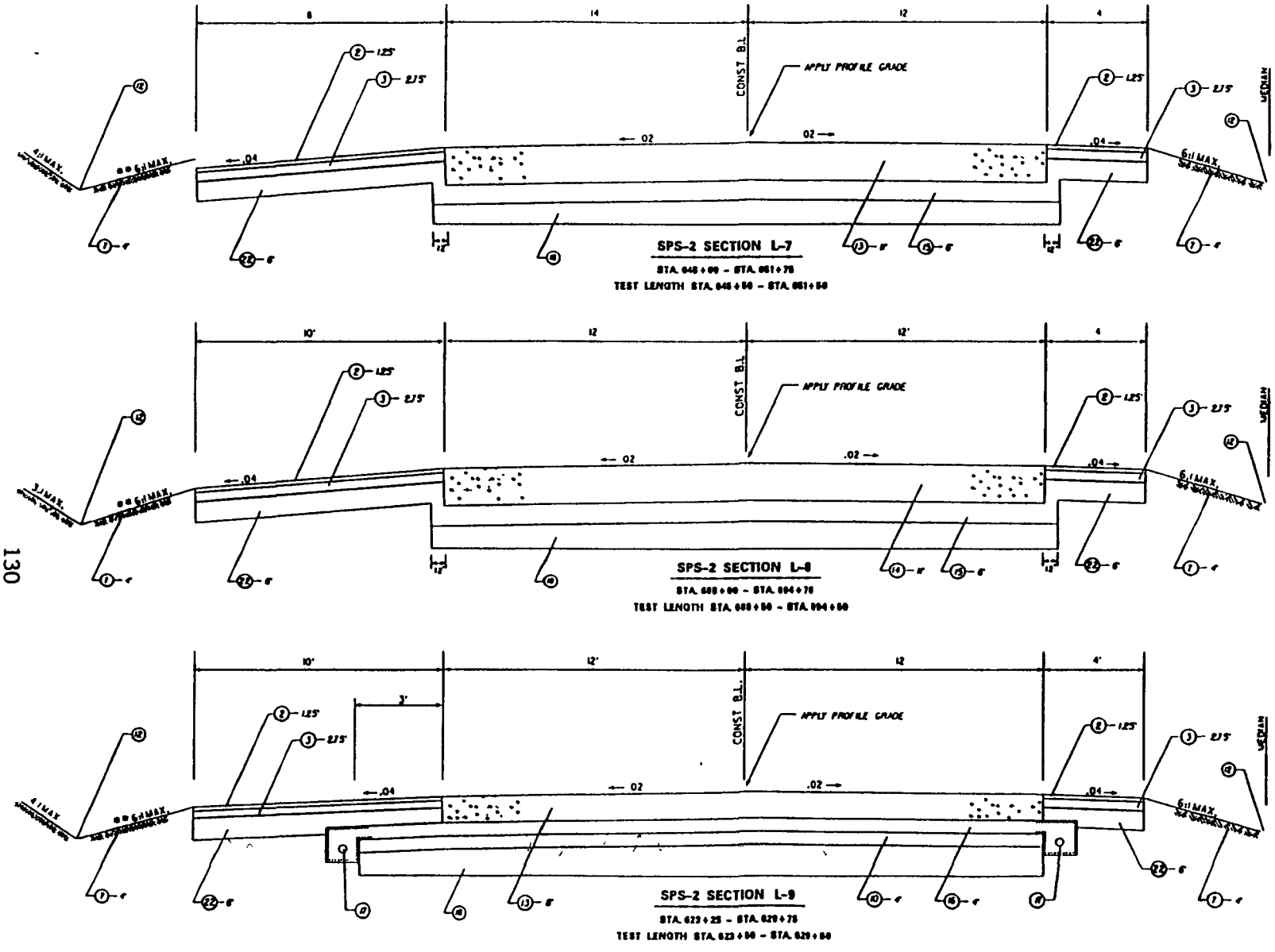

S224 TO MILFORD
REVISIONS
SPS-2 SECTION L-4
STA. 694+78 – STA. 701+80
TEST LENGTH STA. 696+00 – STA. 701+00
SPS-2 SECTION L-5
STA. 806+26 – STA. 814+00
TEST LENGTH STA. 808+50 – STA. 812+50
SPS-2 SECTION L-6
STA. 851+78 – STA. 859+00
TEST LENGTH STA. 852+25 – STA. 858+25
CONST. B.L.
APPLY PROFILE GRADE
MEDIAN
LEGEND
1 OPEN GRADED HOT MIX
2 HOT MIX HOT LAID BIT CONC. PAVT TYPE C
3 HOT MIX HOT LAID BIT CONC. PAVT TYPE B
4 EXISTING HOT MIX OVERLAY (APPROX 6")
5 BITUMINOUS CONCRETE BASE COURSE
6 REINFORCED ASPHALTIC MEMBRANE (1")
7 TOPSOIL, SEED AND MULCH TO LOC
8 MILL PAVEMENT TO CONC SURFACE (WIDTH 5')
9 PORTLAND CEMENT CONCRETE PAVT
10 GRADED AGGREGATE BASE COURSE TYPE B
11 P.C.C. PAVEMENT CURB, TYPE I MODIFIED
12 SEE PLAN GRADE AND OFFSET
13 PLAIN JOINTED CONCRETE PAVT (15" SLABS, 550 PSI FLEXURAL STRENGTH)
14 PLAIN JOINTED CONCRETE PAVT (15 SLABS, 900 PSI FLEXURAL STRENGTH)
15 LEAN CONCRETE BASE
16 PERMEABLE ASPHALT TREATED BASE
17 UNDERDRAIN 4" (SEE DETAIL)
18 BORROW TYPE A (MAX - 2 6" LIFTS)
19 MILL PAVEMENT (4" WIDE X 0.5" DEEP)
20 REMOVE EXISTING LANE AND SHOULDER
21 P.C.C. SIDEWALK 6"
22 ALTERNATE SOIL CEMENT BASE OR GRADED AGGREGATE BASE COURSE, TYPE B

