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LTPP Specific Pavement Studies

Construction Report on
LTPP 890900 and 89A900,
SPS-9A Projects,
Jonquiere, QE, Fall of 1996

Report No. FHWA-TS-98-89-02 **April 1998**

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16. Abstract

This report provides a description of the construction of SPS-9A experiments, SUPERPAVE™ asphalt binder study, field validation of the asphalt specifications and mix design, conducted as part of the Federal Highway Administration (FHWA) Long Term Pavement Performance (LTPP) program in Jonquiere Quebec The construction of six asphalt concrete pavement test sections, three in the West Bound (new construction) and three on the East Bound (overlay construction), started in February 1996 and was completed in September 1996 The construction started in the West Bound with preparing the subgrade/embankment layer followed by a granular subbase and base layers then paving the asphalt concrete binder layer Construction then started in the existing East Bound where embankment and granular subbase were placed on the existing AC of section 02 followed by a granular base layer on all three sections and paving the AC binder layer The surface layer was finally paved in the East Bound lanes first followed by the West Bound lanes using the QE standard mix with PG 52-34 for section 01, SUPERPAVE™ mix with PG 52-40 for section 02, and SUPERPAVE™ alternative mix with PG 52-34 for section 03 This report contains a description of the unbound pavement layers preparation, the paving operations, the equipment used by the contractor, the field sampling and testing operations during and after construction, the laboratory gyratory compacted samples preparation and testing, problems encountered during construction, specific site circumstances, deviations from the standard guidelines, and a summary of the initial data collection

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Construction Report on LTPP 890900 and 89A900, SPS-9A Projects, Jonquiere QE, Fall of 1996

I. Introduction

This report describes the construction of the SPS-9A projects, SUPERPAVE™ asphalt binder study, at Jonquiere QE. SUPERPAVE™ is a mix design system which incorporates previous experience (Level I) and through use of material test results of both binders and mixes enables the designer to predict the performance of the pavement in terms of occurrence of rutting, fatigue cracking, and low temperature transverse cracking (Levels II and III). SUPERPAVE™ was developed by the Strategic Highway Research Program (SHRP). The SPS-9A experiment was developed by the Federal Highway Administration (FHWA) Long Term Pavement Performance (LTPP) Division in cooperation with federal, state, and provincial highway personnel The experiment design requires a minimum of 3 test sections to be constructed at each location of 32 projects in the experiment, as indicated by the unshaded cells in Table 1, representing specific combinations of average temperatures, temperature extremes, and moisture conditions. Construction can include new construction, reconstruction or overlay The minimum three test sections should consist of section 01, agency's standard mix, section 02, SUPERPAVE™ design mix, and section 03, SUPERPAVE™ design mix with alternative binder with a grade either higher or lower than the required SUPERPAVE™ binder such that the performance characteristic of interest relative to the climate and pavement structure (either fatigue, low temperature or permanent deformation) may be expected to exhibit deterioration earlier in the service life of the pavement Since this is a material comparison study, the pavement structure and thickness should be the same for all the test sections Supplemental sections could be added to investigate additional experimental factors of specific agency interest

The objectives of the SPS-9A experiment are to observe the performance of SUPERPAVE™ mixes as well as comparable agency mixes, and to verify the asphalt binder selection procedure in SHRPBIND, which is a process for determining the environment (high and low temperatures) in which the pavement is constructed and will function Table 2 lists the projects at five locations in the LTPP North Atlantic (NA) region where the SPS-9A experiment is being implemented, and where the SHRPBIND was used to display the PG asphalt grades from a particular weather station location showing the 50% and 98% reliability based on the temperature records at each site Table 3 is another listing of these NA projects and the binder selection method used The agencies participation in this experiment depends on the availability of equipment to fulfill the performance and volumetric testing requirements as summarized in Table 4 The Quebec Ministry of Transportation (MTQ) projects lie in the wet-freeze environmental area with a fine grained silty clay subgrade/embankment material The west bound new construction project 890900 involved building three sections, 890901 QE standard mix with PG 52-34 asphalt cement, 890902 SUPERPAVE™ mix with PG 52-40 asphalt cement, and 890903 SUPERPAVE™ alternative mix with PG 52-34 asphalt cement The east bound overlay project 89A900 involved building another set of three sections, 89A901 QE standard mix with PG 52-34 asphalt cement, 89A902 SUPERPAVE™ mix with PG 52-40 asphalt cement, and 89A903 SUPERPAVE™ alternative mix with PG 52-34 asphalt cement.

The project is built on the West Bound and East Bound lanes of NR 170 just 10 kms west of the city of Jonquiere, 24 kms west of the city of Chicoutimi, and approximately 240 kilometers north of Quebec city, Figure 1 has site location maps for this project. The west bound three test sections are constructed adjacent to each other in series starting at the construction chainage of 25+937 and ending at 24+660 (construction stationing is in meters and increasing west to east) The LTPP station 0+00 of the first section 890903 being at construction station 25+937, and the LTPP station 0+152 of the last section 890901 being at construction station 24+660, Figure 2 and Table 5 The east bound three test sections are constructed adjacent to each other in series starting at the construction chainage of 24+843 and ending at 25+930 (construction stationing is in meters and increasing west to east). The LTPP station 0+00 of the first section 89A903 being at construction station 24+843, and the LTPP station 0+152 of the last section 89A901 being at construction station 25+930, Figure 3 and Table 5. Each section is 152.4 meters long and 3.7 meters wide. The West Bound and East Bound outer shoulders, adjacent to the test sections, are paved 3 0 meter wide shoulders. The inner shoulders of NR 170 are constructed with a paved width of 1 2 m.

The project was built as part of the Quebec Ministry of Transportation, Project No 3671-95-0906 "Overlay of 2 36 km of the Existing East Bound Lanes of NR 170 and Constructing 2.36 km of the New West Bound Lanes of NR 170" located west of the city of Jonquiere. The project was advertised for bids in September 1995 using MTQ standard contract administration and construction procedures. The contract was awarded to Excavation De Chicoutimi, Inc. of Chicoutimi, QE in December 1995 for the value of CD$ 3,454,965 00 The Notice to Proceed was designated as January 8, 1996 while the date of completion of all construction was July 15, 1997

On July 19 and 20, 1996 an extreme storm resulted in heavy rainfall throughout the Saguenay-Lac St Jean region of Quebec, 250 kilometers north of Quebec City, where the SPS-9A sites are located Runoff caused rivers throughout the area to rise dramatically to flood levels, in some cases producing discharges well in excess of previously recorded maximum flows Homes in La Baie were destroyed when raging waters crushed one of the earthen dikes of the Stone-Consolidated dam, built in 1908 at the mouth of Lac des Ha! Ha! The flooding had severe effects locally along the valleys, homes were inundated, damaged and destroyed, dams were overtopped and damaged, reservoirs were drained, bridges and roads were washed out, and extensive bank and floodplain erosion occurred. The disaster took the lives of 10 people and forced some 16,000 from their homes. More than 500 houses were destroyed and another 850 were severely damaged, factories and tourist resorts were knocked out as were sewer and water systems. The total estimated cost of the disaster was approximately CD$700 million Flood damage at the SPS-9A sites was repaired during August of 1996 Three areas were washed out, 25+155 - 25+169, 25+369 - 25+394 and 25+637 - 25+642, none of these was inside the monitoring area of any of the six SPS-9A sections

A Pre-Construction meeting was held at the Ministry of Transportation in Quebec City on Thursday September 5, 1996 to discuss the details of the preparations for the construction of this project in Jonquiere QE. Attendees were from MTQ Projects Department Saguenay-Lac St Jean region, MTQ Pavement Department, MTQ Pavement Laboratory, and LTPP North Atlantic Regional Office (NARO). By this time the AC binder layer was already placed on both sides of the road. The details of the sampling and field testing was also discussed and the necessary preparation of the insulated containers to take the samples to the lab for immediate gyratory compaction. The laboratory testing to be performed by the MTQ, the quantity of material required for each of the tests, and the quality control concerns were also discussed. A project showing meeting was held on site on the afternoon of the same day Mr. Jean-Pierre Boivin, the MTQ project engineer and Mr. Basel Abukhater of ITX Stanley Ltd., the North Atlantic Region Coordinating Office (NARCO), met on site and went over the details of paving and sampling and the necessary arrangement needed to fulfill the SPS-9A guidelines and come out with a product acceptable by the Federal Highway Administration (FHWA) Long Term Pavement Performance (LTPP) Division.

On site and in charge of the construction work was Mr. Jean-Pierre Boivin MTQ project engineer and Mr. Luc Gaudreault MTQ project inspector From the MTQ Laboratory Department were Ms. Marina Beaudoin, Mr. Denis Proteau, Mr. Marc Perron, Mr. Serge Charron, and Mr. Jacques Samson who all handled all the material sampling on site as well as the gyratory compaction and the laboratory testing required. All the lab testing was performed at the MTQ Laboratoire des chaussees in Quebec City QE (LTPP Laboratory Assigned Code 8921), Secteur Laboratoire de Quebec also in Quebec City QE (LTPP Laboratory Assigned Code 8922), the FHWA Contractor Laboratory, Braun Intertec in Minneapolis MN (LTPP Laboratory Assigned Code 2711), and the Superpave Regional Test Center, pending finalizing the level III testing to be performed on gyratory samples and cores from the Superpave™ test sections

The Excavation De Chicoutimi Inc. subcontracted Inter-Cite Construction Ltd. to perform all the paving on this job Inter-Cite used asphalt from their drum asphalt plant in Larouche, QE The hauling distance between the SPS-9A sites and the plant is 10-13 kms and takes 7-9 minutes travel time This four bin portable drum mix asphalt plant is manufactured by Boeing model number MS100, the MTQ number is 125 The AC cement used in the AC surface layer was PG 52-40 for the Superpave™ sections 02, and PG 52-34 for the Superpave™ alternative sections 03 and the QE agency sections 01 For the AC binder layer PG 52-34 was used for all the sections in the West Bound new construction part 890900 and penetration grade 80/100 was used for all the sections in the East Bound overlay part 89A900 All mix designs used in this project are included in Appendix A. Photos of the asphalt plant taken on September 18, 1996 are included in Appendix B.

Three pavers were used at the same time during paving Two Barber Greene pavers model BG-245B were used, the first to pave the 1 2 m inner shoulder and the 3 7 m passing lane and the second to pave the 3 7 m slow SPS-9A lane The third paver was a Cedarapids model BCF-2 which was used to pave the 3 0 m outer shoulder The hauling trucks were supplying all three pavers simultaneously with the asphalt mix thus causing some delay in paving. Three rollers were also used for compaction, the breakdown roller was a Drum Vibratory Dynapac Roller model CC 42A, working weight 10258 kg, the intermediate roller was a rubber tire Dynapac Roller model CP 221, maximum weight 21370 kg and tire pressure of the 3 front and 4 back tires is 80 psi per tire The third final roller was a Drum Vibratory Dynapac Roller model CC 21A, working weight 6500 kg. The equipment used on the granular base, subbase and embankment layers included a

Caterpillar vibratory single drum roller model CS-553, operating weight 10780 kg, a 1967 CAT D9G Bulldozer, a 1992 Komatsu D 355A Bulldozer, and a 1988 Ingersoll Rand SP 56DD roller. Some of the specification sheets for this equipment are included in Appendix A.

II. Project Details

West Bound New Construction 890900 Layout

The three main LTPP SPS-9A sections are laid in series starting with section 890903, Superpave™ alternative design with PG 52-34 asphalt cement, with its beginning station 0+00 at construction station 25+937 followed by section 890902, Superpave™ design with PG 52-40 asphalt cement, with its beginning station 0+00 at construction station 25+602 and finally section 890901, Standard MTQ mix design with PG 52-34 asphalt cement, with its beginning station 0+00 at construction station 24+812 and its last station 0+152 at construction station 24+660, Figure 2 and Table 5. Sampling areas ranging in length form 48 m to 100 m on both sides of each section were paved with the same design to be used for coring at six intervals, the first interval is A at 0 months right after paving and the next is B at 6 months, C at 12 months, D at 18 months, E at 24 months, and finally F at 48 months.

East Bound Overlay Construction 89A900 Layout

The three main LTPP SPS-9A sections are laid in series starting with section 89A903, Superpave™ alternative design with PG 52-34 asphalt cement, with its beginning station 0+00 at construction station 24+843 followed by section 89A902, Superpave™ design with PG 52-40 asphalt cement, with its beginning station 0+00 at construction station 25+178 and finally section 89A901, Standard MTQ mix design with PG 52-34 asphalt cement, with its beginning station 0+00 at construction station 25+778 and its last station 0+152 at construction station 25+930, Figure 3 and Table 5 Sampling areas ranging in length form 63 m to 78 m on both sides of each section were paved with the same design to be used for coring at six intervals, the first interval is A at 0 months right after paving and the next is B at 6 months, C at 12 months, D at 18 months, E at 24 months, and finally F at 48 months

Field Materials Sampling and Testing

Locations for field material sampling and testing are summarized in Figures 4 through 6 for 890900 and Figures 7 through 9 for 89A900 Seven stages of field material sampling and testing are required here, first, before construction or paving, on the granular subgrade/embankment, subbase, and base layers This stage involves pushing shoulder auger probes to 6 m depth to check the depth to rigid layer and collecting bulk and moisture samples from the unbound subbase, base, and subgrade layers The second stage of sampling and testing, performed during construction or paving, involves measuring the density, using the nuclear gauge, of the AC binder and surface layers and taking levels on the finished binder and surface layers as well as collecting hot mix samples of the binder layer and the surface layer and constituent aggregate and asphalt cement for laboratory testing and preparing lab mixed gyratory samples Also this stage involves collecting combined aggregate sample and asphalt cement to be sent to the LTPP Materials Reference Library (MRL) for storage The first interval of coring right after construction, referred to as interval A at time = 0 months, is also part of the second stage of sampling.

The third to seventh stages of sampling only require collecting 152 mm cores before and after each of the sections, these are performed at specific intervals starting at interval B at time = 6 months, then interval C at time = 12 months, then interval D at time = 18 months, then interval E at time = 24 months, and finally interval F at time = 48 months. The field testing is summarized in Table 6 and the material sampling is summarized in Table 7, while Table 8 lists the asphalt, aggregate, and mix bulk sampling performed during construction for laboratory testing and for shipping to MRL.

The sampling of hot mix in the field from plant or paver and the subsequent handling and preparation of gyratory compacted specimens at the required compaction temperature can pose problems. There is a need for consistency in the temperature regime experienced by the mix until compaction, particularly for the 28 Gyratory Compacted Specimens (GCS), collected from the SUPERPAVE™ section 02, which are intended for performance testing. The six Quality Control samples, each of about 6 to 6 5 kilograms, should be immediately placed into an insulated container and delivered to the laboratory for GCS compaction.

Laboratory Materials Testing

The laboratory material testing plan for each of the subsurface unbound layers and the combined aggregate and asphalt cement is summarized in Table 9 The LTPP test designation and Protocol number for each test is tabulated and so are the number of tests per layer and material source or test or sample location For the AC surface layer, three main sets of samples are prepared and tested so that the aging characteristics of the binder and mix can be assessed. The constituent aggregate and asphalt cement are used to prepare a lab mixed lab compacted set for comparison with the plant mixed lab compacted set and the plant mixed field compacted set (cores) The gyratory compactor is used for preparing the lab and field specimens using AASHTO TP4 procedure Three gyration levels are of interest, N_{ini} (initial number of gyrations), N_{des} (design number of gyrations), and N_{max} (maximum number of gyrations) The range of values for N_{ini}, N_{des}, and N_{max} is shown in Table 10A which are based on the appropriate traffic loading and environmental conditions The actual values for N_{ini}, N_{des}, and N_{max} for the NA region SPS-9A projects, including the QE sites, are listed in Table 10B

For sections 01 and 03, 9 lab mixed lab compacted gyratory specimens are required from each test section of both projects, 3 of which to be compacted at N_{max} and 6 at 7% air voids From the same sections, 6 plant mixed lab gyratory compacted specimens are required at N_{max} Also 1 lab mixed loose AC sample is kept for maximum specific gravity determination, and 2 plant mixed loose AC samples are collected for maximum specific gravity determination and extraction to determine the asphalt content and the extracted aggregate gradation The laboratory tests, LTPP test designation, LTPP protocol, number of tests per section, and the source of material or specimen are listed in Table 11

For the SUPERPAVE™ sections 02, 40 lab mixed lab compacted gyratory specimens are required from each test section of both projects, 6 of which to be compacted at N_{max}, 2 at 3% air voids , and 32 at 7% air voids From the same sections, 34 plant mixed lab gyratory compacted specimens are required, 6 of which at N_{max}, 2 at 3% air voids, and 26 at 7% air voids. Also 1 lab mixed loose AC sample is kept for maximum specific gravity determination, and 3 plant mixed loose AC samples are collected for maximum specific gravity determination and extraction to determine the asphalt content and the extracted aggregate gradation The laboratory tests, LTPP test designation, LTPP protocol, number of tests per section, and the source of material or specimen are listed in Table 12.

The laboratory testing on the cores for all the sections and all the intervals are listed in Table 13. From each section at each interval 8 152 mm diameter cores are tested except for the SUPERPAVE™ sections 02 at interval A where 34 cores were collected from each project.

In addition to the MTQ Laboratoire des chaussees in Quebec City QE (LTPP Laboratory Assigned Code 8921) and the Secteur Laboratoire de Quebec also in Quebec City QE (LTPP Laboratory Assigned Code 8922), some of the testing, especially the Resilient Modulus, Tensile Strength, and Creep Compliance will be performed by the FHWA-LTPP Contractor Laboratory, Braun Intertec in Minneapolis, MN (LTPP Laboratory Assigned Code 2711) and the Superpave Regional Test Center, the latter pending finalizing the level III testing to be performed on the gyratory samples and cores from the Superpave™ test sections. Table 14 lists the lab, field, and core samples from each of the two projects and the laboratory assigned for testing each sample.

Table 15 lists the dates of all the field testing and sampling activities before, during, and after construction at various periods Table 16 lists the actual dates as compared to the guidelines for the initial monitoring activities performed after construction of the SPS-9A sites.

III. Construction

The construction started with the new construction sections 890900 on the west bound lanes in February 1996. More than 3 m of rock was blasted from the middle Superpave™ section 890902 and the blasted rock was used to fill the areas where sections 890901 and 890903 are constructed Section 890901 was filled with 0 7 - 2 0 m of blasted rock and section 890903 was filled with 1 1 - 4 8 m of blasted rock. Paving of the AC binder layer on the west bound lanes was completed last week of June 1996 after which traffic was shifted to this side and construction started on the east bound existing lanes.

Table 17 lists all the dates of the construction activities for all the sections Excavation De Chicoutimi Inc. used a 1967 CAT D9G and a 1992 Komatsu D355A bulldozers for the subgrade/embankment preparation A 1988 Ingersoll Rand SP-56DD was used for the base/subbase preparation for aggregates with sizes 0-114 mm, 0-64 mm, and 0-19 mm. A Caterpillar single-drum smooth vibratory soil compactor with drum drive model CS-553 was used for base/subbase compaction for aggregates with sizes 0-64 mm and 0-19 mm For paving, three pavers were used, two Barber Greene BG-245B were used for the main line paving and a Cedarapids BCF-2 was used for paving the outside shoulders Three rollers were used for compaction, the breakdown roller was a Dynapac CC 42A 2-wheel steel drum vibratory roller, working weight 10258 kg, the intermediate roller was a Dynapac CP 221 rubber tire roller, maximum operating weight 21370 kg, and the final roller was also a Dynapac CC 21A 2-wheel steel drum vibratory roller, operating weight 6500 kg. Table 18 lists the dates, times, layer paved, thickness, number of times and value of the laydown temperature, air temperature, and weather condition during paving. Figure 10 also shows the surface layer paving dates, times, and sample locations

Nuclear gauge densities were measured on the binder and surface AC layers, the values are tabulated in Table 19 Cores drilled from the sampling areas of each of the six sections at three intervals, interval A (time = 0 months), interval B (time = 6 months), and interval C (time = 12 months), are recorded in Table 20, showing the total thickness, binder and surface, of each of the cores. Rod and Level elevation shots were taken on top of the binder and surface AC layers. Figure 11 shows the location of the elevations measurements, both for the east bound 89A900 overlay project and the west bound 890900 new construction project. Five shots were taken across the width of the SPS travel lane at 15.24 m intervals starting at station 0+00 and finishing at station 0+152, total 55 shots per section per layer. Figure 12 also shows the pavement structure and the two stages of the rod and level elevation measurements. The thickness of the surface layer at these locations and the average, minimum, maximum, and standard deviation are listed in Table 21 Table 22 is a summary of the thickness measurements from the elevations and the cores at the three intervals and how much deviation from the design thickness exist.

Subgrade/Embankment Preparation - West Bound - 890900

Subgrade/embankment preparation started on February 4, 1996 with section 890903 On February 13 work began in section 890902 and on February 15, 1996 the work began on section 890901. More than 3 m of rock was blasted from the middle Superpave™ section 890902 and the blasted rock was used to fill the areas where sections 890901 and 890903 are constructed. Section 890901 was filled with 0 7 - 2.0 m of blasted rock and section 890903 was filled with 1 1 - 4 8 m of blasted rock The subgrade/embankment work was completed on June 4, 1996 for sections 890901 and 890902, while section 890903 was completed on June 10, 1996

Shoulder auger probes were performed on May 13, 1997 to determine if bedrock or other significantly dense layers exist This information is needed for the analysis of the deflection measurements. The probes were augered in the outside shoulder close to the middle of each of the 3 sections, Figures 4-6 If rock or any other dense layer is encountered in the top 6 m, a refusal occurs and the augering is terminated Sections 890901 and 890903 had refusals at depths 0 9 m and 1 05 m respectively due to large stone/boulders at these depths Section 890902 had a refusal at 1 0 m due to bedrock existence Also on the same date, bulk and moisture samples of the subgrade/embankment layer were collected and were sent to the QE MTQ for testing as indicated in Table 9

Subgrade/Embankment Preparation - East Bound - 89A900

Upon completion of the paving of the AC binder layer on the west bound lanes, last week of June 1996, traffic was shifted to this side and construction started on the east bound existing lanes

Blasted rock was used to raise the grade of section 89A902. A thickness ranging from 1257 mm to 1636 mm was used to raise the grade to the desired level before placing the subbase and base layers Sections 89A901 and 89A903 did not require any embankment filling to raise the grade

Shoulder auger probes were performed on May 13, 1997 to determine if bedrock or other significantly dense layers exist This information is needed for the analysis of the deflection measurements The probes were augered in the outside shoulder close to the middle of each of the 3 sections, Figures 7-9 If rock or any other dense layer is encountered in the top 6 m, a refusal occurs and the augering is terminated Sections

89A902 and 89A903 had refusals at depths 1.3 m and 1.8 m respectively due to large stone/boulders at these depths. Section 89A901 had no refusal and the augering was completed to the 6 m required depth.

Subbase/Base Preparation - West Bound - 890900

Subbase/base preparation started on June 4, 1996 with sections 890901 and 890902. On June 10 work began in section 890903. 300 mm of crushed gravel was first placed as a subbase layer over the three sections followed by a base layer of 376 mm of the same crushed gravel material placed in two lifts, first lift 229 mm and second lift 147 mm. The subbase/base work was completed on June 19, 25, and 27, 1996 for sections 890901, 890902, and 890903 respectively.

Bulk and moisture sampling of the subbase/base layers were collected on May 13, 1997 and were sent to the QE MTQ for testing as indicated in Table 9.

Subbase/Base Preparation - East Bound - 89A900

Upon completion of the embankment layer used to raise the grade of section 89A902, 300 mm of crushed gravel was placed as a subbase layer. Sections 89A901 and 89A903 did not have a subbase layer. A base layer of the same crushed gravel material was placed in two lifts on all three sections. Section 89A901 had a first lift ranging from 229 to 240 mm and second lift ranging form 50 to 240 mm, section 89A902 had a first lift of 229 mm and second lift of 147 mm, and section 89A903 had a first lift ranging from 229 to 245 mm and second lift ranging form 91 to 245 mm.

Bulk and moisture sampling of the subbase/base layers were collected on May 14, 1997 and were sent to the QE MTQ for testing as indicated in Table 9

AC Dense Graded Binder Layer Preparation - West Bound - 890900

Binder layer paving on the new construction west bound lanes started on June 26, 1996 in section 890901 and was completed on June 28, 1996 with section 890903 A standard QE MTQ mix, with PG 52-34 asphalt cement, was used on all three sections (Job Mix Formula in Appendix A). Table 18 lists the paving dates, laydown temperatures and the weather condition during paving. Bulk samples of the binder layer were only collected from the SUPERPAVE™ section 890902 and were sent to the FHWA-LTPP Materials Reference Library MRL for storage as indicated in Table 8 and Figure 5 The guidelines of the SPS-9A experiment do not require sampling and testing of the binder layer as is required of the surface layer Three nuclear gauge density measurements were performed on the binder layer of all the sections at 1 5 m offset from the edge of pavement, at station 0+30, 0+76, and 0+122, Figures 4-6 The results from these measurements are tabulated in Table 19

Elevation shots were collected on the surface of this layer, Figure 12 Elevation 1 No elevation measurements were taken before placing the binder layer, thus no record exist of the binder layer thickness from the elevation readings

AC Dense Graded Binder Layer Preparation - East Bound - 89A900

Binder layer paving on the overlay east bound lanes started on September 3, 1996 in section 89A901 and was completed on September 5, 1996 with section 89A903 A standard QE MTQ mix, with 80/100 penetration asphalt cement, was used on all three sections (Job Mix Formula in Appendix A). Table 18 lists the paving dates, laydown temperatures and the weather condition during paving. Bulk samples of the binder layer were only collected from the SUPERPAVE™ section 89A902 and were sent to the FHWA-LTPP Materials Reference Library MRL for storage as indicated in Table 8 and Figure 8. The guidelines of the SPS-9A experiment do not require sampling and testing of the binder layer as is required of the surface layer Three nuclear gauge density measurements were performed on the binder layer of all the sections at 1.5 m offset from the edge of pavement, at station 0+30, 0+76, and 0+122, Figures 7-9 The results from these measurements are tabulated in Table 19.

Elevation shots were collected on the surface of this layer, Figure 12 Elevation 1. No elevation measurements were taken before placing the binder layer, thus no record exist of the binder layer thickness from the elevation readings.

AC Dense Graded Surface Layer Preparation - East Bound - 89A900

Surface layer paving on the overlay east bound lanes started on September 17, 1996 in section 89A901 and was completed on September 18, 1996 with section 89A903. The SPS-9A guidelines require the construction of a minimum three sections that include a design based upon the highway agency's standard hot mix asphalt (HMA) mixture design, SUPERPAVE™, and using a SUPERPAVE™ mixture with a SHRP binder grade either higher or lower than required by the SUPERPAVE™ design method. A standard QE MTQ LC mix, with PG 52-34 asphalt cement, was used on section 89A901, a SUPERPAVE™ mix with PG 52-40 asphalt cement was used on section 89A902, and a SUPERPAVE™ alternative mix with PG 52-34 asphalt cement was used on section 89A903 (Job Mix Formulas in Appendix A) Table 18 lists the paving dates, laydown temperatures and the weather condition during paving The field verification indicated a high air voids in the SUPERPAVE™ gradation. Another mix design was prepared by the MTQ lab for the contractor to pave the SUPERPAVE™ sections on the new construction west bound lanes, Appendix A

Bulk samples of the surface layer include hot mix field samples and constituent materials for quality control tests, SUPERPAVE™ materials and mixture tests, binder characterization, and shipment to the MRL for future tests For the purpose of binder and mix characterization tests, the SPS-9A experiments are classified into Main Study and Level III study The amount of SUPERPAVE™ level III performance tests defines the difference between the Main Study and Level III study projects, Table 4 From each of sections 89A901 and 89A903, 9 laboratory mixed samples and 6 plant mixed samples are required to prepare gyratory compacted specimens for testing by the MTQ lab as indicated in Table 11. One loose lab mixed sample and two loose plant mix samples are also required for completion of the tests needed For the SUPERPAVE™ section 89A902, 40 laboratory mixed samples and 34 plant mixed samples are required to prepare gyratory compacted specimens for testing by the MTQ lab, the LTPP contractor lab Braun Intertec in Minneapolis MN (LTPP Performance Tests), and for storage at the MRL for future testing by the Superpave Regional Testing Center, as indicated in Table 12 One loose lab mixed sample and three loose plant mix samples are also required for completion of the tests needed Three nuclear gauge density measurements were performed on the surface layer of all the sections at 1 5 m offset from the edge of pavement, at station 0+30, 0+76, and 0+122, Figures 7-9 The results from these measurements are tabulated in Table 19

Elevation shots were collected on the surface of this layer, Figure 12 Elevation 2. The difference in the elevation measurements between those taken on the binder layer and the surface layer gives the thickness of the surface layer, as shown in Table 21. The SPS-9A construction guidelines require consistency in layer thickness for each site The elevations of the surface layer should not deviate more than 10 mm from design In Table 21, it is shown that for section 89A903 only 8 points from 55 where outside the limits 69$\pm$10 mm and the average of the 55 points was 70 mm, for section 89A902 13 points from 55 where outside the limits 69$\pm$10 mm and the average of the 55 points was 71 mm, and for section 89A901 10 points from 55 where outside the limits 69 $\pm$ 10 mm and the average of the 55 points was 72 mm.

Coring of the AC surface and binder layers was performed at three intervals, the first at interval A, 0 months after construction, this was conducted on October 23 and 24, 1996, the second at interval B, 6 months after construction, this was conducted on May 15, 1997, and the third at interval C, 12 months after construction, this was conducted on October 9, 1997. The results in Table 20 indicate thickness values outside the limits specified in the construction guidelines, mainly $\pm$ 10 mm for each of the AC binder and surface layers. Only five cores, three from section 89A903, taken in the sampling area after the section at interval A and one each from sections 89A902 and 89A901, taken in the sampling areas before the sections at interval B, all had a total of 110 mm of the binder and surface layers which is lower than the 133 $\pm$ 20 mm design thickness. Also in the construction guidelines it is stated that "the as-compacted thickness of the asphalt concrete layer (surface plus binder course) in any test section shall be constructed to within $\pm$ 6 mm of the average value of the other test sections in the project" Some deviations to this part of the guidelines was noticed.

The thickness from the cores are not as accurate as the thickness from the rod and level for two reasons, first these cores are taken from the sampling areas before (station 0-) and after (station 5+) each section, second the measurements are done on site with a regular measuring tape or ruler Table 22 displays the thickness as determined from the elevation readings for the surface layer and how much they differ from the design surface thickness, and also from the cores for the combined binder and surface layers as well as only the surface layer thickness and how much the surface differs from the design Also indicated are the average combined thickness of every two sections and how that thickness compares to the value of the third section At interval A the cores from sections 89A902 and 89A901 did not meet this requirement At interval B the cores from section 89A903 did not comply and had a 7 mm difference than the average of the other two sections.

AC Dense Graded Surface Layer Preparation - West Bound - 890900

Surface layer paving on the new construction west bound lanes started on September 20, 1996 in section 890901 and was completed on September 24, 1996 with section 890903 The SPS-9A guidelines require the construction of a minimum three sections that include a design based upon the highway agency's standard hot mix asphalt (HMA) mixture design, SUPERPAVE™, and using a SUPERPAVE™ mixture with a SHRP binder grade either higher or lower than required by the SUPERPAVE™ design method A standard QE MTQ LC mix, with PG 52-34 asphalt cement, was used on section 890901, a SUPERPAVE™ mix with PG 52-40 asphalt cement was used on section 890902, and a SUPERPAVE™ alternative mix with PG 52-34 asphalt cement was used on section

890903 (Job Mix Formulas in Appendix A). Table 18 lists the paving dates, laydown temperatures and the weather condition during paving. A different mix design was prepared by the MTQ lab for the contractor to pave the SUPERPAVE™ sections than what was used on the overlay east bound lanes after the field verification indicated a high air voids in the SUPERPAVE™ gradation of these lanes, Appendix A.

Bulk samples of the surface layer include hot mix field samples and constituent materials for quality control tests, SUPERPAVE™ materials and mixture tests, binder characterization, and shipment to the MRL for future tests. For the purpose of binder and mix characterization tests, the SPS-9A experiments are classified into Main Study and Level III study. The amount of SUPERPAVE™ level III performance tests defines the difference between the Main Study and Level III study projects, Table 4 From each of sections 890901 and 890903, 9 laboratory mixed samples and 6 plant mixed samples are required to prepare gyratory compacted specimens for testing by the MTQ lab as indicated in Table 11. One loose lab mixed sample and two loose plant mix samples are also required for completion of the tests needed For the SUPERPAVE™ section 890902, 40 laboratory mixed samples and 34 plant mixed samples are required to prepare gyratory compacted specimens for testing by the MTQ lab, the LTPP contractor lab Braun Intertec in Minneapolis MN (LTPP Performance Tests), and for storage at the MRL for future testing by the Superpave Regional Testing Center, as indicated in Table 12. One loose lab mixed sample and three loose plant mix samples are also required for completion of the tests needed. Three nuclear gauge density measurements were performed on the surface layer of all the sections at 1.5 m offset from the edge of pavement, at station 0+30, 0+76, and 0+122, Figures 4-6. The results from these measurements are tabulated in Table 19.

Elevation shots were collected on the surface of this layer, Figure 12 Elevation 2 The difference in the elevation measurements between those taken on the binder layer and the surface layer gives the thickness of the surface layer, as shown in Table 21. The SPS-9A construction guidelines require consistency in layer thickness for each site The elevations of the surface layer should not deviate more than 10 mm from design In Table 21, it is shown that for section 890903 only 7 points from 55 where outside the limits 69±10 mm and the average of the 55 points was 70 mm, for section 890902 only 4 points from 55 where outside the limits 69±10 mm and the average of the 55 points was 69 mm, and for section 890901 23 points from 55 where outside the limits 69 ± 10 mm and the average of the 55 points was 75 mm

Coring of the AC surface and binder layers was performed at three intervals, the first at interval A, 0 months after construction, this was conducted on October 22 and 23, 1996, the second at interval B, 6 months after construction, this was conducted on May 14 and 15, 1997, and the third at interval C, 12 months after construction, this was conducted on October 8, 1997 The results in Table 20 indicate thickness values outside the limits specified in the construction guidelines, mainly ± 10 mm for each of the AC binder and surface layers Only four cores from section 890902, taken in the sampling area before the section at interval A, had a total of 155 mm of the binder and surface layers which exceeds the 133 ± 20 mm design thickness Also in the construction guidelines it is stated that "the as-compacted thickness of the asphalt concrete layer (surface plus binder course) in any test section shall be constructed to within ± 6 mm of the average value of the other test sections in the project" No deviation to this part of the guidelines was noticed

The thickness from the cores are not as accurate as the thickness from the rod and level for two reasons, first these cores are taken from the sampling areas before (station 0-) and after (station 5+) each section, second the measurements are done on site with a regular measuring tape or ruler. Table 22 displays the thickness as determined from the elevation readings for the surface layer and how much they differ from the design surface thickness, and also from the cores for the combined binder and surface layers as well as only the surface layer thickness and how much the surface differs from the design. Also indicated are the average combined thickness of every two sections and how that thickness compares to the value of the third section No deviation is noticed in any of the sections.

Asphalt Cement and Aggregate Sampling

The asphalt plant was visited four times between September 17 and 24, 1996. Pictures were taken throughout the plant site on September 18, 1996, Photos in Appendix B. Since both projects used the same binder and aggregate combination, there was no need of duplication unless needed. Only the SUPERPAVE™ combined aggregate was sampled from both projects because there was a different mix design prepared by the MTQ lab for the contractor for paving the SUPERPAVE™ sections in the new construction west bound lanes than what was used on the overlay east bound lanes after the field verification indicated a high air voids in the SUPERPAVE™ gradation of the east bound lanes, Appendix A.

Three sets of samples were taken of the two PG grade asphalt cement (PG 52-34 and PG 52-40) and the two combined aggregate types used (QE standard mix and SUPERPAVE™ mix) The first set of samples was collected and sent to the MRL for storage, Table 8B. The second set of samples was collected for the MTQ lab to be used in the SPS-9A laboratory testing of the constituent materials as described in Table 9 While the third set of samples was collected also for the MTQ lab for preparing the laboratory mixed samples that will be used to prepare the lab gyratory specimens for testing as listed in Tables 11 and 12 Table 7 lists all the asphalt and aggregate bulk sampling performed during construction and Table 8 separates the part to be used for testing as part of the SPS-9A experiment and the part to be used for shipping to the MRL facility in Reno, Nevada

Deviations from the Construction Guidelines

Although correspondence between the MTQ and NARO regarding constructing the SPS-9A experiments started as early as November 15, 1997, nominations were not presented till May 30, 1996 and acceptance was not received till late August 1996 The first and only meeting between the MTQ and NARO staff was held on September 5, 1996 At that time the construction to the binder layer was completed on both experiments The NARO representative was not available except during the construction of most of the surface layer, mainly between September 18 and 24, 1996

On July 19 and 20, 1996 an extreme storm resulted in heavy rainfall throughout the Saguenay-Lac St Jean region where the SPS-9A sites are located Runoff caused rivers throughout the area to rise dramatically to flood levels, in some cases producing discharges well in excess of previously recorded maximum flows Homes in La Baie were destroyed when raging waters crushed one of the earthen dikes of the Stone-Consolidated dam, built in 1908 at the mouth of Lac des Ha! Ha! The flooding had severe effects locally along the valleys, homes were inundated, damaged and destroyed, dams were overtopped and damaged, reservoirs were drained, bridges and roads were washed out, and extensive bank and floodplain erosion occurred. The disaster took the lives of 10 people and forced some 16,000 from their homes More than 500 houses were destroyed and another 850 were severely damaged, factories and tourist resorts were knocked out as were sewer and water systems. The total estimated cost of the disaster was approximately CD$700 million. Flood damage at the SPS-9A sites was repaired during August of 1996. Three areas were washed out, 25+155 - 25+169, 25+369 - 25+394 and 25+637 - 25+642, none of these was inside the monitoring area of any of the six SPS-9A sections.

The field verification of the surface layer on the overlay east bound lanes indicated a high air voids in the SUPERPAVE™ gradation Another mix design was prepared by the MTQ lab for the contractor for paving the SUPERPAVE™ sections on the new construction west bound lanes, Appendix A.

When the bulk hot mix quality control samples were collected they were placed in insulated containers and moved to the lab for compaction prior to significant loss of heat. The MTQ lab is located in Quebec city which is approximately 250 kms away from the site and the journey takes around three hours. The sampling and testing guidelines state that if the samples are within 5°C of the compaction temperature, no reheating of the asphalt mix is required prior to compaction Otherwise the asphalt mix shall be reheated to compaction temperature In no event should reheating time be greater than 30 minutes, as longer heating times may change the physical and chemical properties of the asphalt binder As indicated in Table 23, all the samples were reheated to more than 30 minutes before preparing the GCS

The construction guidelines state that "the as-compacted thickness of the asphalt concrete layer (surface plus binder course) in any test section shall be constructed to within ± 6 mm of the average value of the other test sections in the project" Some deviations to this part of the guidelines was noticed. At interval A the cores from sections 89A902 and 89A901 did not meet this requirement At interval B the cores from section 89A903 did not comply and had a 7 mm difference than the average of the other two sections, Table 22.

The construction guidelines state that the finished surface of the overlay should be smooth and provide an excellent ride level As a target, the as-constructed surface should have a pro-rated profile index of less than 160-mm per km as measured by a California type Profilograph and evaluated following California Test 526 No such test was performed on either project and only the LTPP Profilometer was used to measure the profile

Also according to the Guidelines, deflection, profile, and distress survey monitoring measurements were supposed to be performed, 1-3 months, less than two months, and less than six months, respectively after the construction is completed All monitoring activities were delayed due to the fact that construction was completed late September and the weather prevents any work from being performed between the months of November and April in the area

IV. Post Construction Operations and Initial Performance

Five of the sections were marked on October 22, 23, and 24, 1996 as required in the guidelines The sixth section could not be marked at the same time because of rain and was later marked on April 4, 1997 Figure 13 and 14 show the paint marks used on the sections to identify the location of the beginning of each of the sections and at 30.5 m intervals.

Profilometer testing was performed on April 4, 1997. The average International Roughness Index (IRI) values from five runs for each of the six sections are presented in Table 24. Plots of the elevation measurements, in the left wheel path and the right wheel path, from all the sites are presented in Figures 15 to 20. The site was also videoed on April 4, 1997

The Falling Weight Deflectometer (FWD) and Manual Distress Survey (MDS), including transverse Dipstick measurements, on the final layer of the sections were performed on May 28 and 29, 1997. The FWD results are presented in a spreadsheet in Appendix A, while the rut depth values in the left and right wheel paths, as determined from the Dipstick are summarized in Table 25 and plotted in Figures 21 to 23.

During the initial monitoring period, September 1996 to May 1997, the site was reported as having no obvious distresses, the pavement was only noted as having a coarse surface texture.

The east bound lanes were opened to traffic in the early morning hours of Friday September 20, 1996 just before paving started on the west bound The west bound lanes were opened to traffic in the early morning hours of Friday September 27, 1996

Table 1 Experimental Design for SPS-9A Experiments

Moisture		Wet > 635 mm/year of precipitation				Dry < 635 mm/year of precipitation			
Average 7 Day Maximum Pavement Design Temperature		<52C	<58C	<64C	<70C	<52C	<58C	<64C	<70C
Minimum Pavement Design Temperature	>-46C								
	>-40C								
	>-34C								
	>-28C								
	>-22C								
	>-16C								
	>-10C								

Notes Traffic rate should exceed 50,000 ESAL/year in study lane
Total traffic for design (design life) is Agency choice
The average 7-day maximum pavement design temperature is the average of the highest daily pavement temperatures for the seven hottest consecutive days
The minimum pavement design temperature is the coldest pavement temperature of the year

Table 2. PG Asphalt Binders in SPS-9A Projects in the NA Region

Moisture		Wet > 635 mm/year of precipitation				
Average 7 Day Maximum Pavement Design Temperature		<52C	<58C	<64C	<70C	<76C
Minimum Pavement Design Temperature	>-46C	98%QE	98%ON			
	>-40C	**02-QE** 50%QE 50%ON	**02-ON**			
	>-34C	03-QE	03-ON			
	>-28C	03-NJ	**02-NJ** 98%NJ 98%CT	**02-CT**		61-NJ
	>-22C	50%CT	50%NJ	**02-NC** 03-CT 98%NC	03-NC	60-NC
	>-16C		50%NC			
	>-10C					

Notes. Traffic rate should exceed 50,000 ESAL/year in study lane.

Total traffic for design (design life) is Agency choice

The average 7-day maximum pavement design temperature is the average of the highest daily pavement temperatures for the seven hottest consecutive days

The minimum pavement design temperature is the coldest pavement temperature of the year

02-QE. Used in SUPERPAVE™ section 02.

03-QE· Used in Alternative SUPERPAVE™ section 03

98%QE. SHRPBIND PG Asphalt 98% Reliability

50%QE SHRPBIND PG Asphalt 50% Reliability

Table 3 Binder Selection for SPS-9A Experiments in the NA Region

Agency / SPS-9A ID	Weather Station Location	Lat. N / Long. W	SHRPBIND PG Asphalt 98% Reliab. / 50% Reliab.	PG Binder in SUPERPAVE™ Section 02	Binder in Agency Section 01	PG Binder in Alternative SUPERPAVE™ Section 03	Other Binders in Experiment
Quebec / 890900 89A900	Shipshaw	48.45 / 71.22	52-46 / 52-40	PG 52-40	PG 52-34	PG 52-34	
Ontario / 870900	Petawawa	45 95 / 77.32	58-46 / 52-40	PG 58-40	85/100 Pen. Gr.	PG 58-34	PG 58-28 PG 58-34P PG 58-40M
Connec-ticut / 090900	Colchester	41.55 / 72.37	58-28 / 52-22	PG 64-28	AC 20	PG 64-22	Same 3 with RAP
New Jersey / 340900	Highstown	40 27 / 74 57	58-28 / 58-22	PG 58-28	AC 20	PG 52-28	PG 64-22 PG 76-28P AC 20 RAP
North Carolina / 370900	Moncure	35.58 / 79 05	64-22 / 58-16	PG 64-22	AC 20	PG 70-22	PG 76-22MG PG 76-22SMA PG 76-22SBR AC 20 PG 76-22SBS PG 70-22

Notes. P Polymer Modified
M Marshal Design
RAP Recycled Asphalt Pavement
MG Superpave design with Multigrade PG 76-22
SMA SMA Mix with contractor choice of PG 76-22
SBR Superpave design with SBR modified PG 76-22
SBS Superpave design with SBS modified PG 76-22

Table 4. Summary of SPS-9A Testing

Project Type	Test Section	Time After Construction, months					
		0	6	12	18	24	48
Main Study	Agency	V	V	V	V	V	V
	LTPP Binder	S*	V	V	V	V	V
	Alternate LTPP Binder	V	V	V	V	V	V
SUPERPAVE™ Level III Sites	Agency	S		S		S	S
	LTPP Binder	S*		S		S	S
	Alternate LTPP Binder	S		S		S	S

Notes: Testing Types. V = volumetric and binder stiffness tests
S = SUPERPAVE™ Level III performance tests
S* - SUPERPAVE™ Level III testing at t=0 months will be performed on 3 sets of specimens; design mixture in the laboratory, plant mixture compacted in the laboratory, plant mixture compacted in the field (cores)

Table 5 Site Layout, SPS-9A Projects 890900 and 89A900 on West Bound and East Bound NR 170

Constr-uction Stations	Experi-ment Stations	Length (m)	AC Thickness mm	Base/Subbase Thickness mm	Remarks	Section ID
West Bound New Construction						
25+937 - 25+785	0+00 - 1+52	152 4	69 Top 64 Binder	376 GB 300 SB 2286 EMB	Fill	**890903**
25+602 - 25+450	0+00 - 1+52	152 4	69 Top 64 Binder	376 GB 300 SB 0 EMB	Cut	**890902**
24+812 - 24+660	0+00 - 1+52	152 4	69 Top 64 Binder	376 GB 300 SB 1981 EMB	Fill	**890901**
East Bound Overlay Construction						
24+843 - 24+995	0+00 - 1+52	152 4	69 Top 64 Binder	409 GB 0 SB 0 EMB EXISTING PAVEMENT	Low Fill	**89A903**
25+178 - 25+330	0+00 - 1+52	152 4	69 Top 64 Binder	376 GB 300 SB 1453 EMB EXISTING PAVEMENT	High Fill	**89A902**
25+778 - 25+930	0+00 - 1+52	152 4	69 Top 64 Binder	373 GB 0 SB 0 EMB EXISTING PAVEMENT	Low Fill	**89A901**

Notes
- Top -AC Dense Graded Asphalt Concrete Surface Layer
- Binder -AC Dense Graded Asphalt Concrete Binder Layer
- GB -Granular Crushed Gravel Base Layer
- SB -Granular Crushed Gravel Subbase Layer
- EMB -Granular Crushed Gravel / Blasted Rock Embankment Layer

Table 6. Scope of Field Testing

Layer	Section ID	Number of Tests*	Location Designation
Pre Construction **Embankment or Subgrade > 1.2 m Thick** Shoulder Auger Probes to 6 m depth or refusal (Depth to Rigid Layer)	890901/89A901 890902/89A902 890903/89A903	1 1 1	S01A01 S01A02 S01A03
During Construction **Asphalt Concrete Binder** In-Situ Density (Nuclear Gauge)	890901/89A901 890902/89A902 890903/89A903	3 3 3	T04A01 - T06A01 T04A02 - T06A02 T04A03 - T06A03
Levels on the binder layer surface of each section		55 per section	5 transverse locations (pavement edges, mid lane, wheel tracks) at 15.2 m intervals
During Construction **Asphalt Concrete Surface** In-Situ Density (Nuclear Gauge)	890901/89A901 890902/89A902 890903/89A903	3 3 3	T07A01 - T09A01 T07A02 - T09A02 T07A03 - T09A03
Levels on the finished surface of each section		55 per section	5 transverse locations (pavement edges, mid lane, wheel tracks) at 15.2 m intervals

Note: * Number of tests for each of the two projects 890900 and 89A900

Table 7. Scope of Material Sampling

Pre Construction

Layer	Section ID	Number of Samples	Sample Number
Subgrade			
Bulk Sampling	890901/89A901	1 + 1	BS01A01+MS01A01
(10 kg per sample) +	890902/89A902	1 + 1	BS01A02+MS01A02
Moisture Content Samples	890903/89A903	1 + 1	BS01A03+MS01A03
Unbound Subbase			
Bulk Sampling	890901/89A901	1 + 1	BG02A01+MG02A01
(25 kg per sample) +	890902/89A902	1 + 1	BG02A02+MG02A02
Moisture Content Samples	890903/89A903	1 + 1	BG02A03+MG02A03
Unbound Base			
Bulk Sampling	890901/89A901	1 + 1	BG01A01+MG01A01
(25 kg per sample) +	890902/89A902	1 + 1	BG01A02+MG01A02
Moisture Content Samples	890903/89A903	1 + 1	BG01A03+MG01A03

During Construction

Layer	Section ID	Number of Samples	Sample Number
Asphalt Concrete (Surface Layer)			
Bulk Sampling - 6/34 split off samples	890901/89A901	6	BA01A01-BA06A01
(to prepare plant mix gyratory samples)	890902/89A902	34	BA01A02-BA34A02
	890903/89A903	6	BA01A03-BA06A03
Constituent Aggregate Bulk Sampling	890901/89A901	1	BU01A01
(for MRL, for laboratory testing, and to	890902/89A902	1	BU01A02
prepare lab mix gyratory samples)	890903/89A903	1	BU01A03
Asphalt Cement Bulk Sampling	890901/89A901	1	BC01A01
(for MRL, for laboratory testing, and to	890902/89A902	1	BC01A02
prepare lab mix gyratory samples)	890903/89A903	1	BC01A03