Figure 24



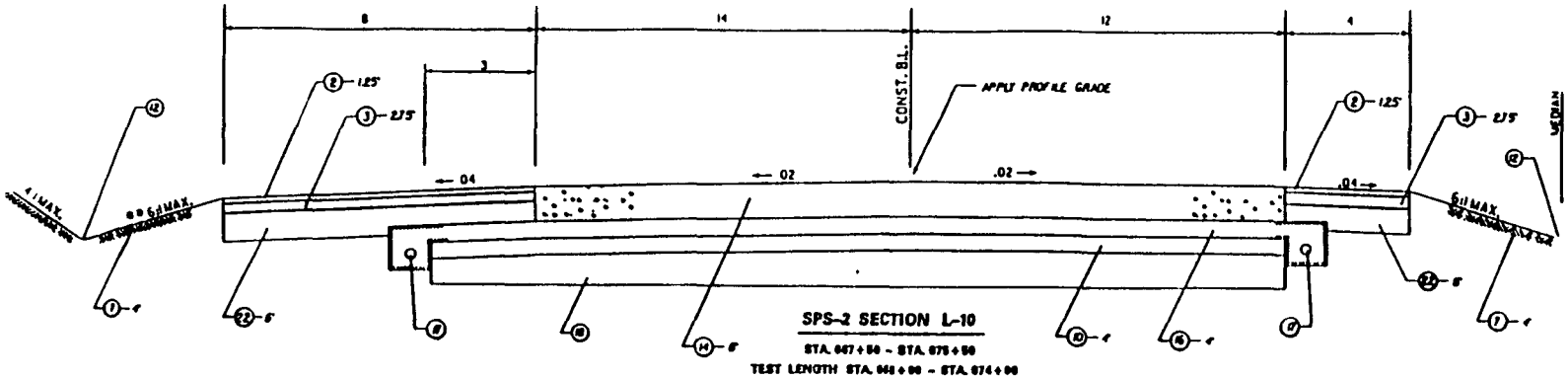
LEGEND

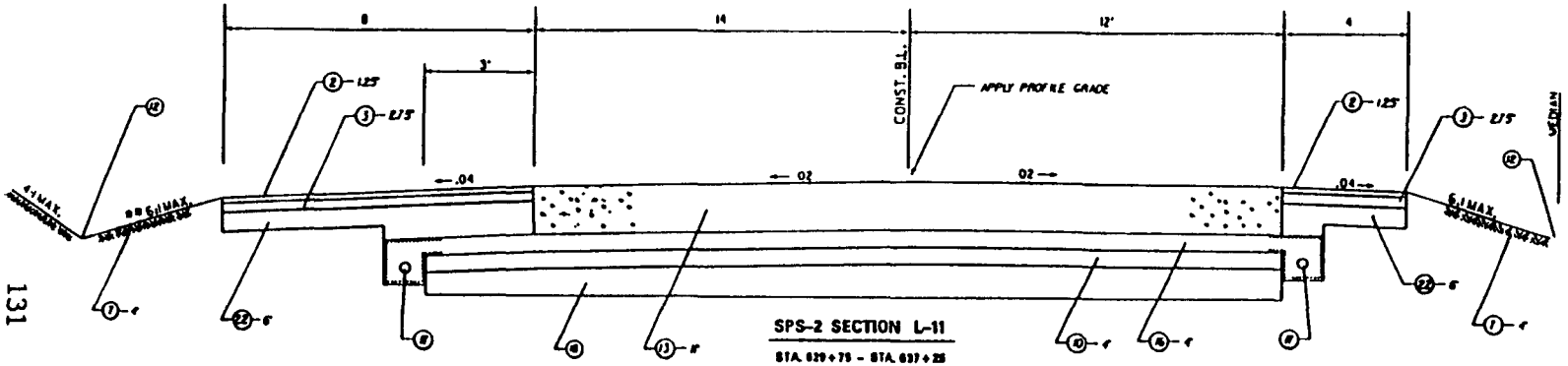
1. OPEN GRADED HOT MIX
2. HOT MIX HOT LAID BIT CONC. PAVT TYPE C
3. HOT MIX HOT LAID BIT CONC. PAVT TYPE B
4. EXISTING HOT MIX OVERLAY (APPROX 6")
5. BITUMINOUS CONCRETE BASE COURSE
6. REINFORCED ASPHALTIC MEMBRANE (F)
7. TOPSOIL, SEED AND MULCH TO LOC.
8. MILL PAVEMENT TO CONC SURFACE (WIDTH $1)
9. PORTLAND CEMENT CONCRETE PAVT
10. GRADED AGGREGATE BASE COURSE TYPE B
11. P.C.C. PARKWAY CURB, TYPE I MODIFIED
12. SEE PLAN GRADE AND OFFSET
13. PLAIN JOINTED CONCRETE PAVT (15 SLABS, 550 PSI FLEXURAL STRENGTH)
14. PLAIN JOINTED CONCRETE PAVT (15 SLABS, 900 PSI FLEXURAL STRENGTH)
15. LEAN CONCRETE BASE
16. PERMEABLE ASPHALT TREATED BASE
17. UNDERDRAIN 4" (SEE DETAIL)
18. BORROW TYPE A (MAX + 2' GRADE)
19. MILL PAVEMENT (4' WIDE X 0.5' DEEP)
20. REMOVE EXISTING LANE AND SHOULDER
21. P.C.C. SIDEWALK 6"
22. ALTERNATE SOIL CEMENT BASE OR GRADED AGGREGATE BASE COURSE TYPE B

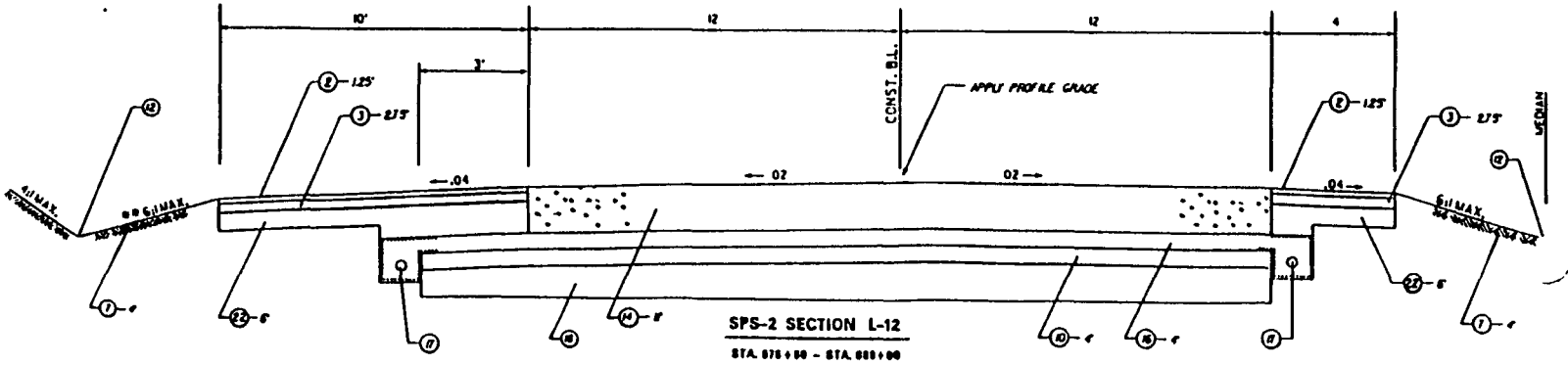
Figure 25

U.S. 113 . .
S224 TO MILFORD

REVISIONS







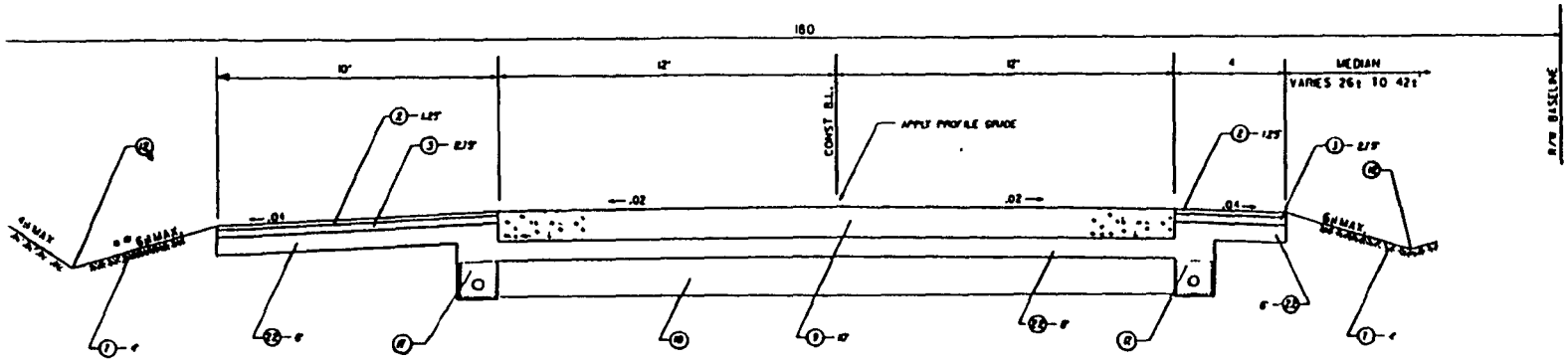
LEGEND

1. OPEN GRADED HOT MIX
2. HOT MIX, HOT LAID BIT CONC. PAVT TYPE C
3. HOT MIX HOT LAID BIT CONC PAVT TYPE B
4. EXISTING HOT MIX OVERLAY (APPROX 6")
5. BITUMINOUS CONCRETE BASE COURSE
6. REINFORCED ASPHALTIC MEMBRANE (F)
7. TOPSOIL, SEED AND MULCH TO LOC.
8. MILL PAVEMENT TO CONC SURFACE (WIDTH 5')
9. PORTLAND CEMENT CONCRETE PAVT
10. GRADED AGGREGATE BASE COURSE TYPE B
11. P.C.C. PARVIN CURB TYPE I MODIFIED
12. SEE PLAN GRADE AND OFFSET
13. PLAIN JOINTED CONCRETE PAVT (15 SLABS, 550 PSI FLEXURAL STRENGTH)
14. PLAIN JOINTED CONCRETE PAVT (15 SLABS, 900 PSI FLEXURAL STRENGTH)
15. LEAN CONCRETE BASE
16. PERMEABLE ASPHALT TREATED BASE
17. UNDERDRAIN (SEE DETAIL)
18. BORROW TYPE A (MAX. 2' 6" LIFTS)
19. MILL PAVEMENT (4' WIDE x 2.5" DEEP)
20. REMOVE EXISTING LANE AND SHOULDER
21. P.C.C. SIDEWALK 6"
22. ALTERNATE SOIL CEMENT BASE OR GRADED AGGREGATE BASE COURSE TYPE B