Post Construction

Layer	Section ID	Number of Samples	Sample Number
Asphalt Concrete (Surface Layer)			
Interval A Coring (0 months)	890901/89A901	8	CA01A01-CA08A01
152 mm coring	890902/89A902	34	CA01A02-CA34A02
	890903/89A903	8	CA01A03-CA08A03
Interval B-F Coring (6-48 months)	890901/89A901	8 X 5 intervals	CA01B01-CA08F01
152 mm coring	890902/89A902	8 X 5 intervals	CA01B02-CA08F02
	890903/89A903	8 X 5 intervals	CA01B03-CA08F03

Table 8. Asphalt and Aggregate Bulk Material Sampling During Construction

A. Materials for Testing as Part of the SPS-9A Experiment

Material Description	Number of Samples	Quantity of Each Sample	Sample Location
Asphalt Cement Bulk Sampling	1 for each type of binder	19 liters	Asphalt Plant
Combined Coarse and Fine Aggregate Bulk Sampling	1 for each aggregate combination	400 kg	Asphalt Plant
HMAC Surface Layer Bulk Sampling - 6 or 34 split off samples (for GC Specimens) + 2 or 3 uncompacted samples	6 + 2 34 + 3 6 + 2	4700g + 2000g 4700-5700g+2000g 4700g + 2000g	890901/89A901 890902/89A902 890903/89A903
Asphalt Cement and Constituent Aggregate Samples to prepare 9/40 GC Specimens and 1 uncompacted sample	9 + 1 40 + 1 9 + 1	4700g + 2000g 4700-5700g+2000g 4700g + 2000g	890901/89A901 890902/89A902 890903/89A903

B. Materials for Shipping to the FHWA - LTPP Materials Reference Library

Material Description	Number of Samples	Quantity of Each Sample	Sample Location
Asphalt Cement Bulk Sampling	1 for each type of binder	19 liters	Asphalt Plant
Constituent Aggregate Bulk Sampling	5 for each aggregate combination	19 liter pails	Asphalt Plant
HMAC Binder Layer Bulk Sampling - split off samples	1	50 kgs	890902/89A902
Lab Mix GC Specimen Plant Mix GC Specimen 152 mm Cores from interval A	20 20 16	5700 g 5700 g 5700 g	890902/89A902 890902/89A902 890902/89A902

Table 9 Field and Laboratory Material Testing

Test Type	LTPP Test Des.	LTPP Protocol	No. of Tests	Material Source /Test Location
Subgrade Layer				
Sieve Analysis	SS01	P51	3	BS01A01,BS01A02,BS01A03
Atterberg Limits	SS03	P43	3	BS01A01,BS01A02,BS01A03
Classification	SS04	P52	3	BS01A01,BS01A02,BS01A03
Natural Moisture Content	SS09	P49	3	MS01A01,MS01A02,MS01A03
Depth to Rigid Layer		LTPP	3	S01A01,S01A02,S01A03
Unbound Subbase/Base Layers				
Particle Size Analysis	UG01	P41	6	BG01A01,BG01A02,BG01A03 BG02A01,BG02A02,BG02A03
Sieve Analysis (washed)	UG02	P41	6	BG01A01,BG01A02,BG01A03 BG02A01,BG02A02,BG02A03
Atterberg Limits	UG04	P43	6	BG01A01,BG01A02,BG01A03 BG02A01,BG02A02,BG02A03
Classification	UG08	P47	6	BG01A01,BG01A02,BG01A03 BG02A01,BG02A02,BG02A03
Natural Moisture Content	UG10	P49	6	MG01A01,MG01A02,MG01A03 MG02A01,MG02A02,MG02A03
Aggregates				**QE AGG.-SUPERPAVE™ AGG.**
Combined Aggregate Gradation	AG04	P14	2	BU01A01 - BU01A02
Specific Gravity of Coarse Agg.	AG01	P11	2	BU01A01 - BU01A02
Specific Gravity of Fine Agg.	AG02	P12	2	BU01A01 - BU01A02
Specific Gravity of Pass 200		A T100	2	BU01A01 - BU01A02
Coarse Agg. Angularity		TM621	2	BU01A01 - BU01A02
Fine Agg. Angularity		C1252	2	BU01A01 - BU01A02
Toughness		A T96	2	BU01A01 - BU01A02
Soundness		A T104	2	BU01A01 - BU01A02
Deleterious Material		A T112	2	BU01A01 - BU01A02
Clay Content		A T176	2	BU01A01 - BU01A02
Thin, Elongated Particles		D4791	2	BU01A01 - BU01A02
Asphalt Cement				**PG 52-34 - PG 52-40**
Penetration @ 5°C		A T49	2*	BC01A01 - BC01A02
Penetration @ 25°C, 46°C	AE02	P22	4*	BC01A01 - BC01A02
Viscosity @ 60°C, 135°C	AE05	P25	8	BC01A01 - BC01A02
Specific Gravity @ 16°C	AE03	P23	4	BC01A01 - BC01A02
Dynamic Sheer @ 3 temps		A TP5	4	BC01A01 - BC01A02
Brookfield Vis @ 135°C, 165°C		D4402	4	BC01A01 - BC01A02
Rolling Thin Film (RTFOT)		A T240	Note	BC01A01 - BC01A02
Dynamic Sheer on RTFOT Residue @ 3 temps		A TP5	4	BC01A01 - BC01A02
Pressure Aging (PAV) of RTFOT Residue		A PP1	Note	BC01A01 - BC01A02
Creep Stiffness of PAV Residue (2 temps) - 24h conditioning		A TP1	4	BC01A01 - BC01A02
Creep Stiffness of PAV Residue (2 temps)		A TP1	4	BC01A01 - BC01A02
Dynamic Sheer on PAV Residue (3 temps)		A TP5	4	BC01A01 - BC01A02
Direct Tension on PAV Residue (2 temps)		A TP3	4	BC01A01 - BC01A02

Note: Sufficient material should be conditioned for the required tests
A = AASHTO tests, C1252 & D4791 & D4402 are ASTM tests, TM621 is a PA DOT test
* Three penetration readings are required from each test

Table 10A. SUPERPAVE™ Gyratory Compaction Effort

Design ESALs (millions)	Average Design High Air Temperature: < 39°C			39 - 40°C			41 - 42°C			43 - 44°C		
	N_{ini}	N_{des}	N_{max}	N_{ini}	N_{des}	N_{max}	N_{ini}	N_{des}	N_{max}	N_{ini}	N_{des}	N_{max}
< 0.3	7	68	104	7	74	114	7	78	121	7	[illegible]2	127
0.3 - 1	7	76	117	7	83	129	7	88	138	8	93	146
1 - 3	7	86	134	8	95	150	8	100	158	8	105	167
3 - 10	8	96	152	8	106	169	8	113	181	9	119	192
10 - 30	8	109	174	9	121	195	9	128	208	9	135	220
30 - 100	9	126	204	9	139	228	9	146	240	10	153	253
> 100	9	142	233	10	158	262	10	165	275	10	172	288

Table 10B SUPERPAVE™ Gyratory Compaction Effort for the SPS-9A Projects in the NA Region

NARO Project Location	Air Temp. Highest / Mean 7 Day	Design ESALs (millions)	N_{ini}	N_{des}	N_{max}
Colchester - Connecticut 090900	34°C / 30°C	1 85	7	86	134
Allentown - New Jersey 340900	37°C / 33°C	39 00	9	126	204
Moncure - North Carolina 370900	39°C / 36°C	3 32	8	96	152
Petawawa - Ontario 870900	34°C / 30°C	2.65	7	86	134
Shipshaw - Quebec 890900 & 89A900	33°C / 29°C	0 50	7	76	117

Table 11. Level 1 Testing of MTQ (Sections 890901 and 89A901) and SUPERPAVE™ Alternative (Sections 890903 and 89A903) Paver and Laboratory Prepared Mixes

Laboratory Test	**LTPP Test Desig.**	**LTPP Protocol**	**No of Tests / Section**	**Source of Material (Specimen)**
Lab Samples Mix Design Testing				
Gyratory Compaction at Design Asph Cont @ N_{Max}		AASHTO TP4	3	NA01AXX-NA03AXX (LA01AXX-LA03AXX)
Gyratory Compaction @ 7% Air Voids		AASHTO TP4	6	NA04AXX-NA09AXX (LA04AXX-LA09AXX)
Bulk Specific Gravity	AC02	P02	9	LA01AXX-LA09AXX
Maximum Specific Gravity	AC03	P03	1	NA03AXX
Moisture Susceptibility	AC05	P05	1	LA04AXX-LA09AXX
Volumetric Calculations				
Volume % of Air Voids		AASHTO	3	LA01AXX-LA03AXX
% Voids in Mineral Agg		PP19	3	LA01AXX-LA03AXX
Voids Filled with Asph			3	LA01AXX-LA03AXX
Field Samples Quality Control Related Testing				
Gyratory Compaction @ N_{Max}		AASHTO TP4	6	BA01AXX-BA06AXX (DA01AXX-DA06AXX)
Bulk Specific Gravity	AC02	P02	6	DA01AXX-DA06AXX
Asphalt Content-Extraction	AC04	P04	2	BA01AXX, BA06AXX
Agg Gradation-Extracted	AG04	P14	2	BA01AXX, BA06AXX
Maximum Specific Gravity	AC03	P03	2	BA01AXX, BA06AXX
Volumetric Calculations				
Volume % of Air Voids		AASHTO	6	DA01AXX-DA06AXX
% Voids in Mineral Agg		PP19	6	DA01AXX-DA06AXX
Voids Filled with Asph.			6	DA01AXX-DA06AXX

$N_{Init} = 7$ $N_{Design} = 76$ $N_{Max} = 117$
XX represents sections 01 and 03

Table 12. Level 3 Testing of SUPERPAVE™ (Sections 890902 and 89A902) Paver and Laboratory Prepared Mixes

Laboratory Test	LTPP Test Desig.	LTPP Protocol	No of Tests per Section	Source of Material (Specimen)
Lab Samples Mix Design Testing				
Gyratory Compaction at Design Asphalt Content @ N_{max}		AASHTO TP4	6	NA01A02-NA06A02 (LA01A02-LA06A02)
Gyratory Compaction @ 3% Air Voids		AASHTO TP4	2	NA07A02-NA08A02 (LA07A02-LA08A02)
Gyratory Compaction @ 7% Air Voids		AASHTO TP4	32	NA09A02-NA40A02 (LA09A02-LA40A02)
Bulk Specific Gravity	AC02	P02	15	LA01A02-LA06A02 LA09A02-LA14A02 LA07A02, LA15A02, LA38A02
Maximum Specific Gravity	AC03	P03	1	NA15A02
Moisture Susceptibility	AC05	P05	1	LA09A02-LA14A02
Volumetric Calculations Volume % of Air Voids %Voids in Mineral Aggregate Voids Filled with Asphalt		AASHTO PP19	 6 6 6	 LA01A02-LA06A02 LA01A02-LA06A02 LA01A02-LA06A02
LTPP Performance Tests * Indirect Tensile Strength Resilient Modulus Creep Compliance	 AC07 AC07 AC06	 P07 P07 P06	 4 1 4	 LA15A02-LA18A02 LA16A02-LA18A02 LA19A02-LA22A02
Field Samples Quality Control Related Testing				
Gyratory Compaction @ N_{Max}		AASHTO TP4	6	BA02-04A02, BA31-33A02 DA02-04A02, DA31-33A02
Gyratory Compaction @ 3% Air Voids		AASHTO TP4	2	BA01A02, BA34A02 (DA01A02, DA34A02)
Gyratory Compaction @ 7% Air Voids		AASHTO TP4	26	BA05A02-BA30A02 (DA05A02-DA30A02)
Bulk Specific Gravity	AC02	P02	9	DA02A02-DA04A02 DA31A02-DA33A02 DA06A02, DA16A02, DA22A02
Asphalt Content - Extraction	AC04	P04	3	BA05A02, BA06A02, BA34A02
Agg. Gradation - Extracted Agg	AG04	P14	3	BA05A02, BA06A02, BA34A02
Maximum Specific Gravity	AC03	P03	3	BA05A02, BA06A02, BA34A02
Volumetric Calculations Volume % of Air Voids %Voids in Mineral Aggregate Voids Filled with Asphalt		AASHTO PP19	 6 6 6	 DA02-04A02, DA31-33A02 DA02-04A02, DA31-33A02 DA02-04A02, DA31-33A02
LTPP Performance Tests * Indirect Tensile Strength Resilient Modulus Creep Compliance	 AC07 AC07 AC06	 P07 P07 P06	 4 1 4	 DA05,DA09,DA17,DA29A02 DA09A02,DA17A02,DA29A02 DA15,DA16,DA18,DA30A02

$N_{Init} = 7$ $N_{Design} = 76$ $N_{Max} = 117$

* 100 mm diameter test specimen will be cored from the 152 mm diameter specimen.
SUPERPAVE™ testing by the SUPERPAVE™ Regional Test Center is to be finalized yet. Meanwhile the gyratory compacted lab and field samples are to be sent to MRL for storage.

Table 13 Laboratory Testing of Cores at All Intervals

Laboratory Test	LTPP Test D.	LTPP Protocol	Tests per Section	Source of Material (Specimen)
All Intervals Sections 01 & 03, Intervals B-F Section 02				
Core Examination / Thickness	AC01	P01	8	All Cores from All Sections
Bulk Specific Gravity	AC02	P02	8	All Cores from All Sections
Maximum Specific Gravity	AC03	P03	2	CA01tXX, CA08tXX
Asphalt Content - Extraction	AC04	P04	8	All Cores from All Sections
Agg. Gradation - Extracted Agg	AG04	P14	2	CA01tXX, CA08tXX
Volumetric Calculations *				
Volume % of Air Voids		AASHTO	2	CA01tXX, CA08tXX
%Voids in Mineral Aggregate		PP19	2	CA01tXX, CA08tXX
Voids Filled with Asphalt			2	CA01tXX, CA08tXX
Recovered Asphalt Cement				
Abson Recovery	AE01	P21	8	All Cores from All Sections
Penetration @ 5°C		AASHTO T49	3***	Combined recovered AC from sec.
Penetration @ 25°C, 46°C	AE02	P22	6***	Combined recovered AC from sec.
Viscosity @ 60°C, 135°C	AE05	P25	12	Combined recovered AC from sec.
Specific Gravity @ 16°C	AE03	P23	6	Combined recovered AC from sec.
Dynamic Sheer @ 3 temps **		AASHTO TP5	6	Combined recovered AC from sec.
Creep Stiffness @ 2 temps.**		AASHTO TP1	6	Combined recovered AC from sec.
Direct Tension @ 2 temps **		AASHTO TP3	6	Combined recovered AC from sec.
Interval A Section 02				
Core Examination / Thickness	AC01	P01	34	All Cores from Section
Bulk Specific Gravity	AC02	P02	8	CA02,06,11,15,19,24,28,33A02
Maximum Specific Gravity	AC03	P03	2	CA11A02, CA24A02
Asphalt Content - Extraction	AC04	P04	8	CA02,06,11,15,19,24,28,33A02
Agg. Gradation - Extracted Agg	AG04	P14	2	CA11A02, CA24A02
Volumetric Calculations *				
Volume % of Air Voids		AASHTO	2	CA11A02, CA24A02
%Voids in Mineral Aggregate		PP19	2	CA11A02, CA24A02
Voids Filled with Asphalt			2	CA11A02, CA24A02
Recovered Asphalt Cement				
Abson Recovery	AE01	P21	8	CA02,06,11,15,19,24,28,33A02
Penetration @ 5°C		AASHTO T49	3***	Combined recovered AC from sec.
Penetration @ 25°C, 46°C	AE02	P22	6***	Combined recovered AC from sec.
Viscosity @ 60°C, 135°C	AE05	P25	12	Combined recovered AC from sec.
Specific Gravity @ 16°C	AE03	P23	6	Combined recovered AC from sec.
Dynamic Sheer @ 3 temps **		AASHTO TP5	6	Combined recovered AC from sec.
Creep Stiffness @ 2 temps **		AASHTO TP1	6	Combined recovered AC from sec.
Direct Tension @ 2 temps **		AASHTO TP3	6	Combined recovered AC from sec.
LTPP Performance Tests ****				
Indirect Tensile Strength	AC07	P07	4	CA07,CA16,CA21,CA31A02
Resilient Modulus	AC07	P07	1	CA16A02,CA21A02,CA31A02
Creep Compliance	AC06	P06	4	CA03,CA14,CA23,CA32A02

t = interval A(0 months), B(6 months), C(12 months), D(18 months), E(24 months), and F(48 months)

* Estimate maximum theoretical specific gravity using extracted AC content and aggregate effective S G determined during construction

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

*** Three penetration readings are required from each test

**** 100 mm diameter test specimen will be cored from the 152 mm diameter cores

SUPERPAVE™ testing by the SUPERPAVE™ Regional Test Center is to be finalized yet. Meanwhile the cores are to be sent to MRL for storage XX = test section 01, 02, and 03

Table 14. Lab, Field, and Core Superpave™ Samples Assigned Laboratory for Testing

Sample Type	MTQ Lab	LTPP Contractor Lab	Superpave Reg. Test Centre Lab	Remarks
Lab Samples	LA01A02 N_{max}	LA15A02 7%AV	LA07A02 3%AV	12 - MTQ Lab
	LA02A02 N_{max}	LA16A02 7%AV	LA08A02 3%AV	8 - LCL Lab
	LA03A02 N_{max}	LA17A02 7%AV	LA23A02 7%AV	20 SRTC Lab
	LA04A02 N_{max}	LA18A02 7%AV	LA24A02 7%AV	**Total - 40 GCS**
	LA05A02 N_{max}	LA19A02 7%AV	LA25A02 7%AV	1 loose sample
	LA06A02 N_{max}	LA20A02 7%AV	LA26A02 7%AV	for MTQ Lab
	LA09A02 7%AV	LA21A02 7%AV	LA27A02 7%AV	NA15A02
	LA10A02 7%AV	LA22A02 7%AV	LA28A02 7%AV	
	LA11A02 7%AV		LA29A02 7%AV	3 Bulk Specific
	LA12A02 7%AV		LA30A02 7%AV	Gravity by MTQ
	LA13A02 7%AV		LA31A02 7%AV	before sending to
	LA14A02 7%AV		LA32A02 7%AV	other Labs
			LA33A02 7%AV	LA07,15,38A02
			LA34A02 7%AV	
			LA35A02 7%AV	Moisture
			LA36A02 7%AV	Susceptibility by
			LA37A02 7%AV	MTQ Lab
			LA38A02 7%AV	LA09-14A02
			LA39A02 7%AV	**Total = 40 Lab**
			LA40A02 7%AV	**GCS + 1 Loose**
Field Samples	DA02A02 N_{max}	DA05A02 7%AV	DA01A02 3%AV	
	DA03A02 N_{max}	DA09A02 7%AV	DA06A02 7%AV	6 - MTQ Lab
	DA04A02 N_{max}	DA15A02 7%AV	DA07A02 7%AV	8 - LCL Lab
	DA31A02 N_{max}	DA16A02 7%AV	DA08A02 7%AV	20 SRTC Lab
	DA32A02 N_{max}	DA17A02 7%AV	DA10A02 7%AV	**Total - 34 GCS**
	DA33A02 N_{max}	DA18A02 7%AV	DA11A02 7%AV	
		DA29A02 7%AV	DA12A02 7%AV	3 loose samples
		DA30A02 7%AV	DA13A02 7%AV	for MTQ Lab
			DA14A02 7%AV	BA05,06,34A02
			DA19A02 7%AV	
			DA20A02 7%AV	3 Bulk Specific
			DA21A02 7%AV	Gravity by MTQ
			DA22A02 7%AV	Lab before
			DA23A02 7%AV	sending to other
			DA24A02 7%AV	Labs
			DA25A02 7%AV	DA06,16,22A02
			DA26A02 7%AV	
			DA27A02 7%AV	**Total = 34 Field**
			DA28A02 7%AV	**GCS + 3 Loose**
			DA34A02 3%AV	
Cores	CA02A02	CA03A02	CA01A02	8 - MTQ Lab
	CA06A02	CA07A02	CA04A02	2 - MTQ (spare)
	CA11A02	CA14A02	CA08-10A02	8 - LCL Lab
	CA15A02	CA16A02	CA12-13A02	16 SRTC Lab
	CA19A02	CA21A02	CA17-18A02	**Total - 34 Cores**
	CA24A02	CA23A02	CA20A02	Maximum
	CA28A02	CA31A02	CA22A02	Specific Gravity
	CA33A02	CA32A02	CA26-27A02	and Extraction -
	CA05A02 spare		CA29-30A02	MTQ
	CA25A02 spare		CA34A02	CA11,24A02
Total	**12+6+10=28**	**8+8+8=24**	**20+20+16=56**	**28+24+56=108**

Table 15. Field Activities Pre, During, and Post Construction

		Pre Construction		During and Post Construction					
	Project ID	**Subg./ Embank. Layers**	**Base/ Subbase Layers**	**AC Binder Layer**	**AC Surface Layer 0 months**	**AC Surface Layer 6 months**	**AC Surface Layer 12 months**	**AC Cement**	**Combined Aggreg. Material**
In-Situ Density	890900			96/09/20 96/09/23	96/09/23 96/09/25				
	89A900			96/09/13 96/09/17	96/09/18 96/09/19				
Shoulder Probe	890900	97/05/13							
	89A900	97/05/13							
Bulk and Moisture Sampling	890900	97/05/13	97/05/13	96/06/27	96/09/22 96/09/24			96/09/22 96/09/24	96/09/22 96/09/24
	89A900	97/05/14	97/05/14	96/09/04	96/09/17 96/09/18			96/09/17 96/09/18	96/09/17 96/09/18
Rod&Level Elevations*	890900			96/09/06 96/09/12	96/09/23 96/09/25				
	89A900			96/09/06 96/09/12	96/09/18 96/09/19				
Photos Taken	890900			96/09/23	96/09/20 96/09/23 96/09/24 96/10/22 96/10/23				
	89A900				96/09/18 96/09/23 96/10/23 96/10/24				
Video Recording	890900				97/04/04				
	89A900				97/04/04				
Site Markings	890900				96/10/22 96/10/23				
	89A900				96/10/23 96/10/24				
Profilo-meter Testing	890900				97/04/04				
	89A900				97/04/04				
FWD Testing	890900				97/05/28				
	89A900				97/05/29				
MDS and Dipstick Survey	890900				97/05/28				
	89A900				97/05/28 97/05/29				
Coring	890900				96/10/22 96/10/23	97/05/14 97/05/15	97/10/08		
	89A900				96/10/23 96/10/24	97/05/15	97/10/09		

Notes: * Refer to Figures 11 and 12 for elevation measurement locations
Date format is in yy/mm/dd

Table 16. SPS-9A Guidelines vs. Actual Monitoring Measurement Dates

Measurement Type	Monitoring Period After Construction	Monitoring Date as per the Guidelines - Construction Finished 890900 (New) - 24 Sep 96 89A900 (Overlay) - 18 Sep 96	Actual Monitoring Completion Date After Construction
Deflection	1-3 Months*	24 Oct 96-24 Dec 96 (890900) 18 Oct 96-18 Dec 96 (89A900)	28 May 97 (890900)[1] 29 May 97 (89A900)[2]
Profile	< 2 Months	Before 24 Nov 96 (890900) 18 Nov 96 (89A900)	04 Apr 97 (890900)[3] 04 Apr 97 (89A900)[4]
Distress Survey	< 6 Months	Before 24 Mar 97 (890900) 18 Mar 97 (89A900)	28 May 97 (890900)[5] 29 May 97 (89A900)[6]
Friction	3-12 Months	24 Dec 96-24 Sep 97 (890900) 18 Dec 96-18 Sep 97 (89A900)	-

Note. Date format is in dd mmm yy

* The LTPP Manual for FWD Testing, Version 2.0/February 1993, requires that FWD testing for SPS-9A be performed 3 to 6 months after construction is completed

1 and 2 Little over five months delay

3 and 4 Little less than five months delay

5 and 6 Little over two months delay

Table 17. Dates of Construction of Layers

Section ID and Layer Thickness (mm)	Embankment Construction yy/mm/dd	Gr. Subbase Construction yy/mm/dd	Gravel Base Construction yy/mm/dd	AC BINDER Paving yy/mm/dd	AC TOP Paving yy/mm/dd
West Bound New Construction					
890903 2286 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	Feb - June 96	June 96	June 96	96/06/28	96/09/24
890902 0 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	Feb - June 96	June 96	June 96	96/06/27	96/09/24
890901 1981 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	Feb - June 96	June 96	June 96	96/06/26	96/09/20
East Bound Overlay Construction					
89A903 EXISTING 0 EMBANKMENT 0 GR. SUBBASE 409 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	-	-	Aug 96	96/09/05	96/09/18
89A902 EXISTING 1453 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	Aug 96	Aug 96	Aug 96	96/09/04	96/09/18
89A901 EXISTING 0 EMBANKMENT 0 GR. SUBBASE 373 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	-	-	Aug 96	96/09/03	96/09/17

Table 18. Paving Dates, Times, Locations, Thickness, Temperature and Weather Conditions

Date dd mmm yy	Time	Section ID	AC Layer	Thick (mm)	#Laydown Temps. °C	Air Temp °C	Weather
26 Jun 96		890901	Binder	64	6/128-143*	18	
27 Jun 96		890902	Binder	64	5/134-140	18	
28 Jun 96		890903	Binder	64	5/133-138	18	
03 Sep 96		89A901	Binder	64	10/137-142	13.9	
04 Sep 96		89A902	Binder	64	5/138-142	12.8	
05 Sep 96		89A903	Binder	64	5/138-142	12.8	
17 Sep 96		89A901	Surface	69		20	
18 Sep 96	1145-1310	89A902	Surface	69	5/139-150	20	Sunny
18 Sep 96	1605-1745	89A903	Surface	69	6/128-138	21.1	
20 Sep 96	1435-1655	890901	Surface	69	6/136-141	13	Partly Cloudy
24 Sep 96	1020-1145	890902	Surface	69	6/145-152	12	Cloudy
24 Sep 96	1615-1710	890903	Surface	69	5/132-139	12	Sunny

* Number of times laydown temperature was measured while paving and the range of temperatures (min-max)
Refer to Figure 10 for more details on the paving of the surface layer

Table 19. SPS-9A Nuclear Gauge In Situ Densities

Section ID	Offset (m)	Density kg/m^3 (Station 30)*	Density kg/m^3 (Station 76)*	Density kg/m^3 (Station 122)*
West Bound **New Construction**				
890903 2286 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2335 2290	 2400 2321	 2382 2335
890902 0 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2365 (station 34) 2301 (station 34)	 2403 2337	 2318 2309
890901 1981 EMBANKMENT 300 GR. SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2496 (station 50) 2215	 2390 (station 96) 2230	 2442 (station 142) 2262
East Bound **Overlay Construction**				
89A903 EXISTING 0 EMBANKMENT 0 GR. SUBBASE 409 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2327 2251	 2350 2235	 2324 2186
89A902 EXISTING 1453 EMBANKMENT 300 GR SUBBASE 376 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2371 2218	 2322 2224	 2390 2274
89A901 EXISTING 0 EMBANKMENT 0 GR SUBBASE 373 GRAVEL BASE 64 AC BINDER 69 AC SURFACE	 1 5 1 5	 2295 2314	 2328 2306	 2375 2292

Notes * Stations at which densities were measured are 30, 76, 122 unless otherwise stated
Densities were measured in the Back Scatter Method
Troxler Thin Layer Density Gauge 4640B was used for the Surface and Binder layers

Table 20 Core Thickness from the Field Material Sampling and Testing Forms

	Before Section Stations 0-				After Section Stations 5+				Design
Section ID	Station m	Offset m	Core #	Thickness	Station m	Offset m	Core #	Thickness	Thickness
Interval	A	0	months						(+20) mm
890903	0-58.5	1.1	CA01A03	125	5+14.0	0.6	CA05A03	145	133
	0-57.0	0.6	CA02A03	130	5+15.5	1.1	CA06A03	140	(113-153)
	0-55.5	1.1	CA03A03	130	5+17.0	0.6	CA07A03	140	
	0-54.0	0.6	CA04A03	135	5+18.5	1.1	CA08A03	135	
890902	0-46.5	1.1	CA01A02	145	5+13.5	1.1	CA05A02	135	133
	0-45.0	0.6	CA02A02	140	5+15.0	0.6	CA06A02	138	(113-153)
	0-43.5	1.1	CA03A02	150	5+16.5	1.1	CA07A02	135	
	0-42.0	0.6	CA04A02	150	5+18.0	0.6	CA08A02	140	
	0-48.0	2.4	CA09A02	155*	5+12.0	2.4	CA22A02	132	
	0-46.5	2.4	CA10A02	155*	5+13.5	2.4	CA23A02	130	
	0-45.0	2.4	CA11A02	155*	5+15.0	2.4	CA24A02	132	
	0-43.5	2.4	CA12A02	155*	5+16.5	2.4	CA25A02	135	
	0-42.0	2.4	CA13A02	150	5+18.0	2.4	CA26A02	137	
	0-40.5	2.4	CA14A02	150	5+19.5	2.4	CA27A02	138	
	0-39.0	2.4	CA15A02	150	5+21.0	2.4	CA28A02	135	
	0-37.5	2.4	CA16A02	145	5+22.5	2.4	CA29A02	135	
	0-36.0	2.4	CA17A02	150	5+24.0	2.4	CA30A02	133	
	0-34.5	2.4	CA18A02	145	5+25.5	2.4	CA31A02	132	
	0-33.0	2.4	CA19A02	145	5+27.0	2.4	CA32A02	130	
	0-31.5	2.4	CA20A02	145	5+28.5	2.4	CA33A02	130	
	0-30.0	2.4	CA21A02	145	5+30.0	2.4	CA34A02	133	
890901	0-46.5	1.1	CA01A01	140	5+14.0	0.6	CA05A01	140	133
	0-45.0	0.6	CA02A01	134	5+15.5	1.1	CA06A01	137	(113-153)
	0-43.5	1.1	CA03A01	140	5+17.0	0.6	CA07A01	140	
	0-42.0	0.6	CA04A01	140	5+18.5	1.1	CA08A01	140	
Interval	B	6	months						
890903	0-50.5	1.1	CA01B03	140	5+21.5	0.6	CA05B03	140	133
	0-49.0	0.6	CA02B03	140	5+23.0	1.1	CA06B03	145	(113-153)
	0-47.5	1.1	CA03B03	130	5+24.5	0.6	CA07B03	140	
	0-46.0	0.6	CA04B03	140	5+26.0	1.1	CA08B03	145	
890902	0-50.5	1.1	CA01B02	140	5+21.5	0.6	CA05B02	135	133
	0-49.0	0.6	CA02B02	145	5+23.0	1.1	CA06B02	135	(113-153)
	0-47.5	1.1	CA03B02	145	5+24.5	0.6	CA07B02	130	
	0-46.0	0.6	CA04B02	140	5+26.0	1.1	CA08B02	130	
890901	0-50.5	1.1	CA01B01	130	5+21.5	0.6	CA05B01	135	133
	0-49.0	0.6	CA02B01	135	5+23.0	1.1	CA06B01	145	(113-153)
	0-47.5	1.1	CA03B01	135	5+24.5	0.6	CA07B01	140	
	0-46.0	0.6	CA04B01	135	5+26.0	1.1	CA08B01	145	
Interval	C	12	months						
890903	0-42.5	1.1	CA01C03	130	5+29.5	0.6	CA05C03	135	133
	0-41.0	0.6	CA02C03	135	5+31.0	1.1	CA06C03	130	(113-153)
	0-39.5	1.1	CA03C03	135	5+32.5	0.6	CA07C03	130	
	0-38.0	0.6	CA04C03	130	5+34.0	1.1	CA08C03	130	
890902	0-42.5	1.1	CA01C02	150	5+29.5	0.6	CA05C02	130	133
	0-41.0	0.6	CA02C02	145	5+31.0	1.1	CA06C02	135	(113-153)
	0-39.5	1.1	CA03C02	145	5+32.5	0.6	CA07C02	130	
	0-38.0	0.6	CA04C02	145	5+34.0	1.1	CA08C02	130	
890901	0-42.5	1.1	CA01C01	135	5+29.5	0.6	CA05C01	145	133
	0-41.0	0.6	CA02C01	130	5+31.0	1.1	CA06C01	140	(113-153)
	0-39.5	1.1	CA03C01	130	5+32.5	0.6	CA07C01	150	
	0-38.0	0.6	CA04C01	130	5+34.0	1.1	CA08C01	140	

Notes * Cores are outside the allowable range of ± 10 mm of the binder layer and ± 10 mm of the surface layer design thickness

Table 20(Cont.). Core Thickness from the Field Material Sampling and Testing Forms

	Before Section Stations 0-				After Section Stations 5+				Design
Section ID	**Station m**	**Offset m**	**Core #**	**Thickness**	**Station m**	**Offset m**	**Core #**	**Thickness**	**Thickness**
Interval	**A**	**0**	**months**						**(±20) mm**
89A903	0-58 5	1 1	CA01A03	135	5+14 0	0 6	CA05A03	115	133
	0-57 0	0.6	CA02A03	140	5+15.5	1 1	CA06A03	110*	(113-153)
	0-55 5	1 1	CA03A03	137	5+17 0	0 6	CA07A03	110*	
	0-54 0	0 6	CA04A03	140	5+18 5	1 1	CA08A03	110*	
89A902	0-58 5	1.1	CA01A02	120	5+13 5	1 1	CA05A02	122	133
	0-57 0	0 6	CA02A02	130	5+15 0	0 6	CA06A02	125	(113-153)
	0-55 5	1 1	CA03A02	120	5+16 5	1 1	CA07A02	121	
	0-54 0	0 6	CA04A02	125	5+18 0	0 6	CA08A02	125	
	0-60 0	2 4	CA09A02	125	5+12 0	2 4	CA22A02	123	
	0-58 5	2.4	CA10A02	120	5+13 5	2 4	CA23A02	124	
	0-57 0	2 4	CA11A02	117	5+15 0	2 4	CA24A02	125	
	0-55.5	2.4	CA12A02	118	5+16 5	2 4	CA25A02	122	
	0-54 0	2 4	CA13A02	115	5+18 0	2 4	CA26A02	124	
	0-52 5	2 4	CA14A02	120	5+19 5	2 4	CA27A02	125	
	0-51 0	2.4	CA15A02	117	5+21 0	2 4	CA28A02	125	
	0-49 5	2 4	CA16A02	120	5+22 5	2 4	CA29A02	126	
	0-48 0	2 4	CA17A02	115	5+24 0	2 4	CA30A02	125	
	0-46 5	2 4	CA18A02	113	5+25 5	2 4	CA31A02	128	
	0-45 0	2 4	CA19A02	115	5+27 0	2 4	CA32A02	125	
	0-43 5	2 4	CA20A02	117	5+28 5	2 4	CA33A02	130	
	0-42 0	2 4	CA21A02	117	5+30 0	2 4	CA34A02	127	
89A901	0-58 5	1 1	CA01A01	125	5+14 0	0 6	CA05A01	150	133
	0-57 0	0 6	CA02A01	128	5+15 5	1 1	CA06A01	149	(113-153)
	0-55 5	1 1	CA03A01	130	5+17 0	0 6	CA07A01	150	
	0-54 0	0 6	CA04A01	125	5+18 5	1 1	CA08A01	142	
Interval	**B**	**6**	**months**						
89A903	0-50 5	1 1	CA01B03	135	5+21 5	0 6	CA05B03	115	133
	0-49 0	0 6	CA02B03	140	5+23 0	1 1	CA06B03	135	(113-153)
	0-47 5	1 1	CA03B03	140	5+24 5	0 6	CA07B03	120	
	0-46 0	0 6	CA04B03	140	5+26 0	1 1	CA08B03	130	
89A902	0-50 5	1 1	CA01B02	120	5+21 5	0 6	CA05B02	125	133
	0-49 0	0 6	CA02B02	125	5+23 0	1 1	CA06B02	130	(113-153)
	0-47 5	1 1	CA03B02	110*	5+24 5	0 6	CA07B02	130	
	0-46 0	0 6	CA04B02	120	5+26 0	1 1	CA08B02	140	
89A901	0-50 5	1 1	CA01B01	115	5+21 5	0 6	CA05B01	135	133
	0-49 0	0 6	CA02B01	110*	5+23 0	1 1	CA06B01	140	(113-153)
	0-47 5	1 1	CA03B01	115	5+24 5	0 6	CA07B01	130	
	0-46 0	0 6	CA04B01	120	5+26 0	1 1	CA08B01	140	
Interval	**C**	**12**	**months**						
89A903	0-42 5	1 1	CA01C03	135	5+29 5	0 6	CA05C03	120	133
	0-41 0	0 6	CA02C03	140	5+31 0	1 1	CA06C03	120	(113-153)
	0-39 5	1 1	CA03C03	135	5+32 5	0 6	CA07C03	125	
	0-38 0	0 6	CA04C03	140	5+34 0	1 1	CA08C03	120	
89A902	0-42 5	1 1	CA01C02	120	5+29 5	0 6	CA05C02	130	133
	0-41 0	0 6	CA02C02	130	5+31 0	1 1	CA06C02	140	(113-153)
	0-39 5	1 1	CA03C02	125	5+32 5	0 6	CA07C02	130	
	0-38 0	0 6	CA04C02	135	5+34 0	1 1	CA08C02	145	
89A901	0-42 5	1 1	CA01C01	130	5+29 5	0 6	CA05C01	140	133
	0-41 0	0 6	CA02C01	135	5+31 0	1 1	CA06C01	140	(113-153)
	0-39 5	1 1	CA03C01	135	5+32 5	0 6	CA07C01	140	
	0-38 0	0 6	CA04C01	130	5+34 0	1 1	CA08C01	130	

Notes * Cores are outside the allowable range of ± 10 mm of the binder layer and ± 10 mm of the surface layer design thickness

Table 21. Layer Thickness from Rod and Level Elevations

			890903		890902		890901		89A903		89A902		89A901	
Exper. Station	**Offset meters**	**SThick Locat.**	**Const. Station**	**69mm SURF**	**Const. Station**	**69mm SURF**	**Const. Station**	**69mm SURF**	**Const. Station**	**69mm SURF**	**Const. Station**	**69mm SURF**	**Const. Station**	**69mm SURF**
0	0	EOP	25937	76	25602	68	24812	66	24843	72	25178	84*	25778	66
	0 92	OWP		75		71		73		77		81*		74
	1 83	MID		71		67		71		78		90*		78
	2 75	IWP		71		72		71		72		78		77
	3 66	CL		64		68		65		75		57*		88*
15 2	0	EOP	25922	82*	25587	66	24797	57*	24858	74	25193	64	25793	71
	0 92	OWP		76		73		55*		89*		73		72
	1 83	MID		79		71		57*		79		76		82*
	2 75	IWP		82*		75		59		72		72		82*
	3 66	CL		73		65		57*		71		75		79
30 4	0	EOP	25907	75	25572	73	24782	66	24873	75	25208	75	25808	85*
	0 92	OWP		76		71		71		73		65		86*
	1 83	MID		74		73		70		71		69		81*
	2 75	IWP		78		69		72		68		76		75
	3 66	CL		67		63		75		66		66		65
45 6	0	EOP	25891	78	25556	70	24766	53*	24889	66	25224	61	25824	82*
	0 92	OWP		76		72		63		60		68		80*
	1 83	MID		73		75		66		64		72		79
	2 75	IWP		73		75		72		68		66		71
	3 66	CL		73		69		73		70		120*		62
60 8	0	EOP	25876	78	25541	74	24751	72	24904	80*	25239	71	25839	77
	0 92	OWP		74		74		76		75		66		83*
	1 83	MID		70		71		81*		71		70		73
	2 75	IWP		66		80*		80*		63		69		67
	3 66	CL		68		69		88*		69		62		60
76 0	0	EOP	25861	66	25526	75	24736	80*	24919	86*	25254	54*	25854	71
	0 92	OWP		76		80*		87*		82*		59		76
	1 83	MID		70		72		88*		81*		57*		70
	2 75	IWP		68		72		81*		76		50*		66
	3 66	CL		67		62		96*		76		46*		73
91 2	0	EOP	25846	77	25511	67	24721	85*	24934	76	25269	60	25869	54*
	0 92	OWP		70		67		87*		71		71		72
	1 83	MID		65		63		90*		69		68		70
	2 75	IWP		65		59		85*		50*		62		70
	3 66	CL		60		57*		99*		72		64		65
106 4	0	EOP	25831	70	25496	68	24706	77	24949	70	25284	67	25884	70
	0 92	OWP		69		66		83*		77		72		74
	1 83	MID		68		65		89*		68		72		74
	2 75	IWP		63		66		82*		87*		69		75
	3 66	CL		70		66		82*		69		68		72
121 6	0	EOP	25815	69	25480	70	24690	76	24965	65	25300	73	25900	70
	0 92	OWP		71		69		74		63		78		76
	1 83	MID		64		67		76		67		83*		71
	2 75	IWP		58*		65		76		62		68		74
	3 66	CL		56*		66		86*		61		69		78
136 8	0	EOP	25800	79	25465	70	24675	61	24980	70	25315	65	25915	62
	0 92	OWP		75		75		71		66		76		66
	1 83	MID		66		69		74		62		77		65
	2 75	IWP		62		62		59		60		73		65
	3 66	CL		54*		68		79		73		73		67
152 0	0	EOP	25785	58*	25450	76	24660	69	24995	51*	25330	77	25930	66
	0 92	OWP		77		71		75		61		85*		72
	1 83	MID		75		69		77		62		81*		71
	2 75	IWP		69		65		75		59		85*		65
	3 66	CL		58*		55*		78		63		78		59
	Averag.	AVG		70		69		75		70		71		72
	Minum.	MIN		54		55		53		50		46		54
	Maxum	MAX		82		80		99		89		120		88
	St Dev	DEV		6 6		5 0		10 5		8 0		11 1		7 2

* Note Outside specification thickness (SThick) limits of design thickness +/- 10 mm.

Table 22. Summary of Surface Layer Average Thickness from Rod and Level Survey and Cores

Section ID	Surf. Elev. Thick. (69mm)	Diff. from Design (69mm)	Int. A Cores Total Thick.	Int. A Cores Surf. Thick.	Diff. from Design (69mm)	Int. B Cores Total Thick.	Int. B Cores Surf. Thick.	Diff. from Design (69mm)	Int. C Cores Total Thick.	Int. C Cores Surf. Thick.	Diff. from Design (69mm)
West Bound New Construction											
890903 (average 890901&02)	70	+1	135 (141)	78	+9	140 (138)	76	+7	132 (138)	69	0
890902 (average 890901&03)	69	0	141 (137)	76	+7	138 (139)	72	+3	139 (135)	75	+6
890901 (average 890902&03)	75	+6	139 (140)	77	+8	138 (139)	78	+9	138 (135)	74	+5
East Bound Overlay Construction											
89A903 (average 89A901&02)	70	+1	125 (125)	62	-7	132* (125)	66	-3	129 (133)	69	0
89A902 (average 89A901&03)	71	+2	122* (131)	75	+6	125 (129)	73	+4	132 (132)	78	+9
89A901 (average 89A902&03)	72	+3	137* (122)	71	+2	126 (128)	64	-5	135 (131)	73	+4

Thickness is in millimeters

The SPS-9A construction guidelines require consistency in layer thickness for each site. The elevations of the surface layer should not deviate more than 10 mm from design Also in the construction guidelines it is stated that "the as-compacted thickness of the asphalt concrete layer (surface plus binder course) in any test section shall be constructed to within $\pm$ 6 mm of the average value of the other test sections in the project"

* Indicates an asphalt concrete compacted thickness (surface plus binder course) that exceed the allowable limit of $\pm$ 6 mm of the average value of the other test sections in the same project

Table 23. Bulk HMA Mix Samples Temperature and Heating Times

Section ID	Day & Date Sampled dd mmm yy	Temperature Upon Arrival at the Lab °C	Oven Set Temperature °C	Hours in Oven (In - Out) Total Time	Temperature at the Time of Compaction
East Bound Overlay Construction					
89A901	17 Sep 96	86	160	(2215-0030) 2hrs&15min	130
89A902	18 Sep 96	80	135	(1800-2300) 5hrs&00min	135
89A903	18 Sep 96	100	135	(2100-0000) 3hrs&00min	130
West Bound New Construction					
890901	20 Sep 96	88	140	(1915-2300) 3hrs&45min	130
890902	24 Sep 96	111	150	(1445-1815) 3hrs&30min	135
890903	24 Sep 96	-	140	(1930-2315) 3hrs&45min	130

Table 24. IRI Values from the Profilometer Survey After Construction

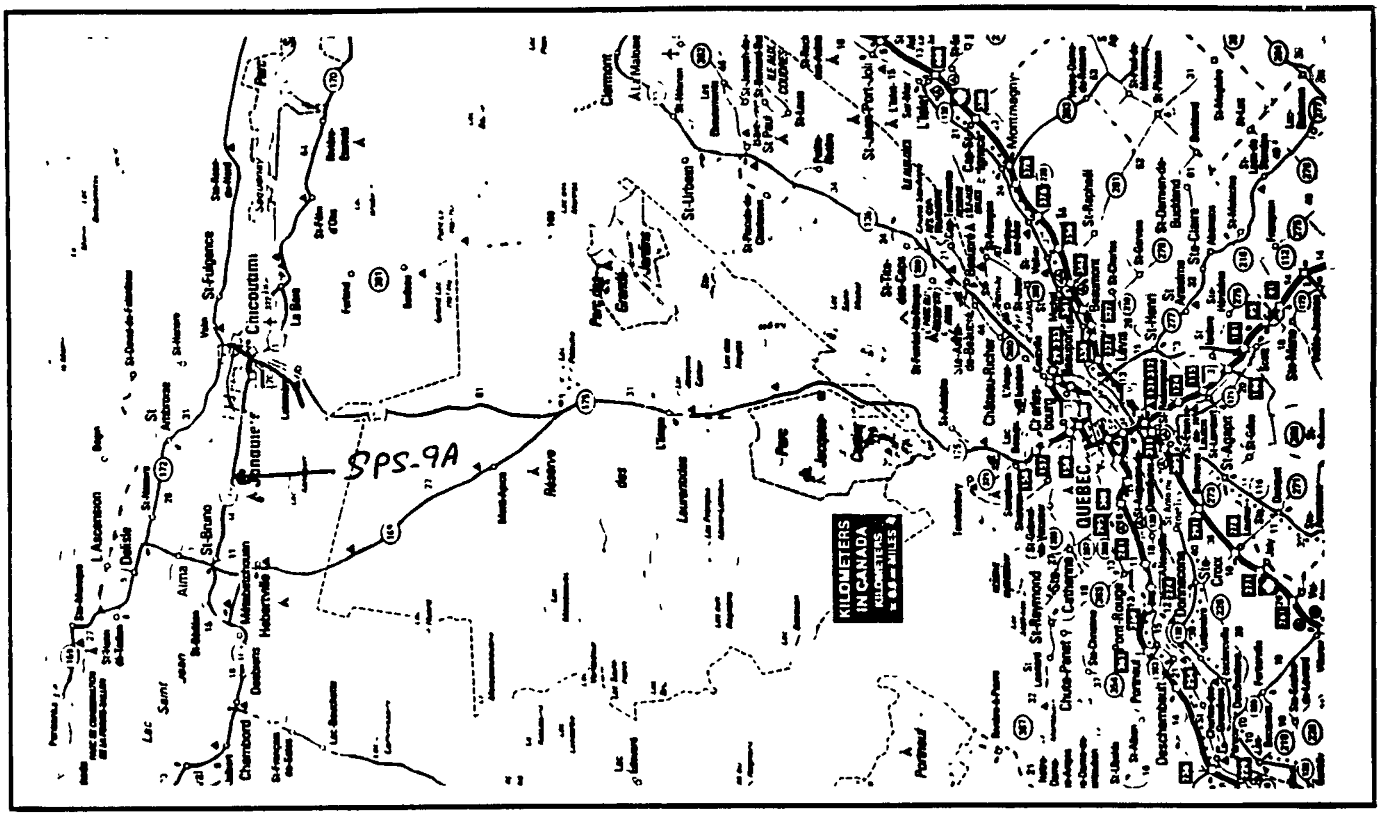
Section ID	Date Surveyed dd mmm yy	Left Wheel Path IRI of 5 Runs (m/km)	Right Wheel Path IRI of 5 Runs (m/km)	Average IRI of 5 Runs (m/km)
West Bound New Construction				
890903	04 Apr 97	1.285	1.279	1.282
890902	04 Apr 97	1 015	1.415	1.216
890901	04 Apr 97	1 247	1.452	1.349
East Bound Overlay Construction				
89A903	04 Apr 97	1 559	2 003	1.781
89A902	04 Apr 97	1 328	1 884	1 606
89A901	04 Apr 97	1 715	1.978	1 847

Plots of Profilometer Elevations, Left Wheel Path and Right Wheel Path, are presented in Figures 15-20.

Table 25. Rut Depth from the Dipstick Survey After Construction

Section ID	Date Surveyed dd mmm yy	**LWP** Avg Rut Depth (mm)	**RWP** Avg Rut Depth (mm)	Average Ru Depth (mm)
West Bound New Construction				
890903	28 May 97	0.9 mm	1.8 mm	1.4 mm
890902	28 May 97	1.5 mm	2.4 mm	2.0 mm
890901	28 May 97	2.2 mm	3.0 mm	2.6 mm
East Bound Overlay Construction				
89A903	28 May 97	1 0 mm	2.3 mm	1 7 mm
89A902	29 May 97	2 8 mm	3 7 mm	3 3 mm
89A901	29 May 97	1 8 mm	1 4 mm	1 6 mm

Rut Depth Plots, Left Wheel Path (LWP) and Right Wheel Path (RWP), are presented in Figures 21-23.