Figure 26

U.S.
S224 TO MILFORD

REVISIONS

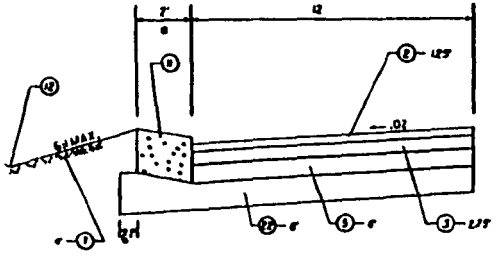


SOUTHBOUND TYPICAL SECTION

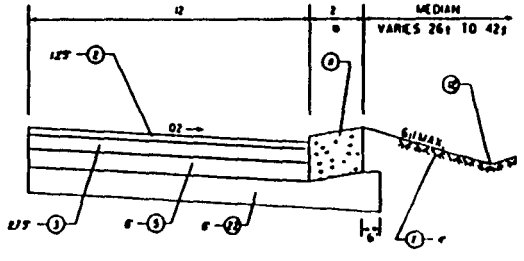
DELDOT TYPICAL RIGID PAVEMENT { STA. 696+00 – STA. 701+00
STA. 708+00 – STA. 712+00

SHRP SPS-2 SUPPLEMENTAL SECTION DE-10 STA. 702+00 – STA. 708+00
(TEST LENGTH STA. 702+00 TO 707+00)

SHRP SPS-2 SUPPLEMENTAL SECTION PD-10 STA. 691+00 – STA. 696+20
(TEST LENGTH STA. 691+20 TO 696+20)



RIGHT TURN LANE (SB)



LEFT TURN LANE (SB)

LEGEND

1. OPEN GRADED HOT MIX
2. HOT MIX HOT LAID BIT CONC PAVT TYPE C
3. HOT MIX HOT LAID BIT CONC PAVT TYPE B
4. EXISTING HOT MIX OVERLAY (APPROX 6")
5. BITUMINOUS CONCRETE BASE COURSE
6. REINFORCED ASPHALTIC MEMBRANE (F)
7. TOPSOIL, SEED AND MULCH TO LOC.
8. MILL PAVEMENT TO CONC. SURFACE (WIDTH 5')
9. PORTLAND CEMENT CONCRETE PAVT
10. GRADED AGGREGATE BASE COURSE TYPE B
11. P.C.C. PARKWAY CURB, TYPE 1
12. CONSTRUCT DITCH WHERE SHOWN SEE PLAN GRADE AND OFFSET
13. PLAIN JOINTED CONCRETE PAVT 15" SLABS, 550 PSI FLEXURAL STRENGTH)
14. PLAIN JOINTED CONCRETE PAVT 15" SLABS, 900 PSI FLEXURAL STRENGTH)
15. LEAN CONCRETE BASE
16. PERMEABLE ASPHALT TREATED BASE
17. UNDERDRAIN (SEE DETAIL)
18. BORROW TYPE A (MAX. 2 6" LIFTS)
19. MILL PAVEMENT 1.4' WIDE X 2.5' DEEP)
20. REMOVE EXISTING LANE AND SHOULDER
21. P.C.C. SIDEWALK 6"
22. ALTERNATE - SOIL CEMENT BASE OR GRADED AGGREGATE BASE COURSE TYPE B