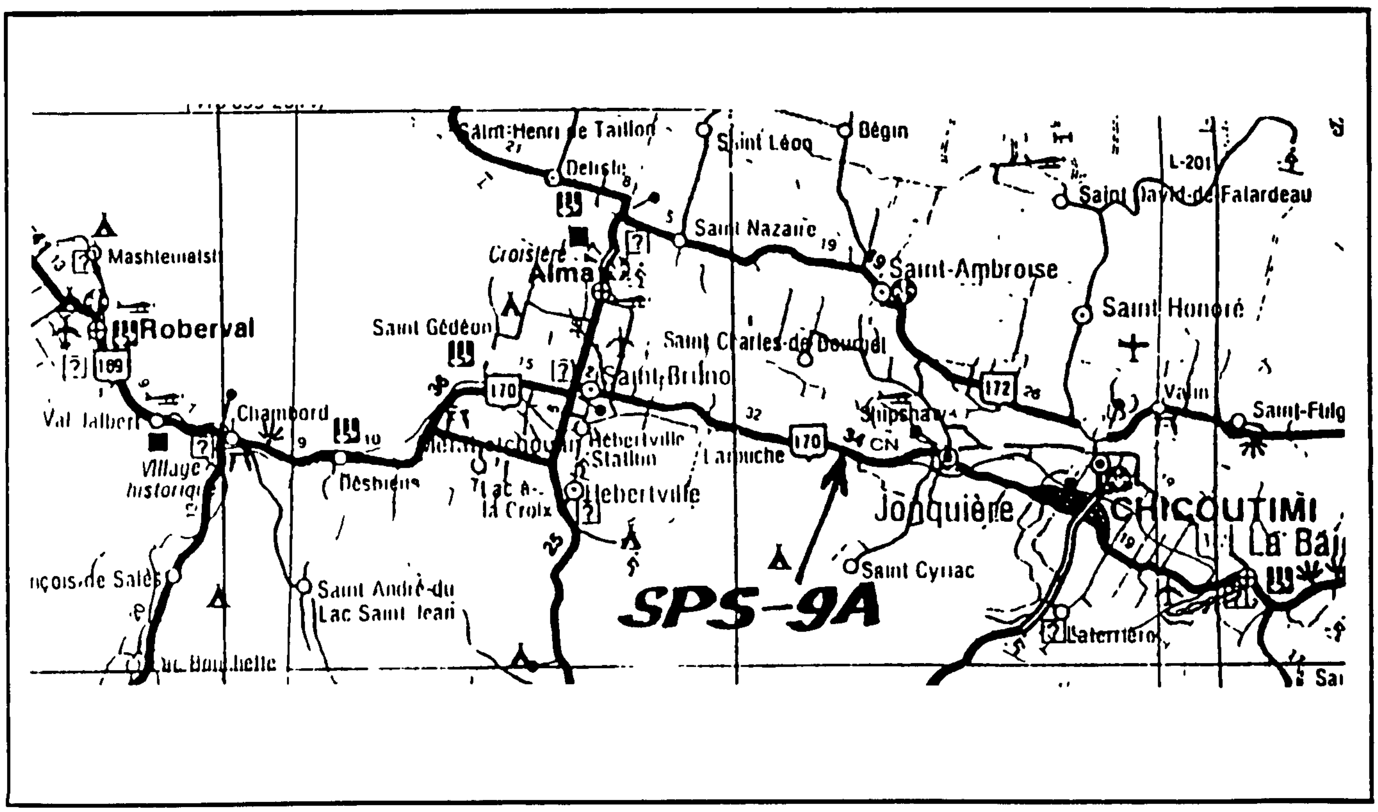
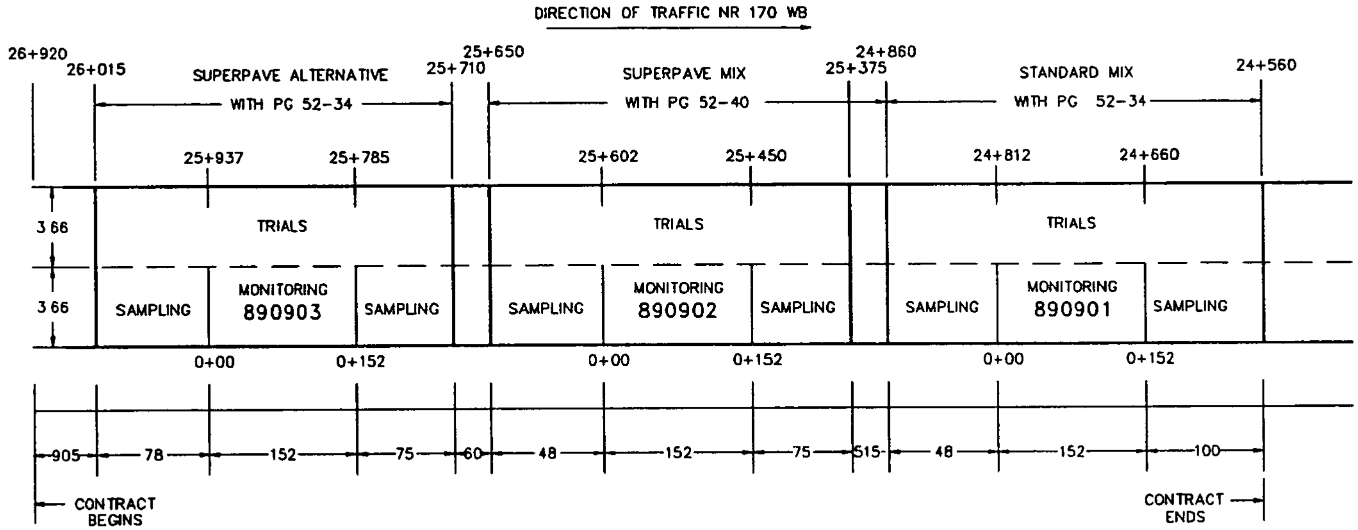
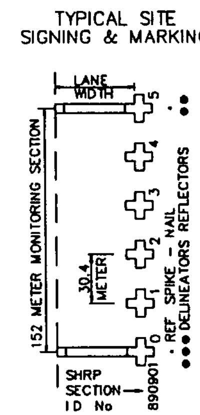


Figure 1 Site Location Maps - SPS Projects 890900 and 89A900

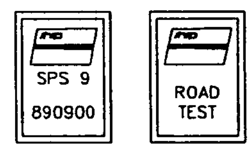
FHWA–LTPP SPS 9A JONQUIERE, QE DESIGN SCHEMATIC

VALIDATION OF SHRP ASPHALT SPECIFICATIONS AND MIX DESIGN AND INNOVATIONS IN ASPHALT PAVEMENTS





LAYER No	LAYER TYPE	DESCRIPTION	01 CODE	01 THICKNESS	02 CODE	02 THICKNESS	03 CODE	03 THICKNESS
1	SS	SUBGRADE SOILS – CLAY	51	--	65	--	53	--
2	EMB	CR GRAVEL FROST BLANKET	23	1981	--	--	23	2286
3	SB	CR GRAVEL SUBBASE	23	300	23	300	23	300
4	GB	CR GRAVEL BASE COURSE	23	376	23	376	23	376
5	AC	AC BINDER COURSE	01	64	01	64	01	64
6	AC	AC SURFACE COURSE	01	69	01	69	01	69



LAYOUT OF NEW CONSTRUCTION TEST SECTIONS

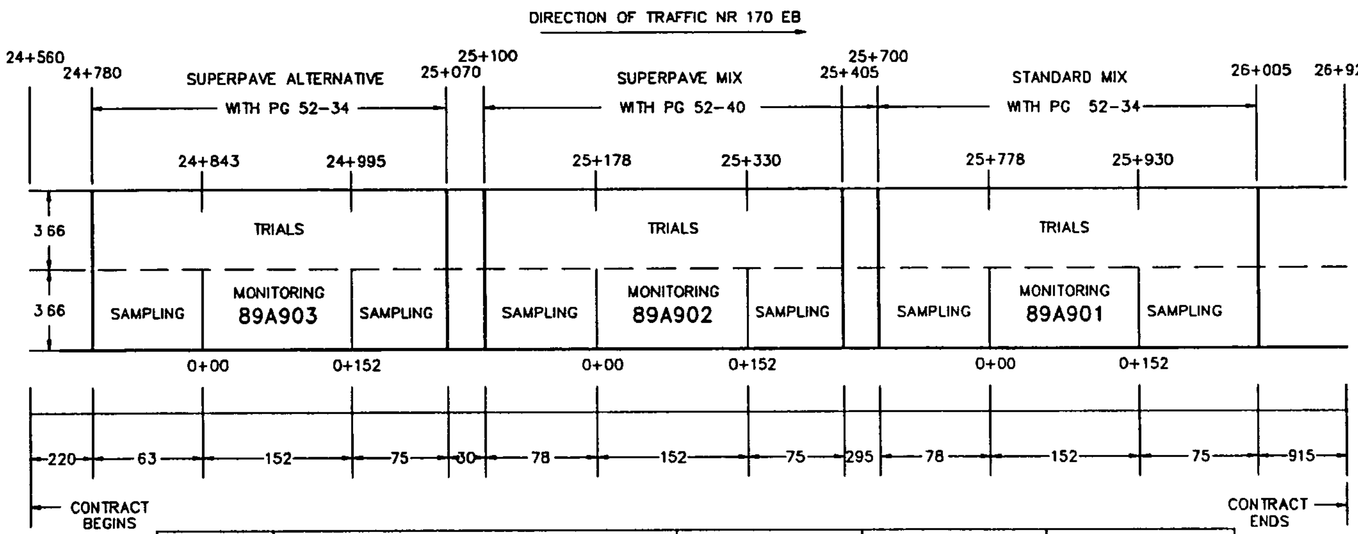
QE MTQ SPS-9A
NR 170 WB, JONQUIERE QE

SPS-9A-02

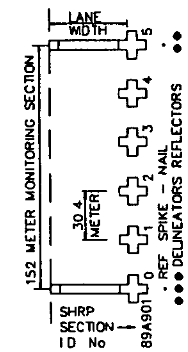
FHWA SPS-9A TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

FIGURE 2 LAYOUT OF SPS-9A NEW CONSTRUCTION TEST SECTIONS, PROJECT 890900, NR170 WB, JONQUIERE QUEBEC

FHWA–LTPP SPS 9A JONQUIERE, QE DESIGN SCHEMATIC
VALIDATION OF SHRP ASPHALT SPECIFICATIONS AND
MIX DESIGN AND INNOVATIONS IN ASPHALT PAVEMENTS



TYPICAL SITE
SIGNING & MARKING



LAYER No	LAYER TYPE	DESCRIPTION	01 CODE	01 THICKNESS	02 CODE	02 THICKNESS	03 CODE	03 THICKNESS
1	SS	SUBGRADE SOILS – SILTY CLAY	53	--	53	--	53	--
2	EMB	CR GRAVEL	--	--	23	2315	23	1351
3	SB	SAND SUBBASE	24	701	24	749	24	498
4	GB	SOIL AGG MIXTURE BASE	25	201	25	231	25	201
5	AC	EXISTING PAVEMENT	01	201	01	206	01	150
6	EMB	CR GRAVEL	--	--	23	1453	--	--
7	SB	CR GRAVEL SUBBASE	--	--	23	300	--	--
8	GB	CR GRAVEL BASE	23	373	23	376	23	409
9	AC	AC BINDER COURSE	01	64	01	64	01	64
10	AC	AC SURFACE COURSE	01	69	01	69	01	69

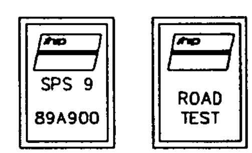


FIGURE 3 LAYOUT OF SPS–9A OVERLAY TEST SECTIONS, PROJECT 89A900, NR170 EB, JONQUIERE QUEBEC

LAYOUT OF
OVERLAY
TEST SECTIONS

QE MTQ SPS–9A
NR 170 EB, JONQUIERE QE

PLOTDATE MAR 23/98
SPS–9A–02
FHWA SPS–9A TEST SECTIONS ONLY
DIMENSIONAL DETAILS ONLY
DRAWING NOT TO SCALE

C:\CAD–DWGS\QUEBEC\89A900.DWG

44

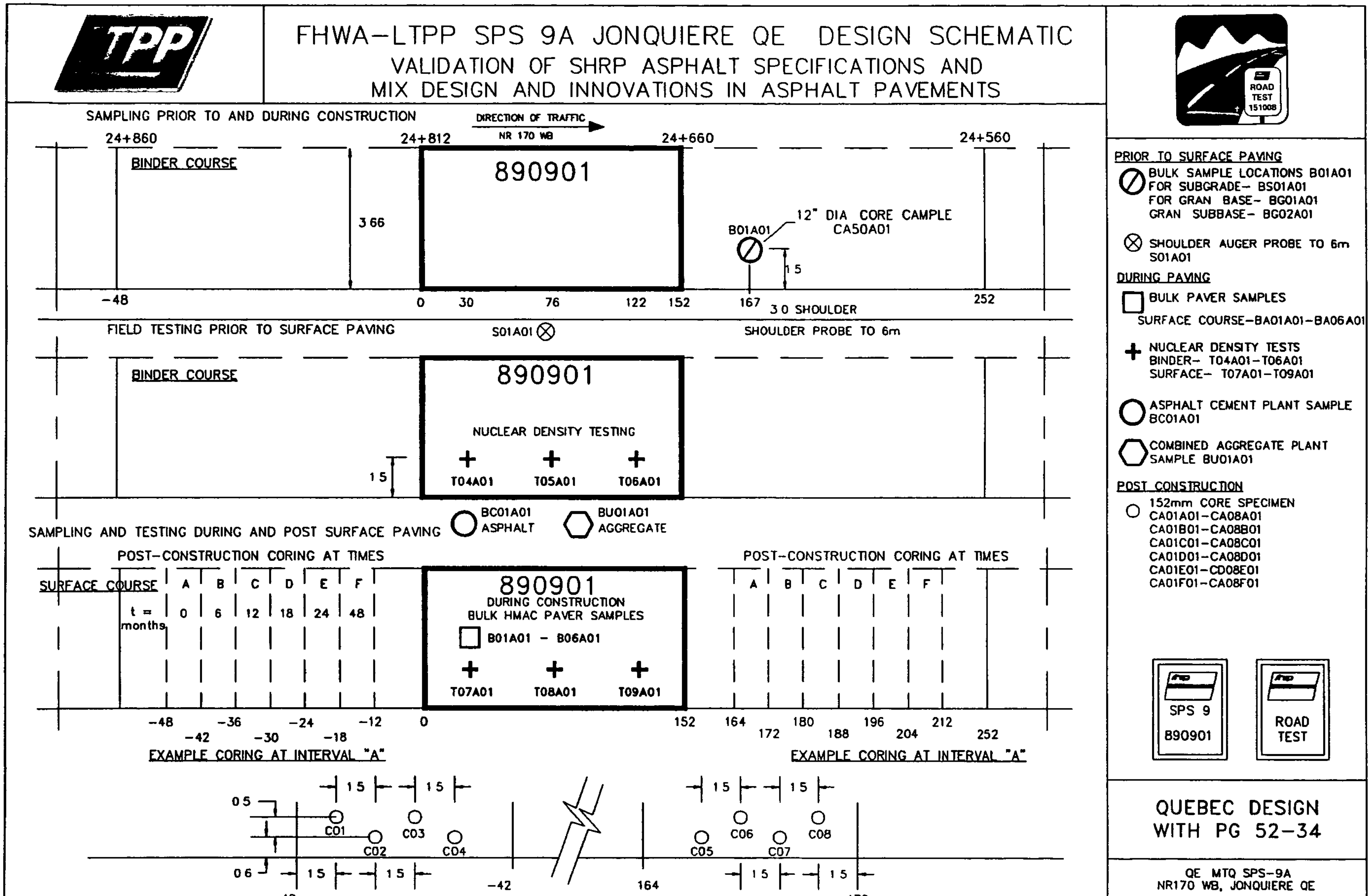


FIGURE 4 MATERIALS SAMPLING AND TESTING PLAN SPS–9A SECTION 890901

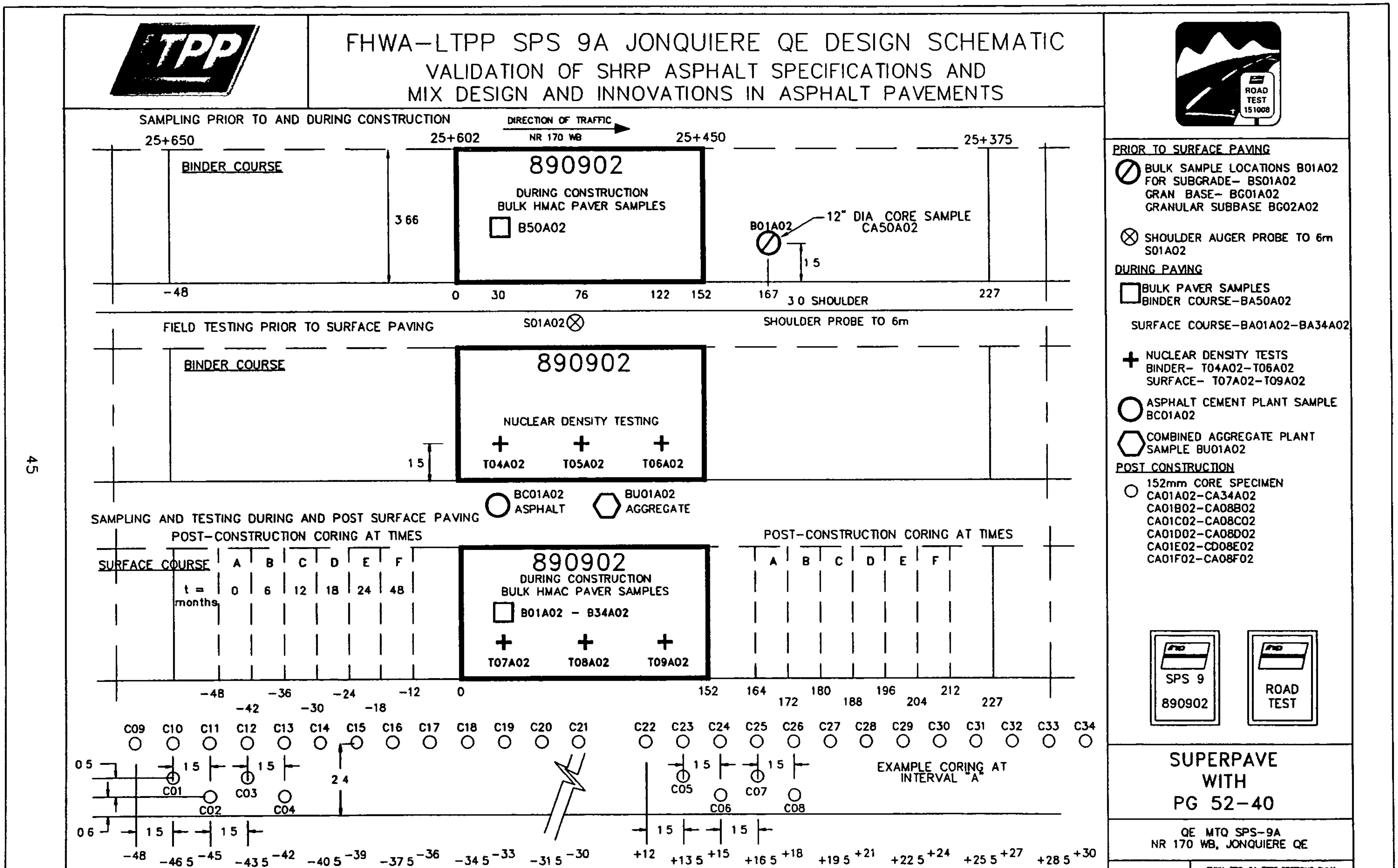


FIGURE 5 MATERIALS SAMPLING AND TESTING PLAN SPS–9A SECTION 890902

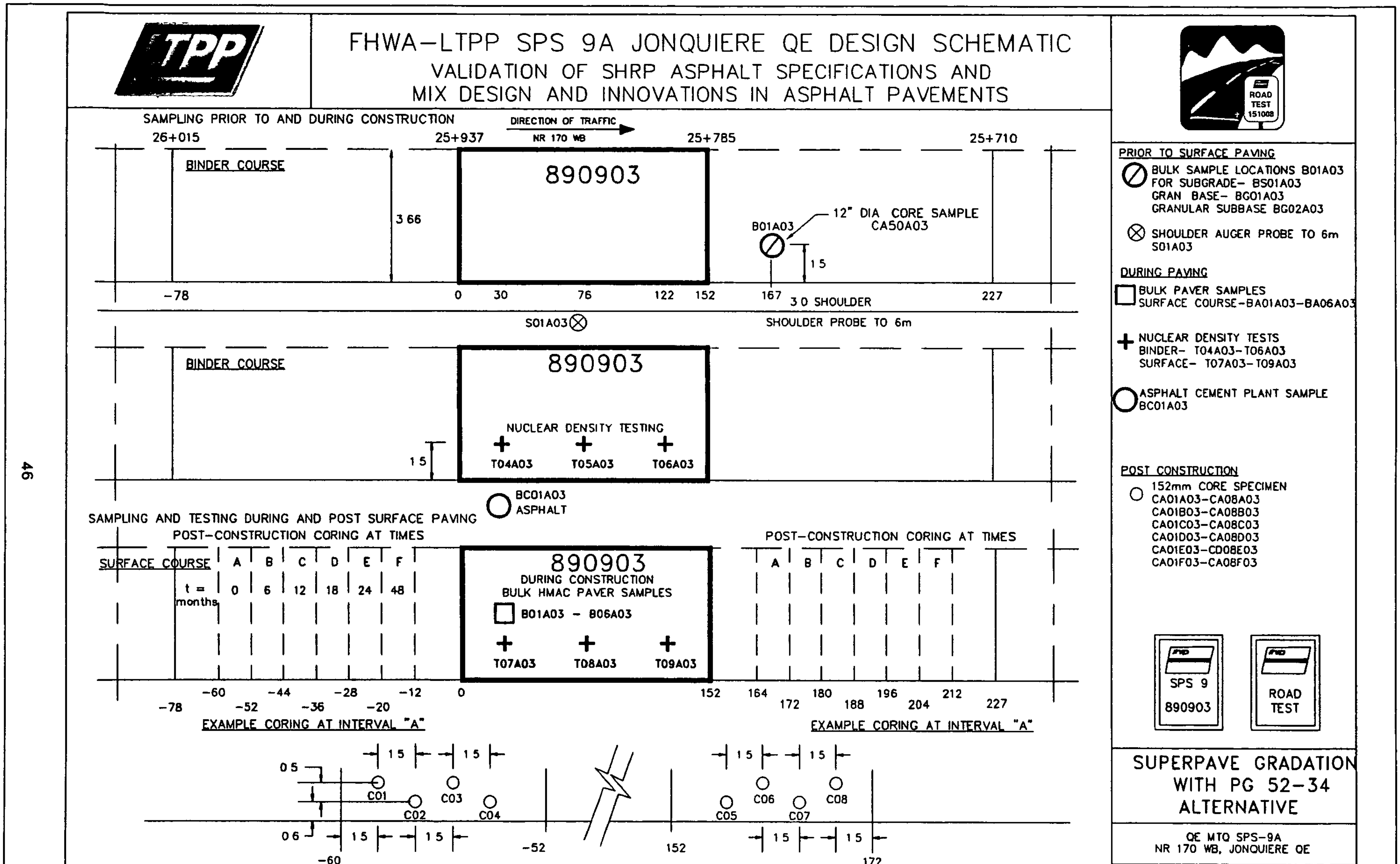


FIGURE 6 MATERIALS SAMPLING AND TESTING PLAN SPS-9A SECTION 890903

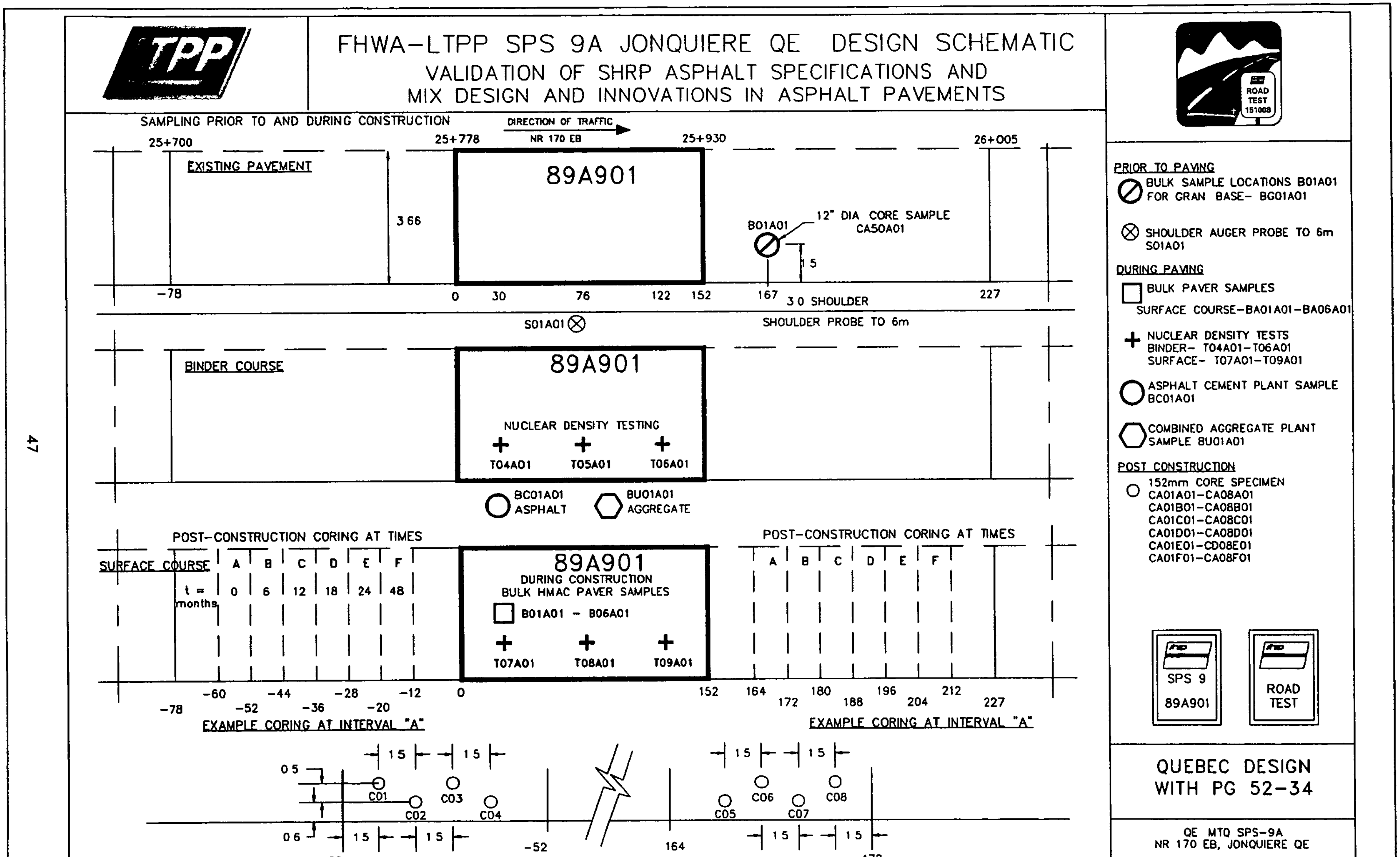


FIGURE 7 MATERIALS SAMPLING AND TESTING PLAN SPS-9A SECTION 89A901

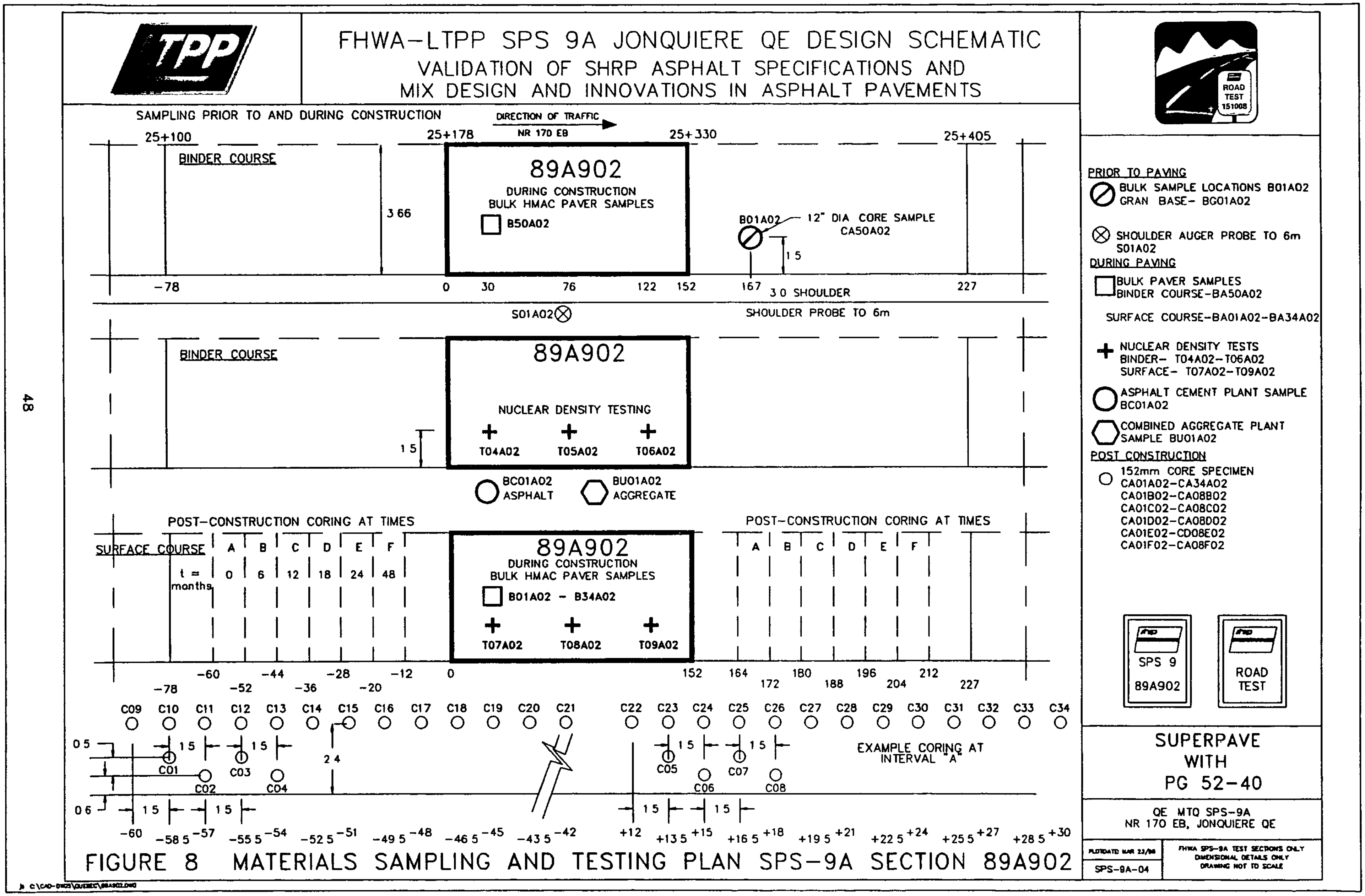


FIGURE 8 MATERIALS SAMPLING AND TESTING PLAN SPS-9A SECTION 89A902

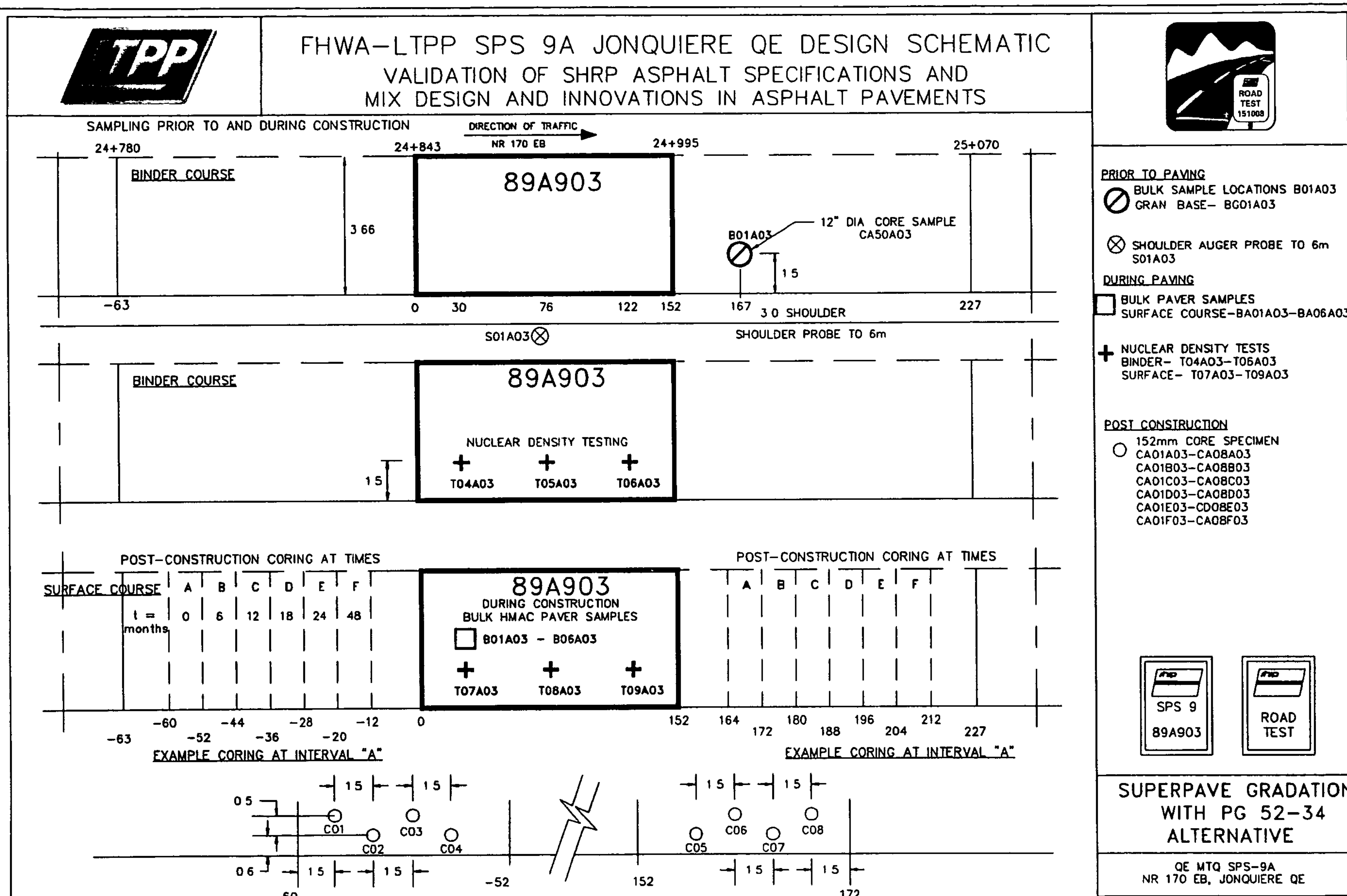


FIGURE 9 MATERIALS SAMPLING AND TESTING PLAN SPS-9A SECTION 89A903

	890901		890902		890903	
	24+660 24+812		25+450 25+602		25+785 25+937	Const. Stations
WB Outside	0+152 0+00		0+152 0+00		0+152 0+00	Exper Stations
Shoulder	1435 1655		1020 1145		1615 1710	SPS Pav Time
SPS WB lane **Sep.20=>** Paving Date	69 mm Standard Mix With PG 52-34 BA01A01-BA06A01	**9/24** =>	69 mm SUPERPAVE™ With PG 52-40 BA01A02-BA34A02	**9/24** =>	69 mm Superpave™ Alt. With PG 52-34 BA01A03-BA06A03	Thickness Type of Pavement **<Bulk Samples**
non SPS NB lane			←=======		NR 170 West Bound Traffic Direction	
WB Inside **Shoulder**						

CL

	89A903		89A902		89A901	
EB Inside **Shoulder**						
non SPS EB lane	NR 170 East Bound Traffic Direction		=======→			
Thickness Type of Pavement **Bulk Samples>**	69 mm Superpave™ Alt. With PG 52-34 BA01A03-BA06A03	**9/18** <=	69 mm SUPERPAVE™ With PG 52-40 BA01A02-BA34A02	**9/18** <=	69 mm Standard Mix With PG 52-34 BA01A01-BA06A01	SPS EB lane **<=Sep.17** Paving Date
EB Outside	1745 1605		1310 1145			SPS Pav Time
Shoulder	0+00 0+152		0+00 0+152		0+00 0+152	Exper Stations
	24+843 24+995		25+178 25+330		25+778 25+930	Const. Stations

Not to scale

CL - Center Line
Refer to Table 18 for more details on the paving of the binder and surface layers

Figure 10 Surface Layer Type, Paving Dates, Paving Times, and Bulk Sample Locations

0+45.6	0+30.4	West Bound	Outer Shoulder 0+15.2	0+00
x Edge of Pavement (EOP)	x		x	x
x Outer Wheel Path (OWP)	x		x NR 170	x
x Midlane (MID)	x	←=====	x East Bound	x
x Inner Wheel Path (IWP)	x		x Traffic Direction	x
x Centerline (CL)	x		x	x

←===== NR 170
West Bound
Traffic Direction

0+45.6	0+30.4	West Bound	Inner Shoulder 0+15.2	0+00

0+00	0+15.2	East Bound	Inner Shoulder 0+30.4	0+45.6

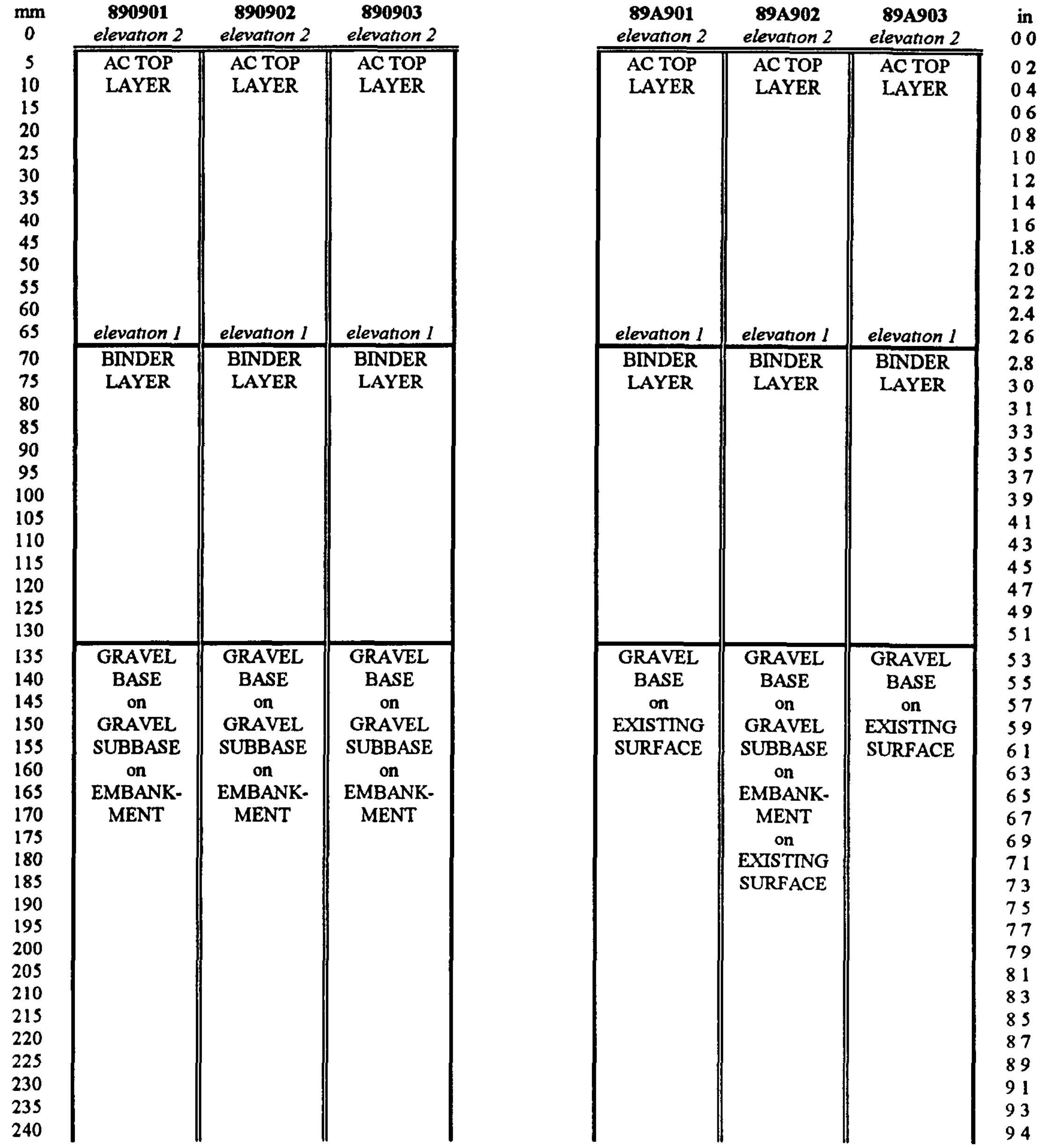
=====→ NR 170
East Bound
Traffic Direction

x Centerline (CL)	x		x	x
x Inner Wheel Path (IWP)	x		x NR 170	x
x Midlane (MID)	x	=====→	x East Bound	x
x Outer Wheel Path (OWP)	x		x Traffic Direction	x
x Edge of Pavement (EOP)	x		x	x
0+00	0+15.2	East Bound	Outer Shoulder 0+30.4	0+45.6

x Location of Elevation Measurement

EOP Offset	0 00 m
OWP Offset	0 92 m
MID Offset	1 83 m
IWP Offset	2.75 m
CL Offset	3 66 m

Figure 11 Location of Elevation Measurements



Notes Refer to Table 15 for the dates of the two stages of elevation measurements

First stage	elevation 1	AC Binder Layer	September 6 - September 12, 1996
Second stage	elevation 2	AC Top Layer	September 18 - September 25, 1996

Figure 12 Pavement Structures and the Two Stages of Rod and Level Elevations

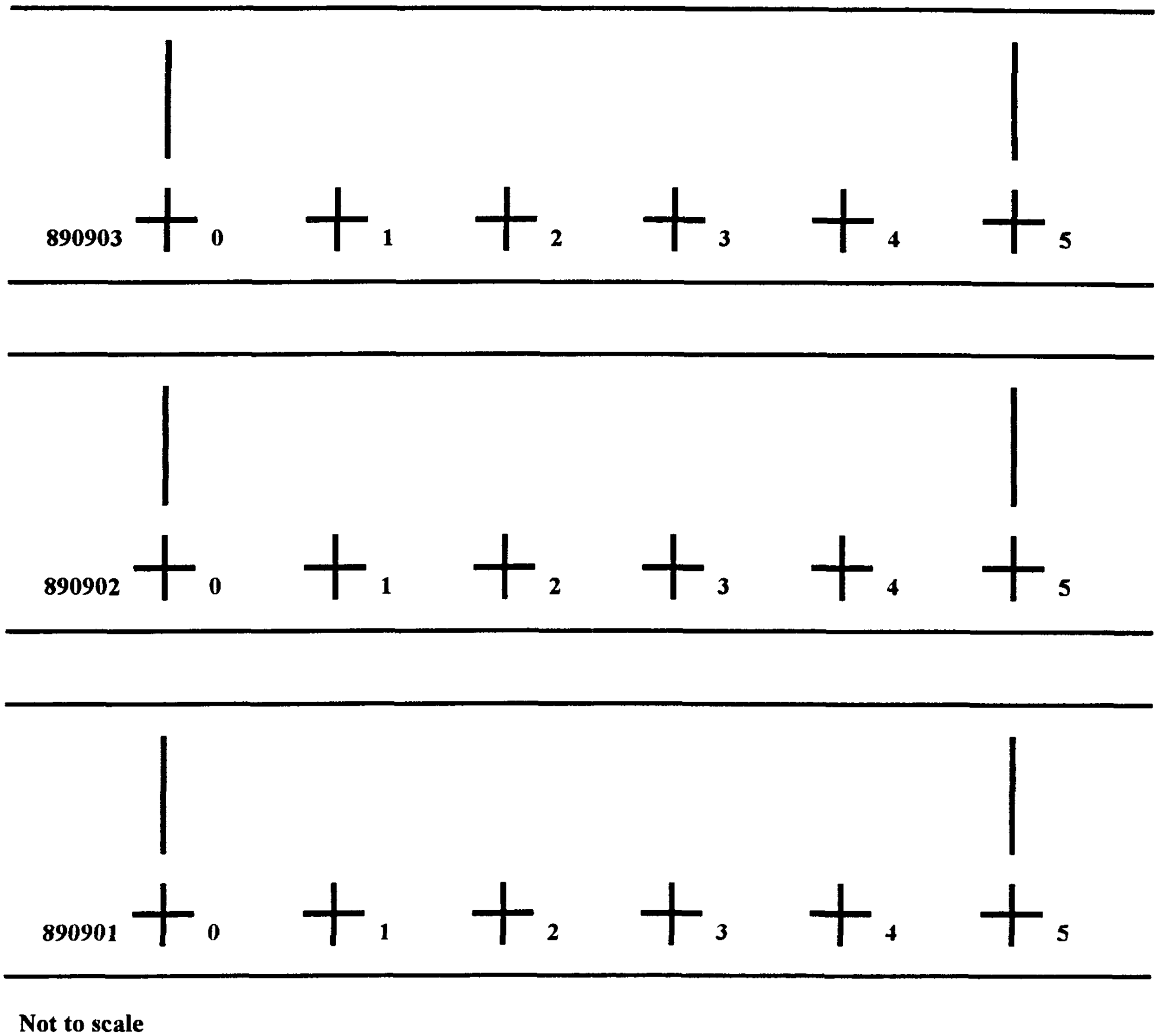
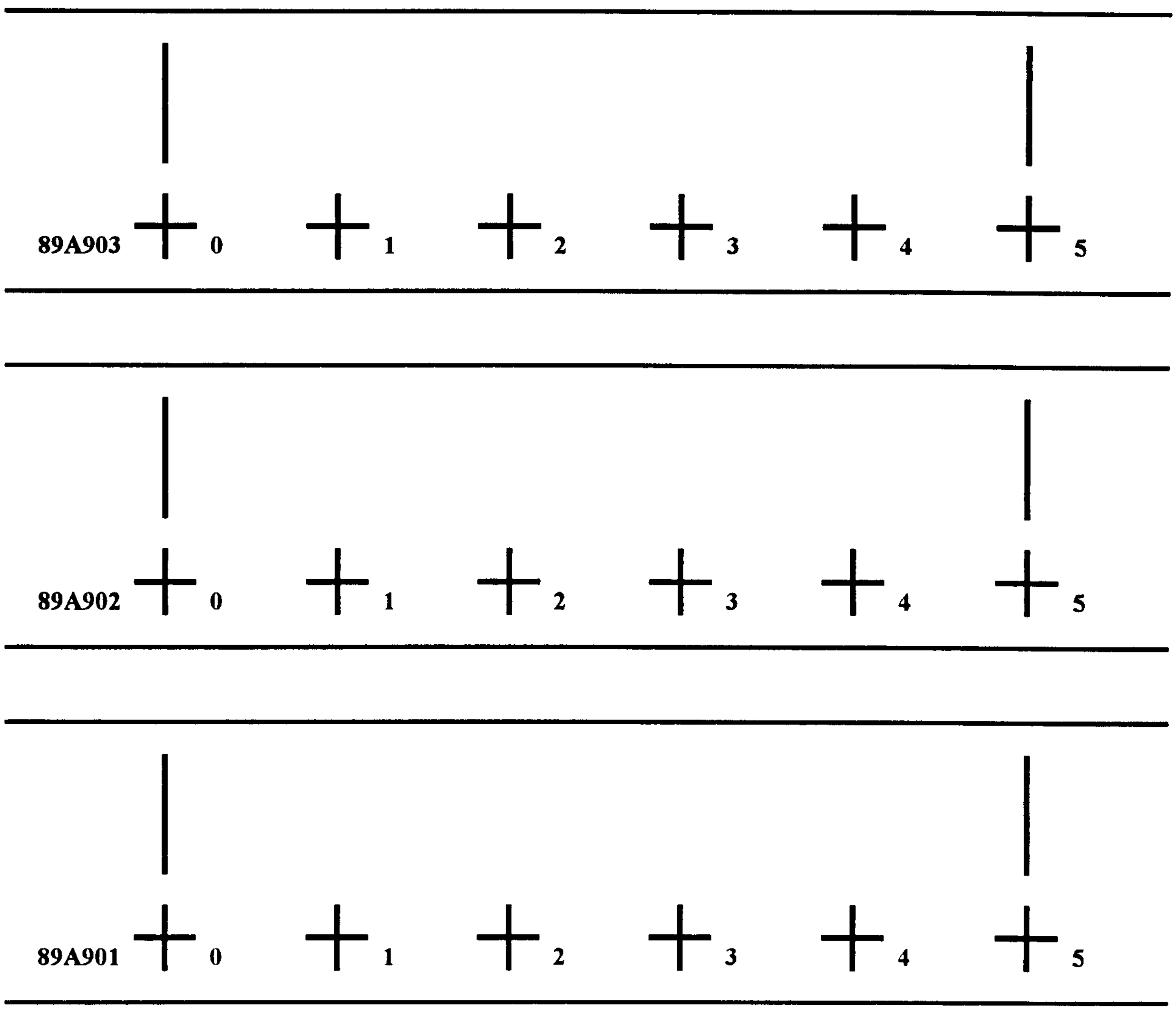
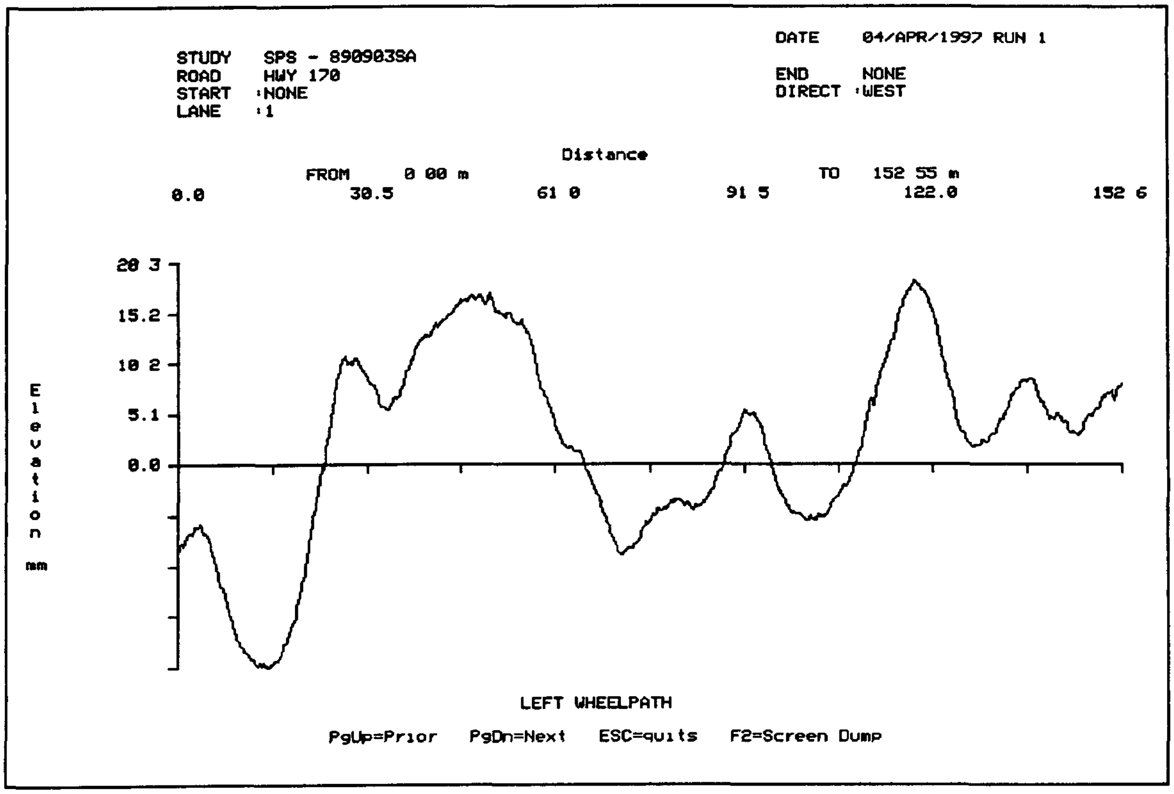