* BUILD CURB ONLY WHERE SHOWN ON PLAN
** 4% MAX IN WETLAND AREAS

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Figure 27

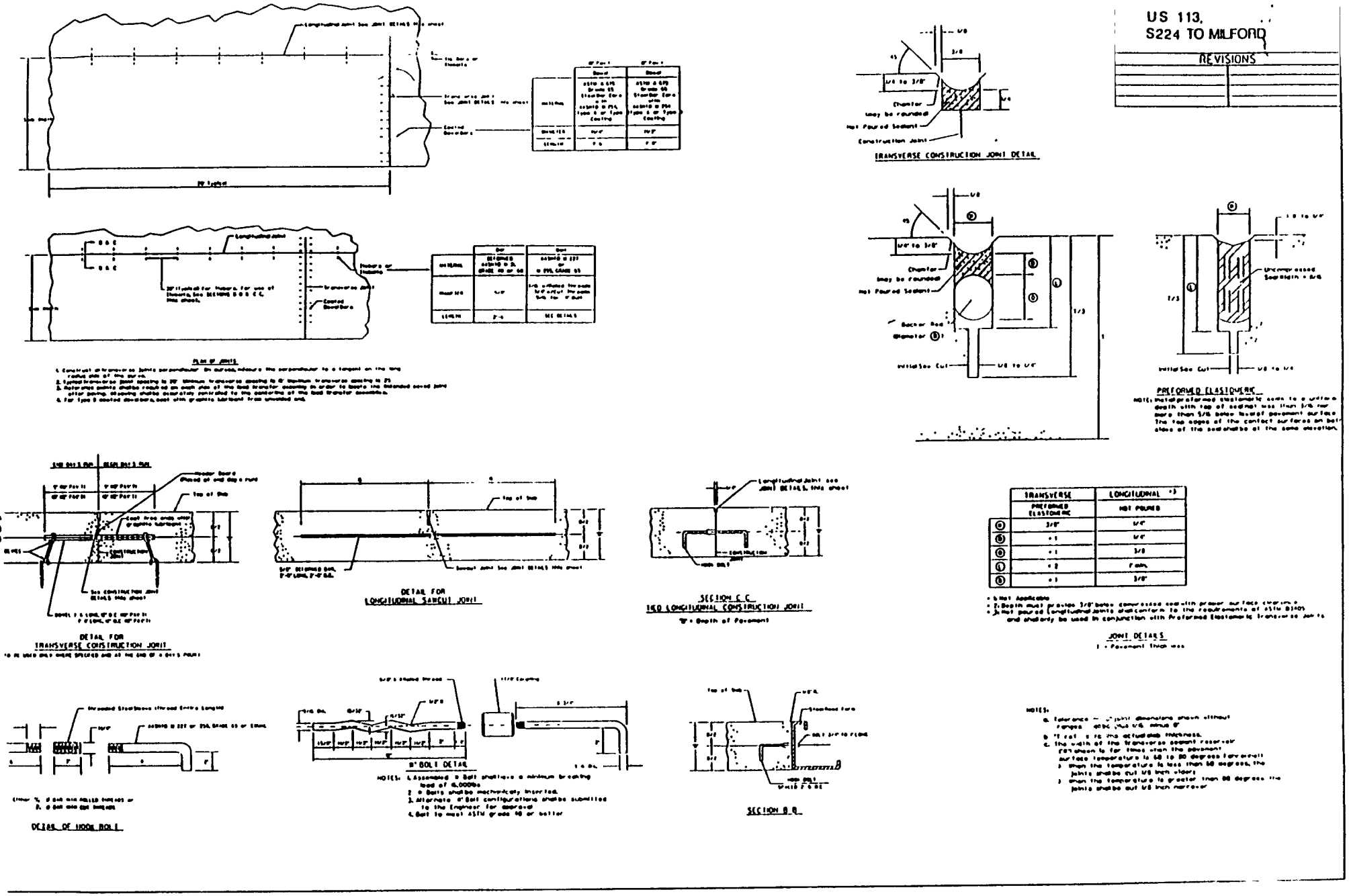
US 113,
S224 TO MILFORD
REVISIONS
TRANSVERSE CONSTRUCTION JOINT DETAIL
PREFORMED ELASTOMERIC
DETAIL FOR
TRANSVERSE CONSTRUCTION JOINT
DETAIL FOR
LONGITUDINAL SAWCUT JOINT
SECTION C C
160 LONGITUDINAL CONSTRUCTION JOINT
JOINT DETAILS
DETAIL OF HOOK BOLT
SECTION B B
133

Figure 28

APPENDIX A
Project Deviation Report

WIM RECENTLY INSTALLED

LTPP SPS Project Deviation Report — **State Code** 10

Project Summary Sheet — **Project Code** 0200

Project Classification Information

SPS Experiment Number: SPS 2 | State or Province: DELAWARE

LTPP Region: ☒ North Atlantic ☐ North Central ☐ Southern ☐ Western

Climate Zone: ☐ Dry-Freeze ☐ Dry-No Freeze ☒ Wet-Freeze ☐ Wet-No Freeze

Subgrade Classification: ☐ Fine Grain ☒ Coarse Grain ☐ Active (SPS-8 Only)

Project Experiment Classification Designation (SPS 1,2,8):

Construction Start Date: 9/20/93 | Construction End Date: 5/13/96

FHWA Incentive Funds Provided to Agency for this Project: ☒ Yes ☐ No

Deviation Summary

Site Location Deviations: ☐ No Deviations ☒ Minor Deviations ☐ Significant Deviations

Construction Deviations: ☐ No Deviations ☒ Minor Deviations ☐ Significant Deviations

Data Collection and Processing Status Summary

Inventory Data (SPS 5,6,7,9): ☐ Complete Submission ☐ Incomplete ☐ Data Not Available

Materials Data: ☐ All Scheduled Samples Obtained & Tested ☒ Incomplete / No Test Data

Contruction Data: ☒ All Required Data Obtained ☐ Incomplete / Missing Data Elements

Historical Traffic Data: ☐ All Required Historical Estimates Submitted (SPS 5,6,7,9) ☐ Required Estimates Not Submitted

Traffic Monitoring Equipment: ☒ WIM Installed On-Site ☒ AVC Installed On-Site ☒ ATR Installed On-Site ☐ No Equipment Installed

Traffic Monitoring: ☐ Preferred ☐ Continuous ☐ Minimum ☐ Below Minimum ☐ Site Related

Traffic Monitoring Data: ☐ Monitoring Data Submitted ☒ No Monitoring Data Submitted

FWD Measurements: ☐ Pre-Construction Tests Performed ☒ Construction Tests Performed ☒ Post-Construction Tests Performed

Profile Measurements: ☐ Pre-Construction Tests Performed ☒ Post-Construction Tests Performed

Distress Measurements: ☐ Pre-Construction Tests Performed ☒ Post-Construction Tests Performed

Maint. & Rehab. Data: ☐ Complete Submission ☐ Incomplete ☐ Data Not Available

Friction Data: ☐ Complete Submission ☒ Incomplete ☐ Data Not Available

Report Status

Materials Sampling & Test. Plan: ☒ Document Prepared ☒ Final Submitted to FHWA

Construction Report: ☒ Document Prepared ☐ Final Submitted to FHWA

AWS (SPS 1,2 & 8): ☒ AWS Installed ☒ AWS Installation Report Submitted to FHWA

LTPP SPS Project Deviation Report
Site Location Guidelines Deviations

State Code 10
Project Code 0200

☐ Comments Pertain to ALL Test Sections on Project

☒ Comments Pertain Only to Section(s): (Specify) 100201, 100203, 100204, 100205, 100207, 100208 100209 & 100211

Site Location Guideline Deviation Comments

Eight of the twelve test sections contained partial shallow cuts but the cut subgrades had to meet type 'A' borrow specifications. Those cut subgrades that did not meet the type 'A' specifications were excavated to receive 12 inches of type 'A' borrow (with prior approval).