Figure 13. NR 170 West Bound SPS-9A New Construction Test Sections Site Marking Plan After Construction



Not to scale

Figure 14 NR 170 East Bound SPS-9A Overlay Test Sections Site Marking Plan After Construction



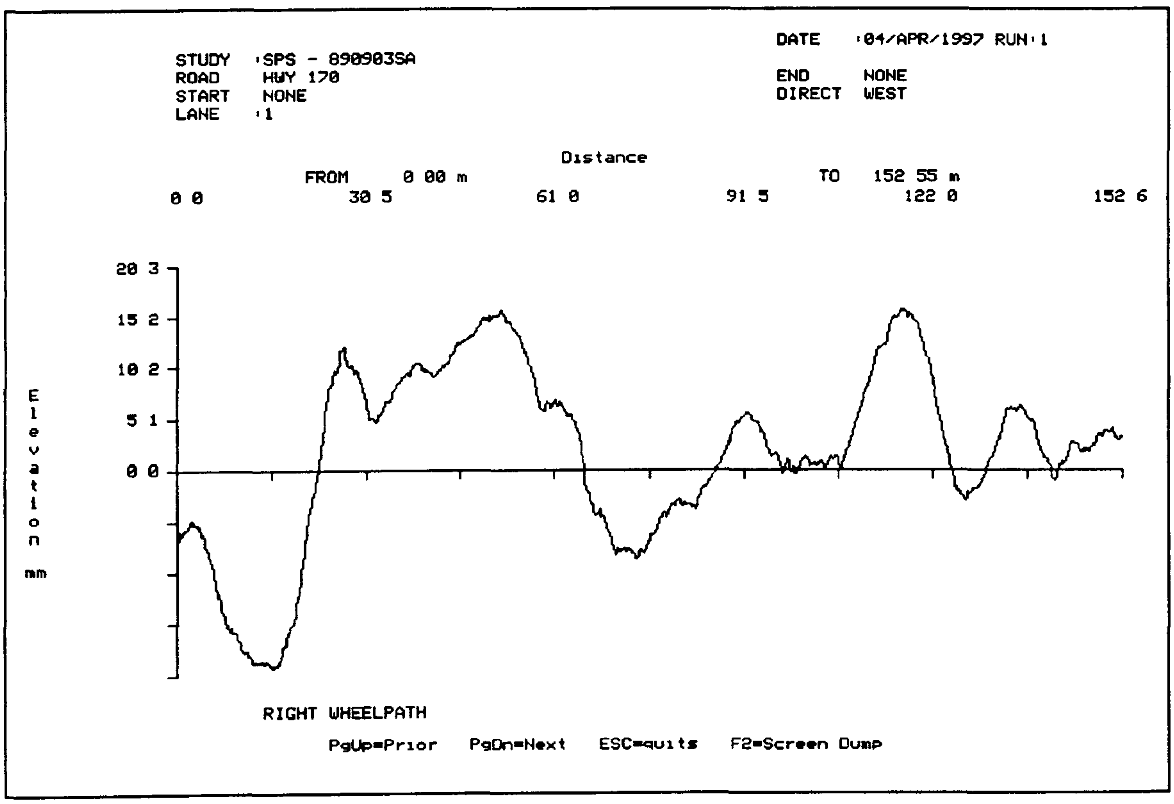
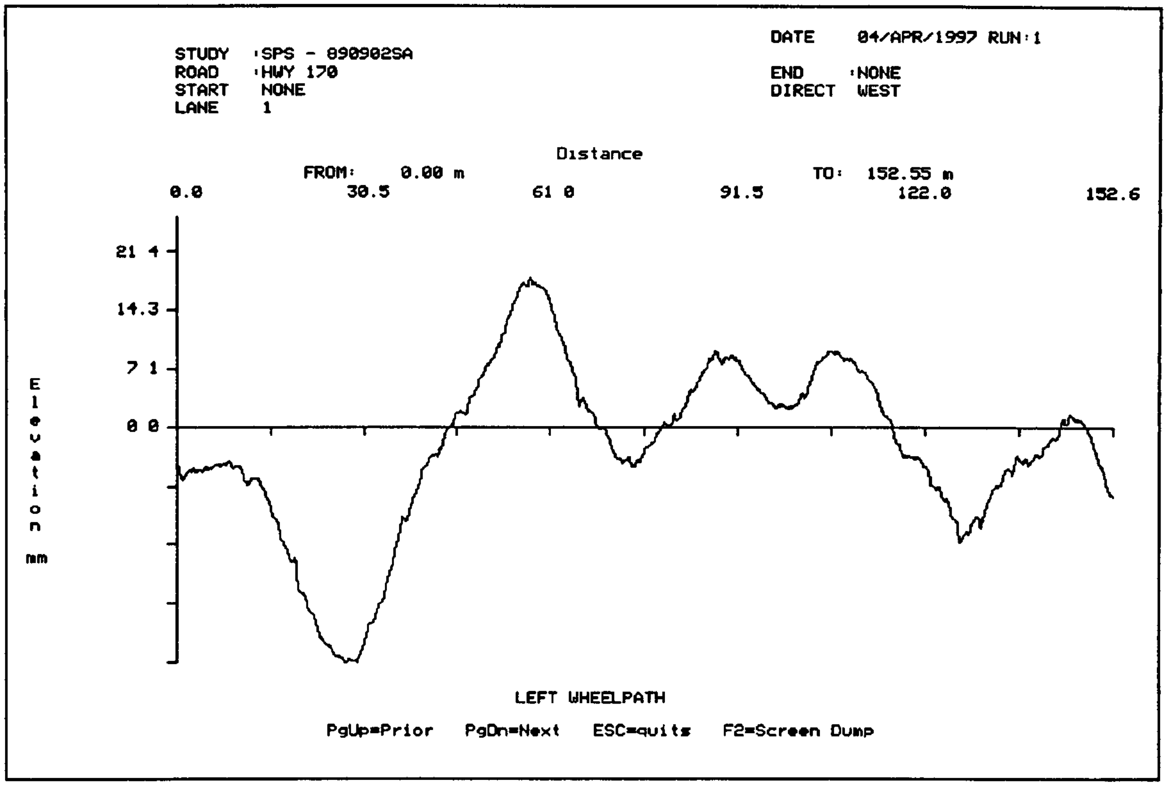


Figure 15 Elevation Measurements, Section 890903, as Collected with the Profilometer



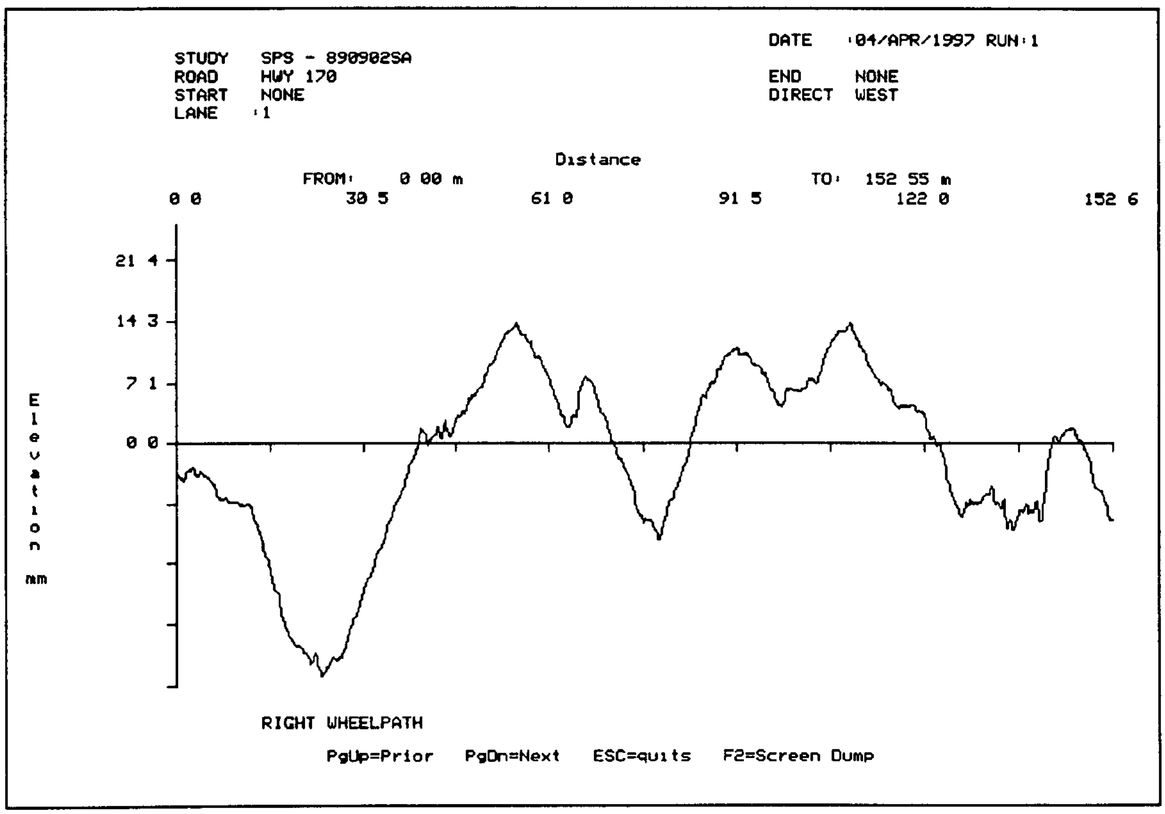
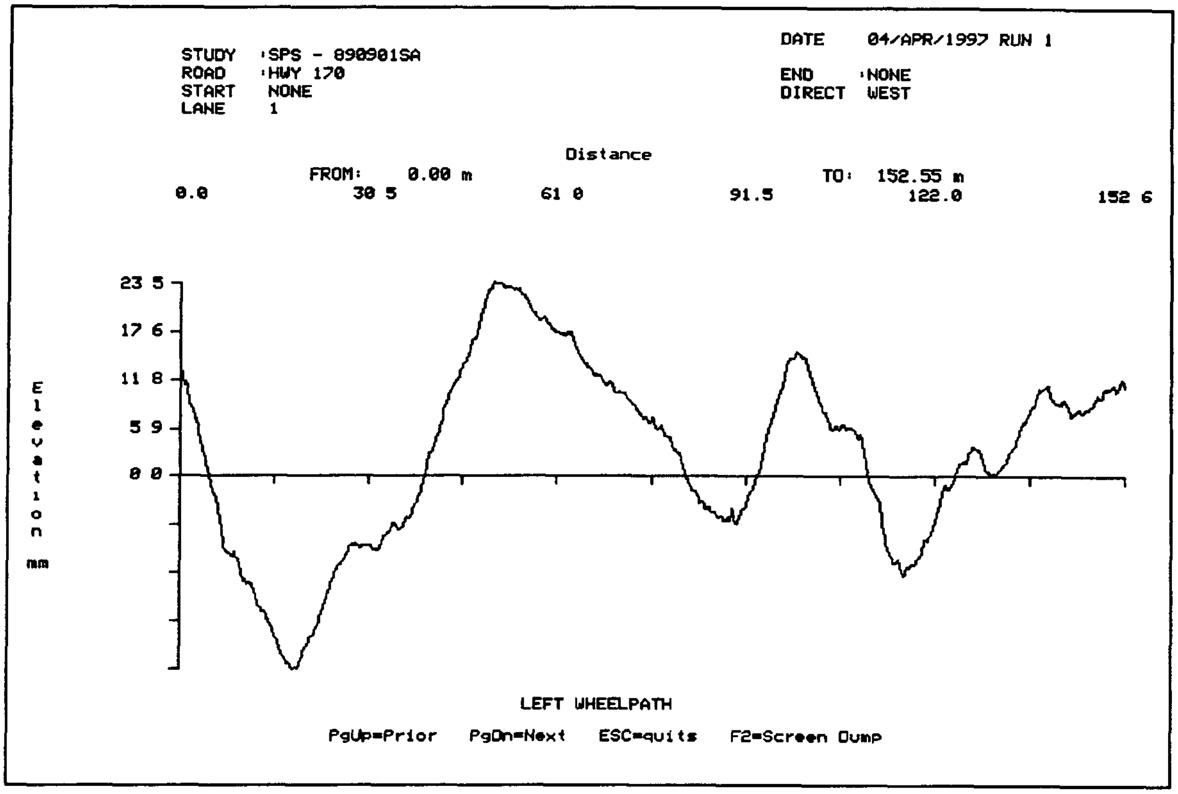


Figure 16 Elevation Measurements, Section 890902, as Collected with the Profilometer



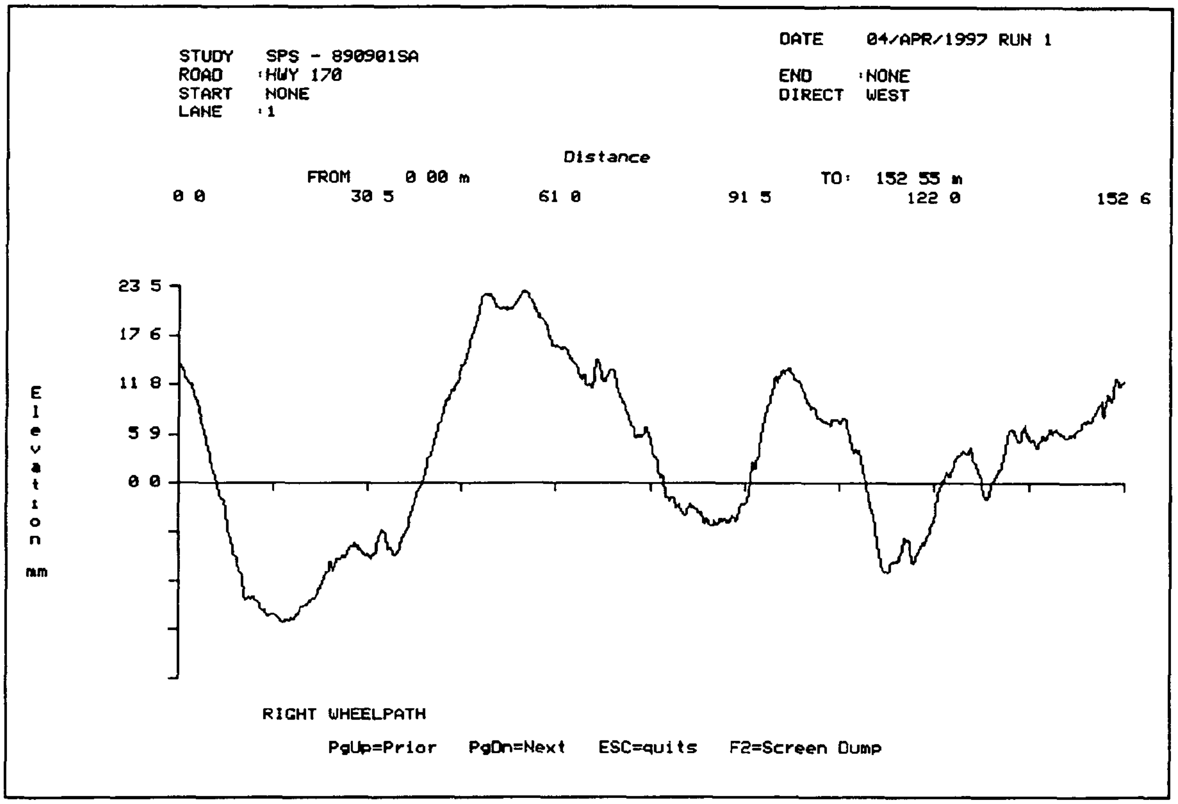
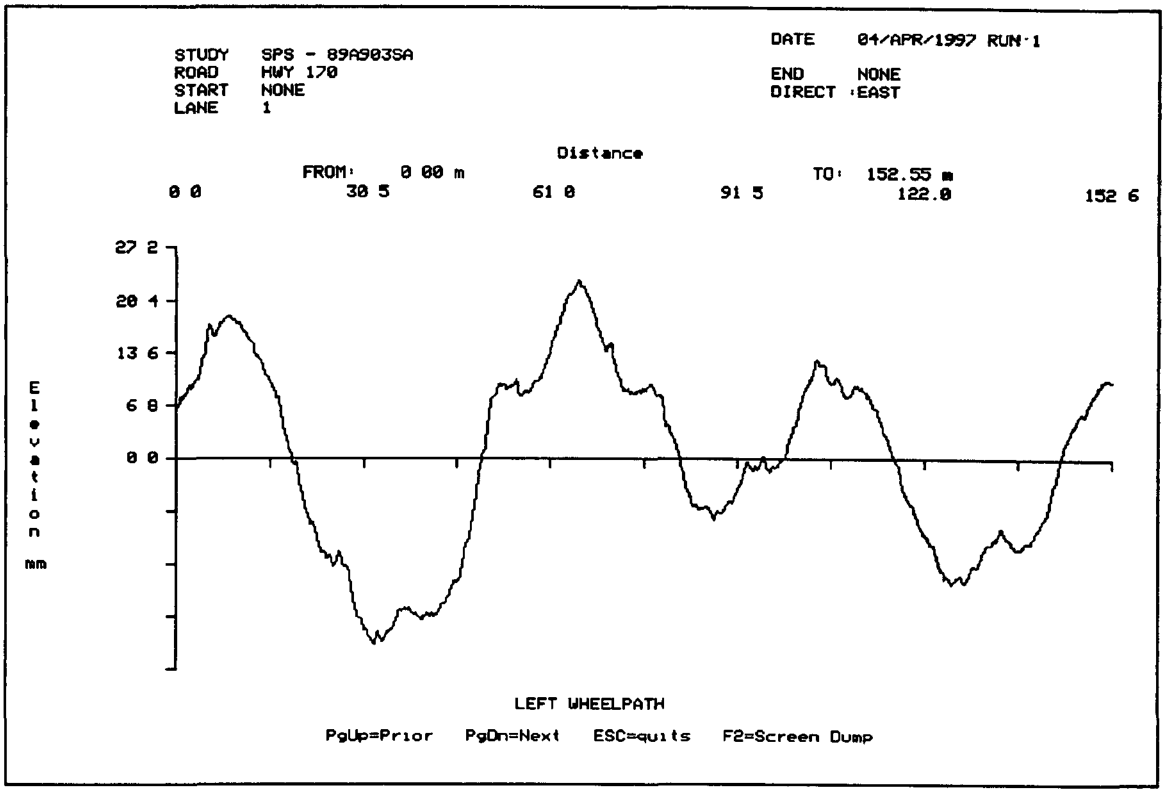


Figure 17. Elevation Measurements, Section 890901, as Collected with the Profilometer



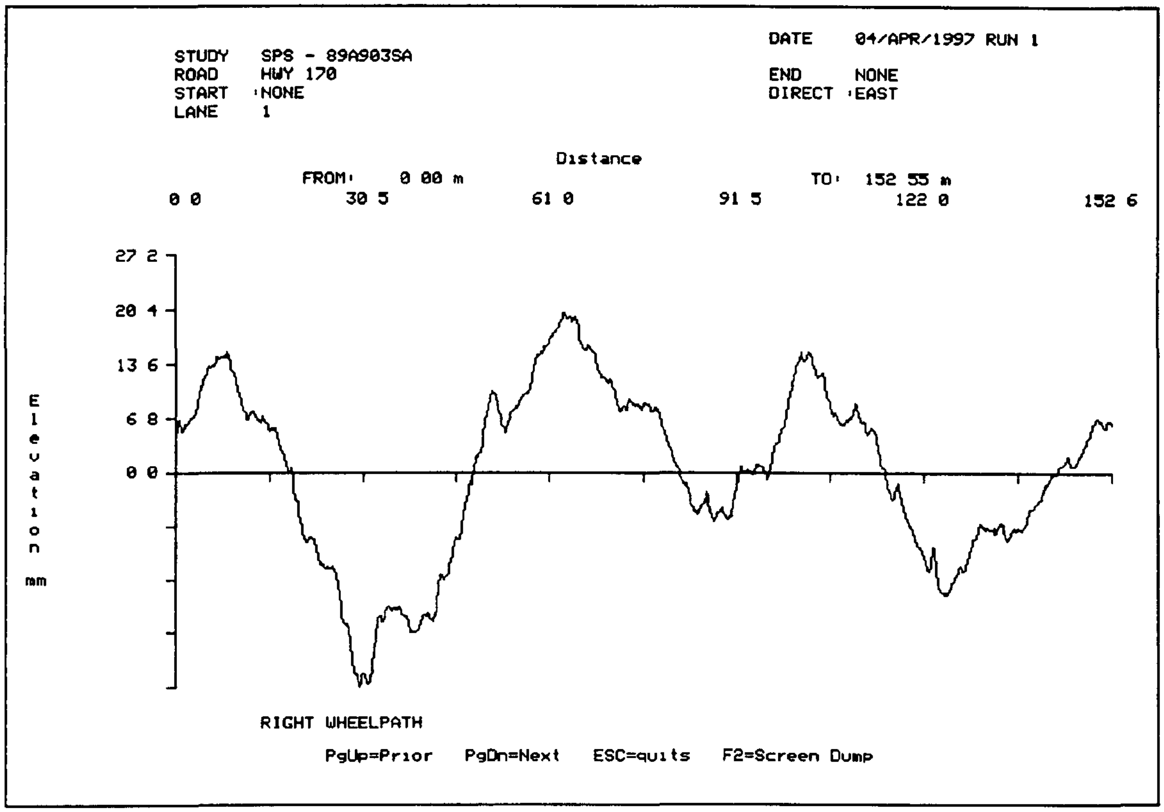
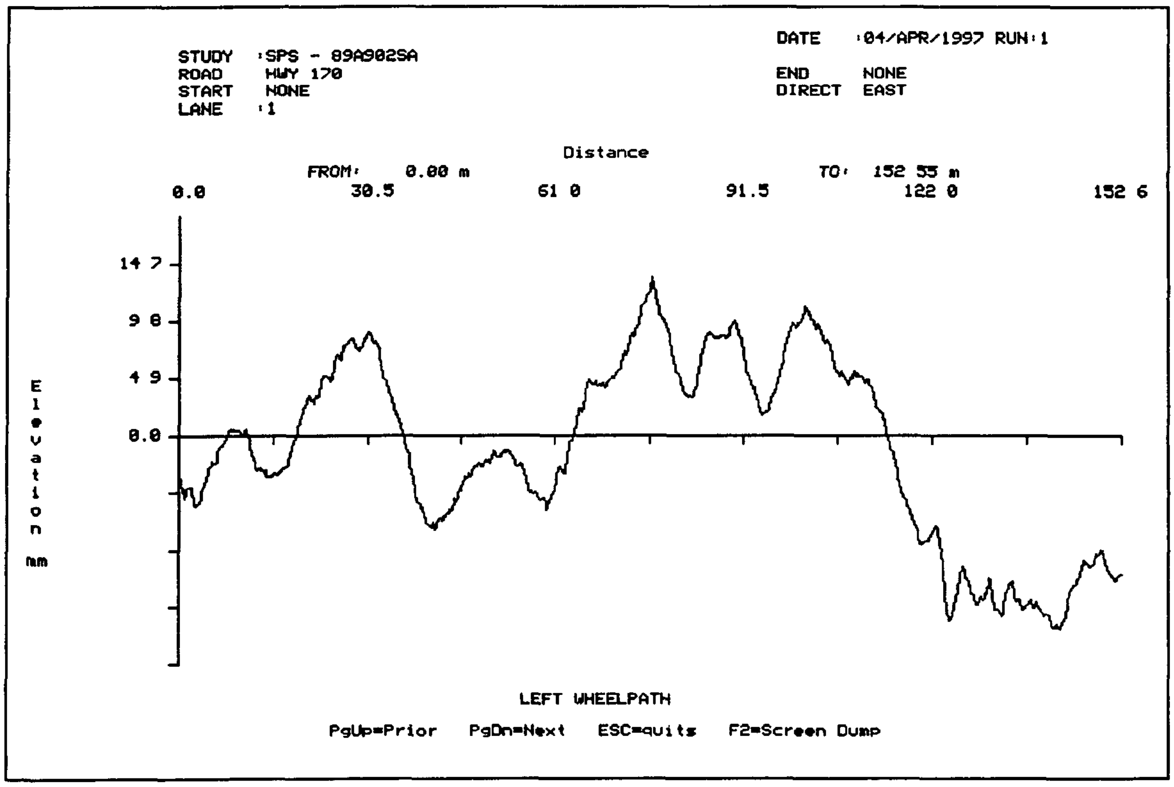