Page 2 of 14 Preparer A. Rutka Date 7/12/96

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

☐ Comments Pertain to ALL Test Sections on Project

☒ Comments Pertain Only to Section(s): (Specify) 100212

Data Collection & Material Sampling and Testing Deviation Comments

A transverse construction joint was placed within this section.

 Preparer A. Rutka Date 7/12/96

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

☐ Comments Pertain to ALL Test Sections on Project

☒ Comments Pertain Only to Section(s): (Specify) 100211, 100203 & 100207

Data Collection & Material Sampling and Testing Deviation Comments

The longitudinal joint was sawn 5 days after the concrete placement.

 Preparer A. Rutka Date 7/12/96

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

[X] Comments Pertain to ALL Test Sections on Project

[ ] Comments Pertain Only to Section(s): (Specify) _____

Data Collection & Material Sampling and Testing Deviation Comments

Bases did not extend the full width of the shoulder (with prior approval).

Neoprene was used in the transverse joints (hot poured in three sections where the joints were rough) and hot poured rubberized asphalt in the longitudinal joint.

No joint sealant was used between the mainline concrete pavement and the asphalt shoulder.

Joint sealing was done in 1996 and in the second construction season.

The road was opened to construction traffic before joint sealing.

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

☐ Comments Pertain to ALL Test Sections on Project

☒ Comments Pertain Only to Section(s): (Specify) 100212, 100210, 100211 & 100209

Data Collection & Material Sampling and Testing Deviation Comments

Edge drains were not located at the outside edges of the shoulder.

Edge drain outlets were spaced at distances greater than 250 feet.

 Preparer _____ Date 7/12/96

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

☐ Comments Pertain to All Test Sections on Project
☒ Comments Pertain Only to Section(s): (Specify) 08, 12, 10, 02, 06, 07, 03, 11, 09, 01, 05

Construction Guidelines Deviation Comments

SEE ATTACHED TABLES - 25 mm FROM CONST REPORT

LAYER THICKNESS TOLERANCE

12 mm GABC, PATB, LCB

6 mm PCC

Page 7 of 14 Preparer Ed Leshuny Date 10/3/96

TABLE 25
DEL DOT SPS-2 US 113, MILFORD DE
Layer Thickness (ins.) - 5 Point Levels - 100200

Test Section	GABC		PATB		LCB		PCC		Total		Remarks
	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	Design	5 Pt. Level	
100259	8	7.89					10	10 20	18	18.1	
100204	6	6.24					11	11.04	17	17.3	
100208					6	6.00	11	12 00 ✓	17	18.0	
100212	4	3.72	4	3.72			11	12 40 ✓	19	19.8	
100210	4	4 32	4	3.84			8	8 30 ✓	16	16.5	
100202	6	6.48					8	8.76 ✓	14	15.2	Replaced PCC
100206					6	6.12	8	8 88 ✓	14	15.0	Replaced PCC
100207					6	6 84 ✓	11	11 34 ✓	17	18.3	
100203	6	6.12					11	11.74 ✓	17	17.9	
100211	4	3 84	4	3 72			11	11.75 ✓	19	19.3	
100209	4	3 36 ✓	4	4 75 ✓			8	8.22	16	16.3	Replaced PATB & PCC
100201	6	6 19					8	8.28 ✓	14	14.5	Replaced PCC
100205					6	5.52	8	9.12 ✓	14	14.6	Replaced PCC
100260	8	7.80					10	10.20	18	18.0	

TABLE 26
DEL DOT SPS-2 US 113, MILFORD DE
Comparison of LCB and PCC Thicknesses (ins.)
4" Cores, 5 Point Levels and Design

Test Section	LCB (6")		PCC			Remarks
	4" Cores	5 Pt. Levels	4" Cores	5 Pt. Levels	Design	
100259			10.75	10.20	10	
100204			10.47	11.04	11	
100208	5.99	6.00	11.08	12.00	11	
100212			11.71	12.40	11	
100210			8.02	8.30	8	
100202			8.45	8.76	8	Replaced PCC
100206	6.16	6.12	8.55	8.88	8	Replaced PCC
100207	6.05	6.84	11.42	11.34	11	
100203			11.55	11.74	11	
100211			11.14	11.75	11	
100209			8.51	8.22	8	Replaced PCC
100201			8.00	8.28	8	Replaced PCC
100205	6.06	5.52	8.59	9.12	8	Replaced PCC
100560			10.80	10.20	10	

9 B 14

LTPP SPS Project Deviation Report
Other Deviations

State Code 10
Project Code 0200

☐ Comments Pertain to All Test Sections on Project
☒ Comments Pertain Only to Section(s): (Specify) 01, 05, 09

Other Deviation Comments:

Cracks within the test section at the stations listed below were repaired by removing and replacing the concrete - all repairs full width

100201	617+39.6	617+43.6
	617+52.6	617+58.7
	617+82.6	617+88.7
	618+12.7	618+18.6
	618+42.6	618+48.6
	619+62.4	619+68.5
100209	624+52.5	624+58.2
	624+97.0	625+03.0
	626+77.0	626+83.0
100205	607+09.0	607+26.0
	607+76.3	607+56.1
	607+95.7	608+03.3
	608+29.2	608+38.9
	608+57.1	608+63.1
	609+47.2	609+53.2
	609+62.1	609+68.1
	609+92.1	610+98.2
	610+07.1	610+13.1
	610+22.2	610+28.2
	610+61.9	610+71.1
	610+96.8	611+02.8
	611+11.5	611+17.5
	611+28.6	611+45.7
	611+56.6	611+62.6
	611+71.7	611+77.7
	611+88.6	612+08.3

Page 10 of 14 Preparer EJ Lasswing Date 10/3/96

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 10 Project Code 0200

☐ Comments Pertain to All Test Sections on Project
☑ Comments Pertain Only to Section(s): (Specify) 07, 03, 11

Construction Guidelines Deviation Comments

550 FLEX ST. CONCRETE NOT USED ON SECTIONS 02, 03, 11 3000 PSI COMP USED INSTEAD

550 FLEX ST CONCRETE USED ON SECTIONS 01, 05, 09. CONCRETE REMOVED AND REPLACED WITH 650 FLEX ST CONC

SECTIONS 02 & 06 WERE PLACED WITH 900 PSI FLEX 6½ BAG MIX. CONCRETE WAS LATER REMOVED AND REPLACED WITH 900 PSI FLEX 7½ BAG MIX

 Preparer JD Lessing Date 10/3/96

LTPP SPS Project Deviation Report **Construction Guidelines Deviations**	State Code 10 Project Code 0200

☐ Comments Pertain to All Test Sections on Project
☒ Comments Pertain Only to Section(s): (Specify) 05

Construction Guidelines Deviation Comments

Profile Index greater than 10 in. per mile (24.9)

Note this section is scheduled for diamond grinding

Page 12 of 14 Preparer Ed Lesswing Date 10/3/96

LTPP SPS Project Deviation Report Data Collection & Material Sampling and Testing	State Code Project Code	10 0200

[X] Comments Pertain to ALL Test Sections on Project

[ ] Comments Pertain Only to Section(s): (Specify) _____

Data Collection & Material Sampling and Testing Deviation Comments

Tensile strength testing equipment was not obtained until after July 25, 1995 so cylinders and cores requiring this test prior to this time were missed.

365 day cores will not be obtained until the northbound lanes have been rehabilitated and opened to traffic.

Page 13 of 14 Preparer A. Rutka Date 7/12/96

LTPP SPS Project Deviation Report	State Code	10
Data Collection & Materials Sampling and Testing	Project Code	200

[x] Comments Pertain to ALL Test Sections on Project

[ ] Comments Pertain Only to Section(s): (Specify) _____

Data Collection & Materials Sampling and Testing Deviation Comments

Samples have been sent to the labs but the materials testing data available to date is not complete..

Page 14 of 14 Preparer A. Rutka Date 7/12/96

APPENDIX B

Concrete Pavement Performance Data For PCS/Law Forensic Study (Cover Letter Only, 3 Pages)

PAVEMENT
MANAGEMENT
SYSTEMS

October 3, 1995
50451110-13.08.2

Mr. Monte Symons
Federal Highway Research Administration
LTPP, HNR-40
Turner Fairbanks Research Center
6300 Georgetown Pike Room F215
McLean, Virginia 22101-2296

RE: DE SPS-2 Report on US 113, Concrete Pavement Performance Data for the Forensic Study by PCS/Law

Dear Mr. Symons:

This is in response to your Fax of July 21, 1995 to Bill Phang/Ivan Pecnik, and Gary Elkins letter of the same date to you on the above subject.

Three sections of thin low-strength (550 psi flexural strength) concrete made with 4 bags of Portland cement (100201, 100205, 100209), and three sections of thin high-strength (900 psi flexural strength) concrete made with 6-1/2 bags of a 65% Portland cement/35% NEWCEM slag cement mix (100202, 100206, 100210) developed early cracking.

Five of the six sections mentioned above (100201, 100205, 100209, 100202, 100206) have been removed and will be replaced later this fall. The fall time frame is the result of the fact that replacement dowel baskets will not be available until sometime in October. Sections 100201, 100205, 100209 will be replaced with a 6 bag mix while sections 100202 and 100206 will be replaced with a 7-1/2 bag mix. The cracks in section 100210 (two in the monitoring area) will be repaired by removing and replacing the concrete for three feet on either side of the crack. Concrete removal operations will require the repair of the lean concrete base under sections 100205 and 100206, the addition of material to and re-grading of the GABC under sections 100201 and 100202 and the replacement of the majority of the PATB under section 100209.

Gary Elkins correspondence of July 21, 1995 requests that certain data be gathered and submitted to PCS/Law. We are submitting the following information to PCS/Law with Dr. Rada's c.c.:

415 LAWRENCE BELL DRIVE
UNIT #3
AMHERST, N.Y 14221
TEL (716) 632-0804
FAX (716) 632-4808

- Delaware SPS-2 Report on US 113 - Concrete Pavement Performance Data for the Forensic Study by PCS/Law

This report includes the following Tables/Appendices:

Table 1 SPS-2 Layout Plan

Table 2 Summary of Crack Survey

Table 3 Concrete Test Results - Cylinders and Beams

Table 4 Concrete Test Results - LCB

Table 5 Concrete Core Test Results

Table 6 Milled Areas 100205, 100206

Appendix A Information package prepared for meeting with Gary Elkins.

Appendix B Memorandum from Gary Elkins to Monte Symons dated June 21, 1995.

Appendix C Laboratory data sheets for the concrete test results for cylinders and beams.

Appendix D Laboratory data sheets for the LCB cores.

Appendix E Laboratory data sheets for the concrete surface cores and for the LCB cores below the surface cores.

Appendix F Construction data sheets 15, 16, 18, 19, 20 and 21 for all of the test sections.

Appendix G Distress survey maps for 100205 and 100206 for the milled areas of the LCB.

Appendix H Crack maps and observations during/after concrete break-up operation. The above observations are for the five sections that will be replaced (100201, 100202, 100205, 100206, 100209).

Also included is a crack map for section 100210 (this section will be repaired) and a video showing the break-up of the five sections which will be removed.

Should you need additional information, please advise.

Yours Sincerely,

Ed Lesswing

Ed Lesswing
Project Engineer
Pavement Management Systems Limited

EL/tf

enclosure (report only)

C.C. G. Rada, PCS/Law, w/enclosures
I.J. Pecnik, P.E., R.E., NARO, w/o enclosures
F. Meyer, NARO, w/o enclosures
W. Kling, DEL DOT, w/ enclosure, (report only)
A. Rutka, NARO, w/ enclosure, (report only)
W.A. Phang, D. Eng., w/o enclosures

APPENDIX C
Photographs

Photo 1 - Plate Load Bearing Test Equipment in place just prior to testing.

Photo 2 - Station 649+50 facing north. Water tank in use prior to compaction of DGAB.

Photo 3 - Station 681+00. PATB paving train-truck, shuttle buggy, paver and roller.

Photo 4 - Station 667+25 facing north. PATB has been placed on the passing lane. Driving lane is primed and awaiting PATB.

Photo 5 - Overall view of transition from 12' to 14' pavement at Station 629+75.

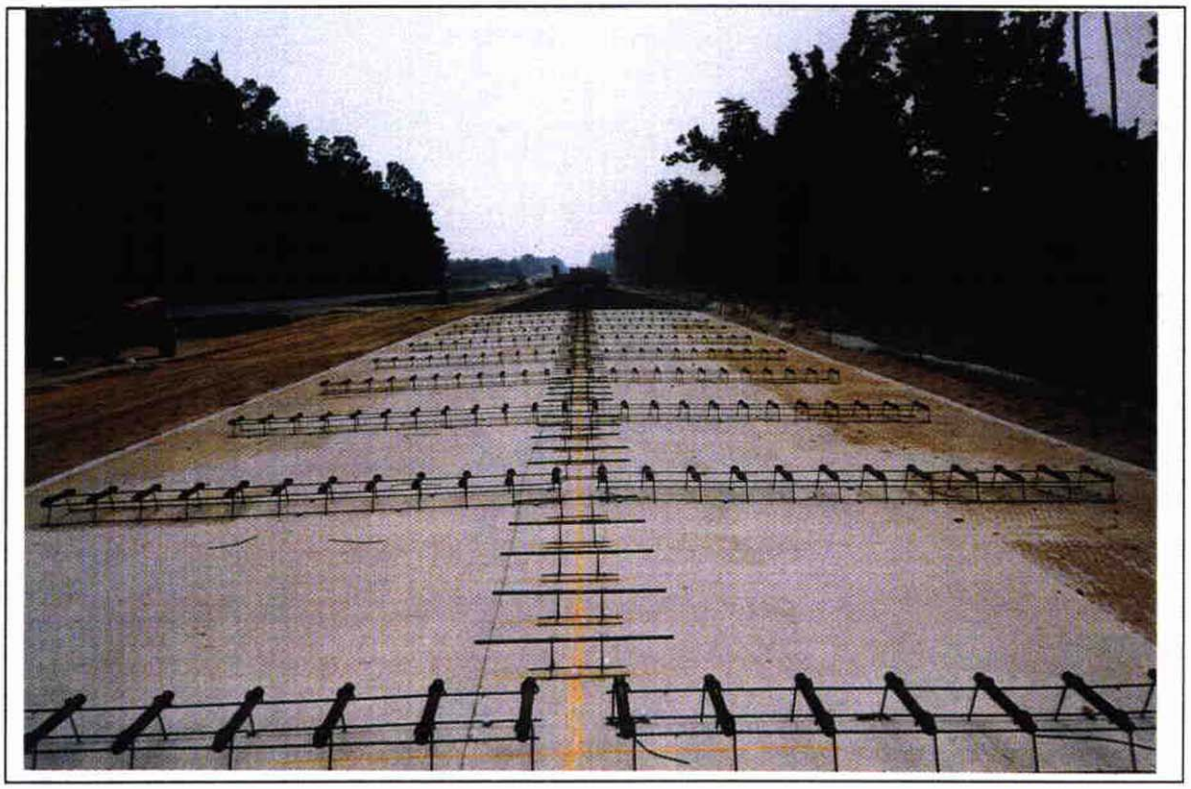

Photo 6 - Station 689+70 facing south. Partial view of test sections 100208 and 100212 showing dowel baskets on LCB. Note milling in both lanes required for paver.

Photo 7 - Station 651+75. Loading wheel barrows for DELDOT tests.

Photo 8 - Station 651+75. View of field sampling - beams, cylinders, etc.

Photo 9 - Test Section 100205. Finishing pavement edges behind the paver. Due to harsh mix, finishers are well behind the paver.

Photo 10 - Station 623+95. Outside shoulder. The crack at the edge is 4" from the joint and extends to the center line.