Figure 18 Elevation Measurements, Section 89A903, as Collected with the Profilometer



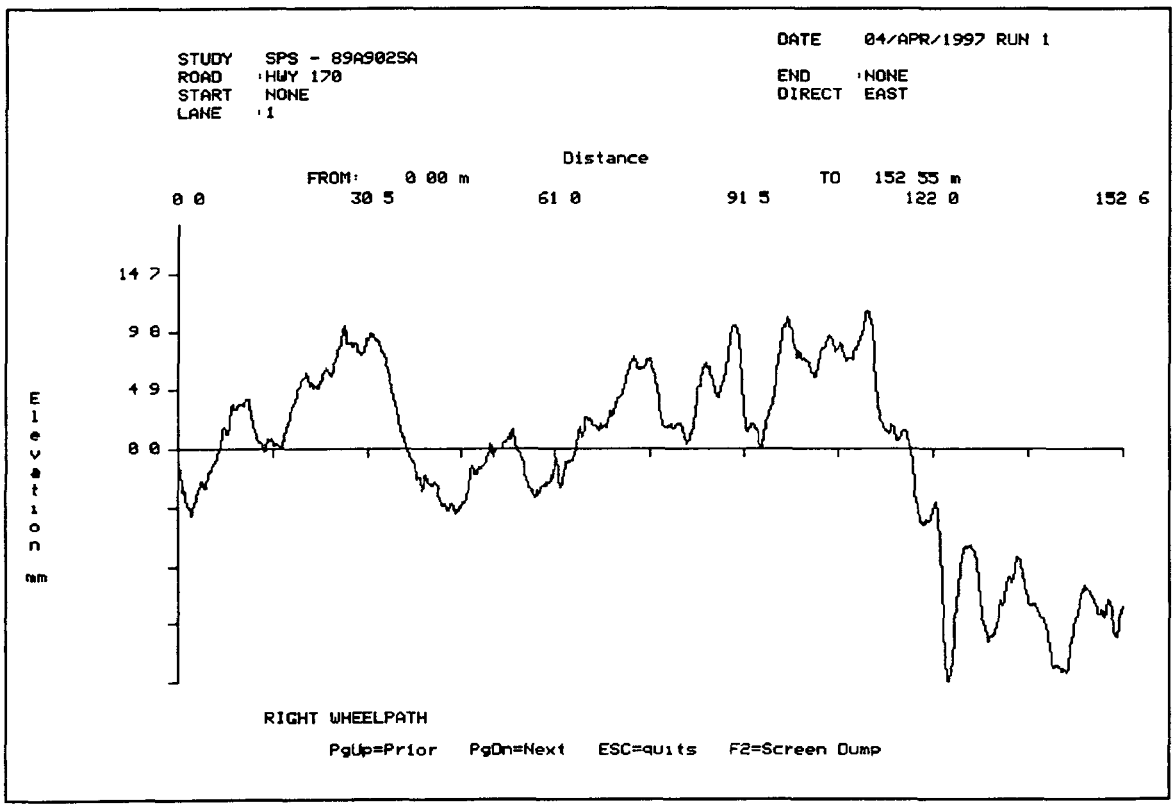
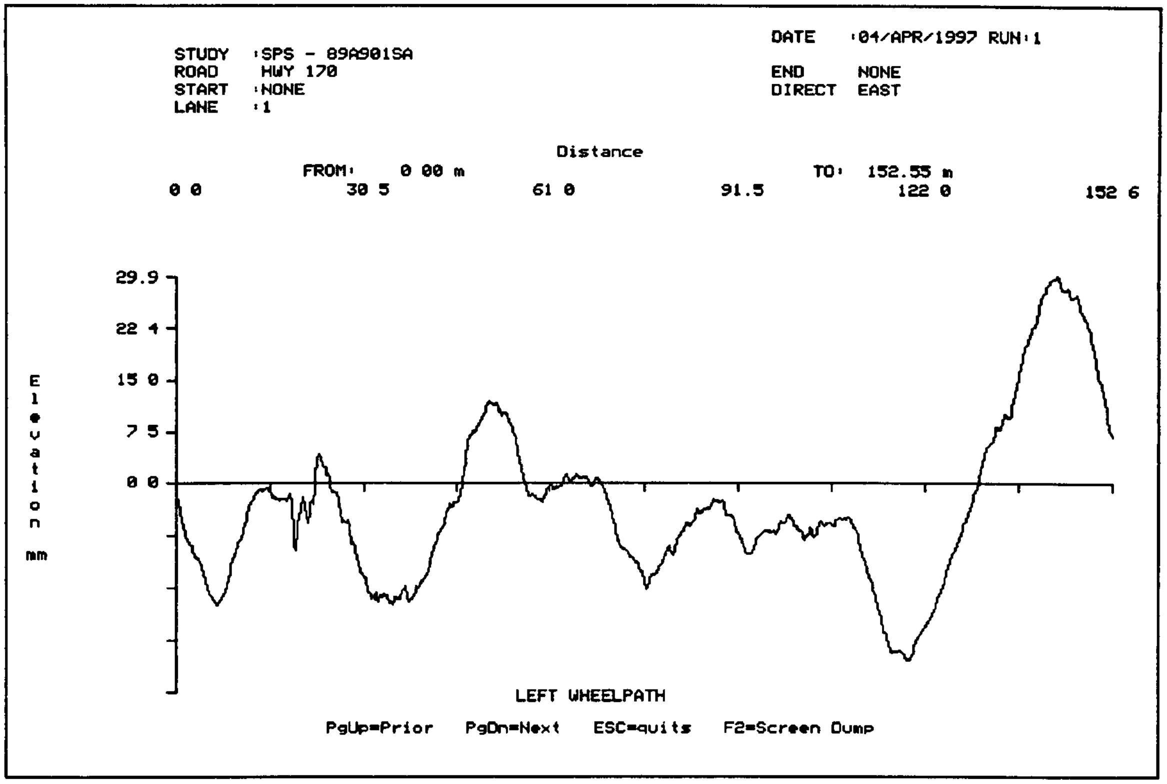


Figure 19 Elevation Measurements, Section 89A902 as Collected with the Profilometer



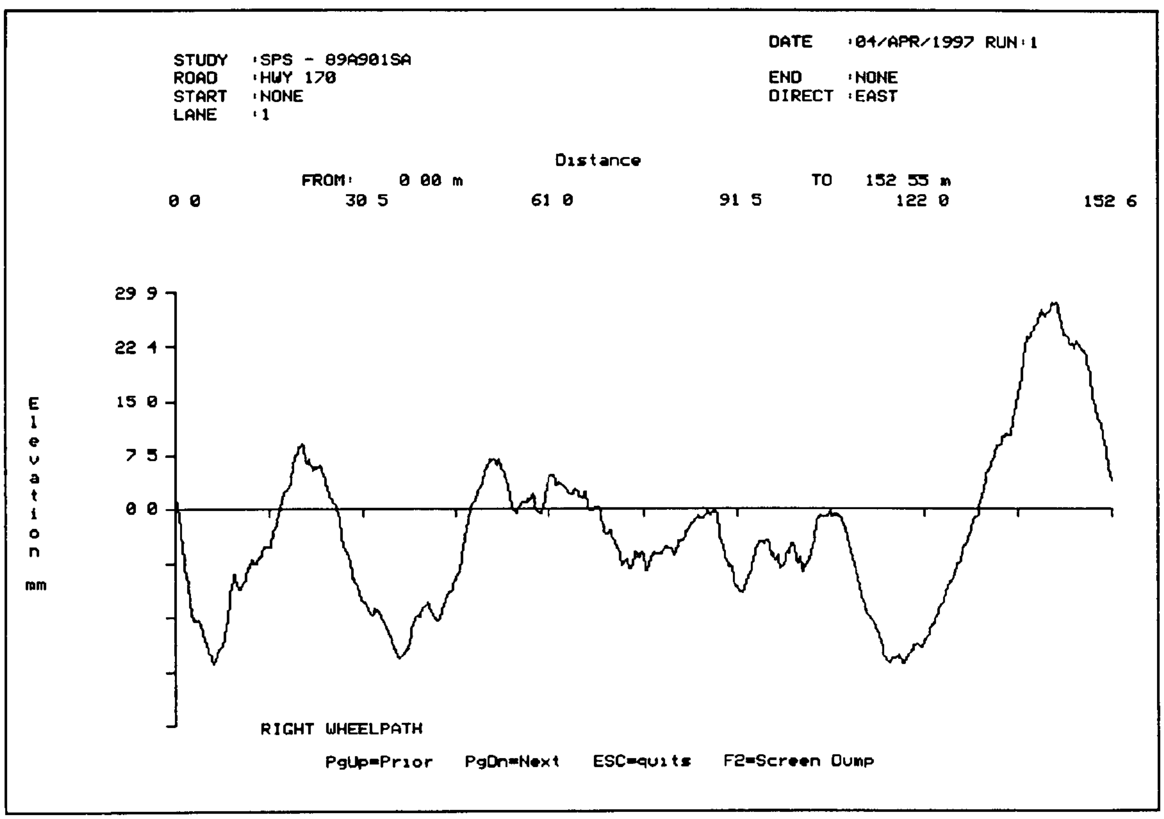
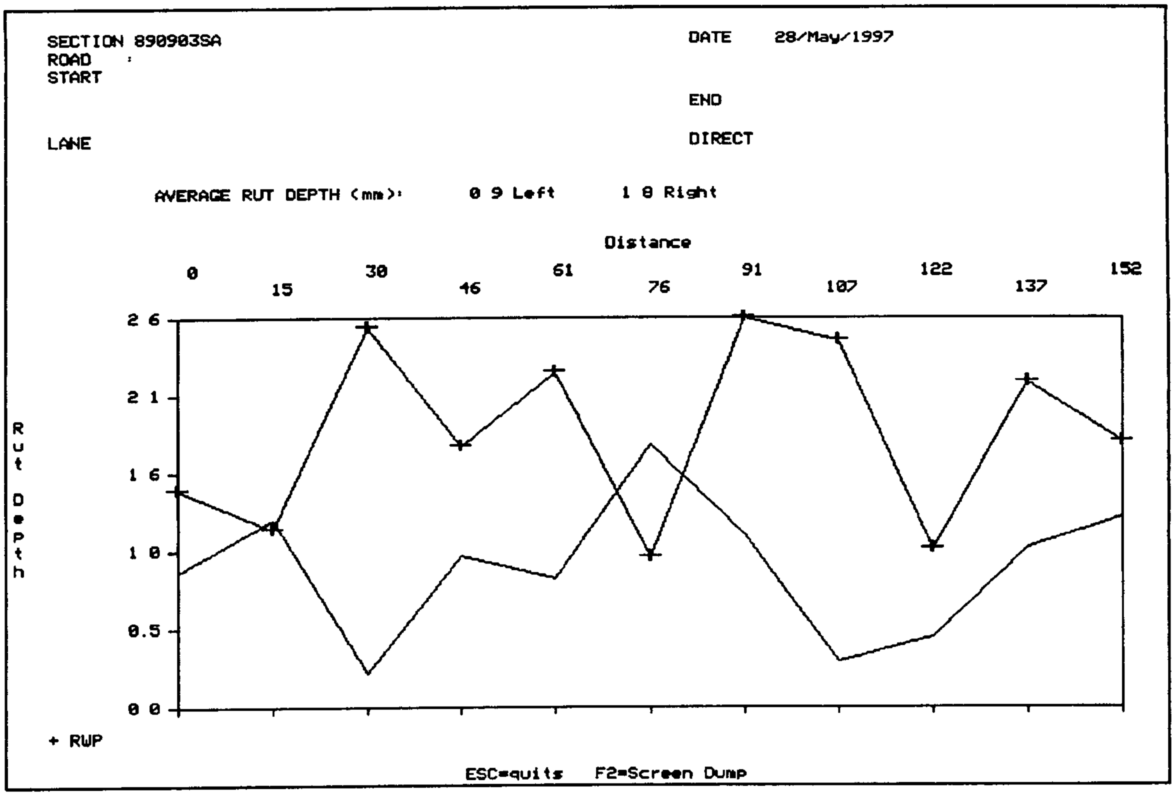


Figure 20 Elevation Measurements, Section 89A901, as Collected with the Profilometer



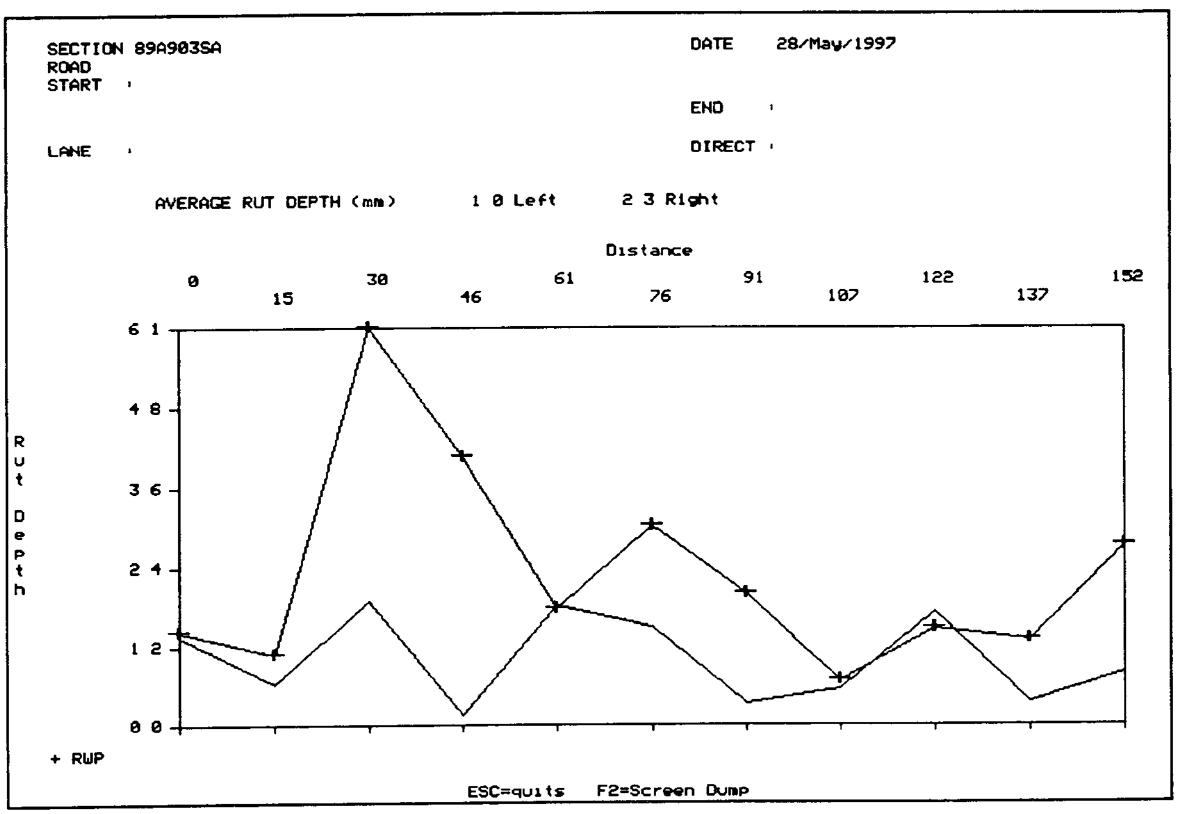
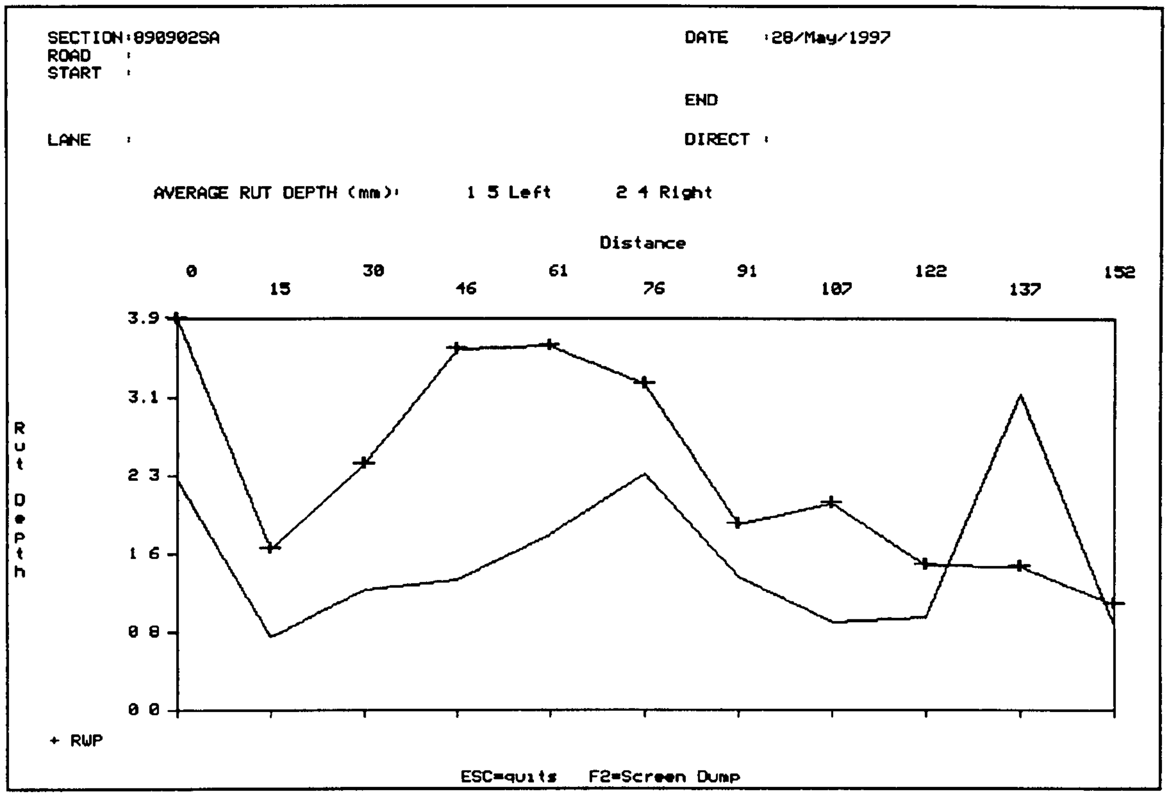


Figure 21 Rut Depth, Sections 890903 and 89A903, as Measured by the Dipstick



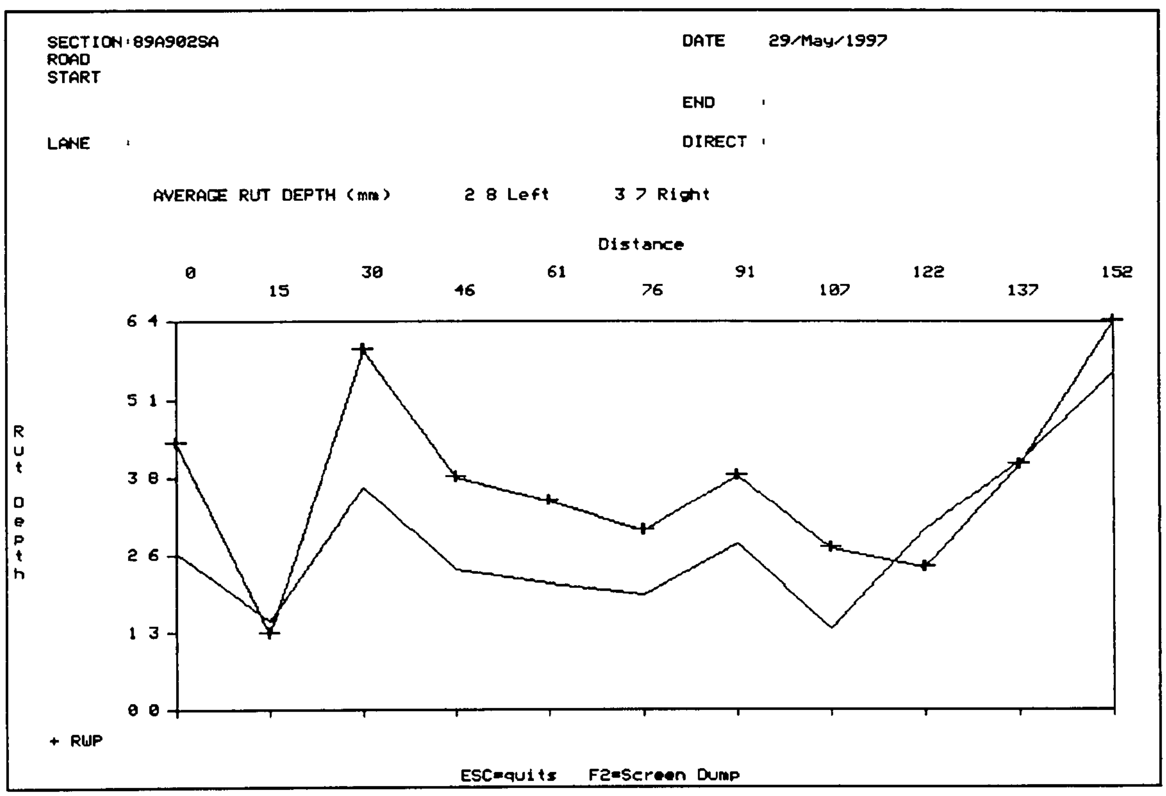
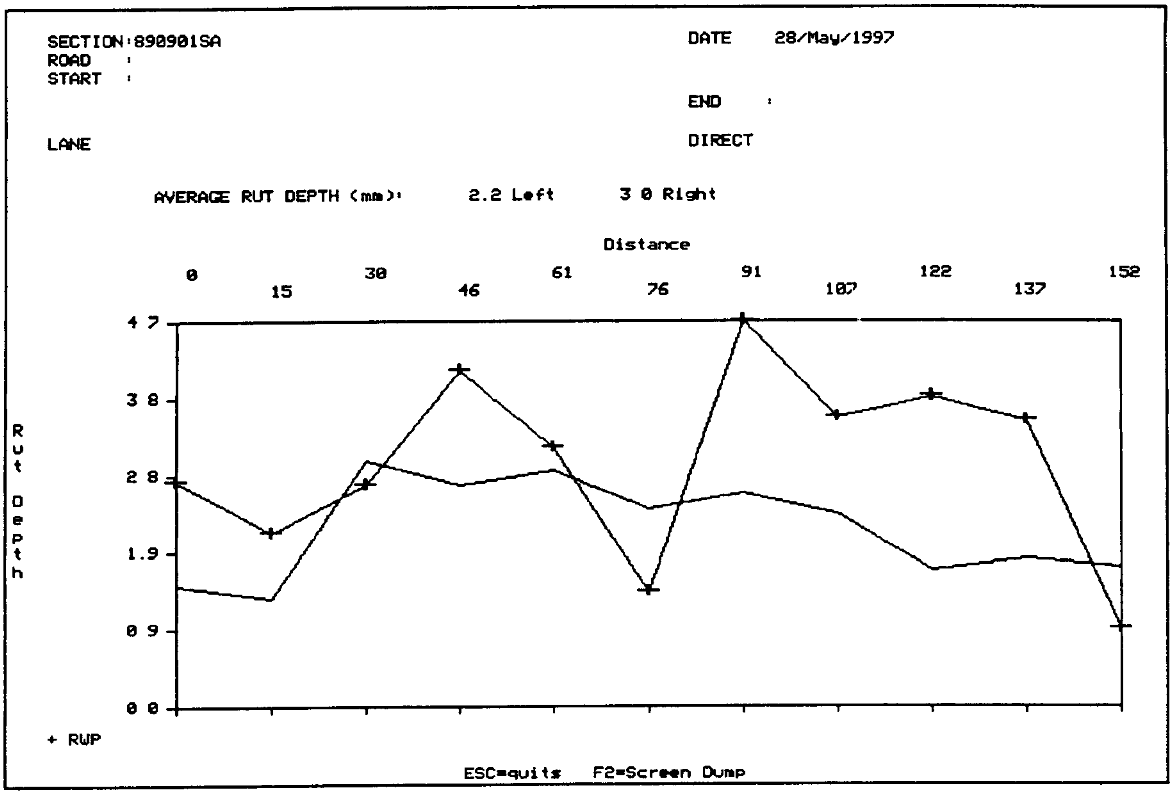


Figure 22. Rut Depth, Sections 890902 and 89A902, as Measured by the Dipstick



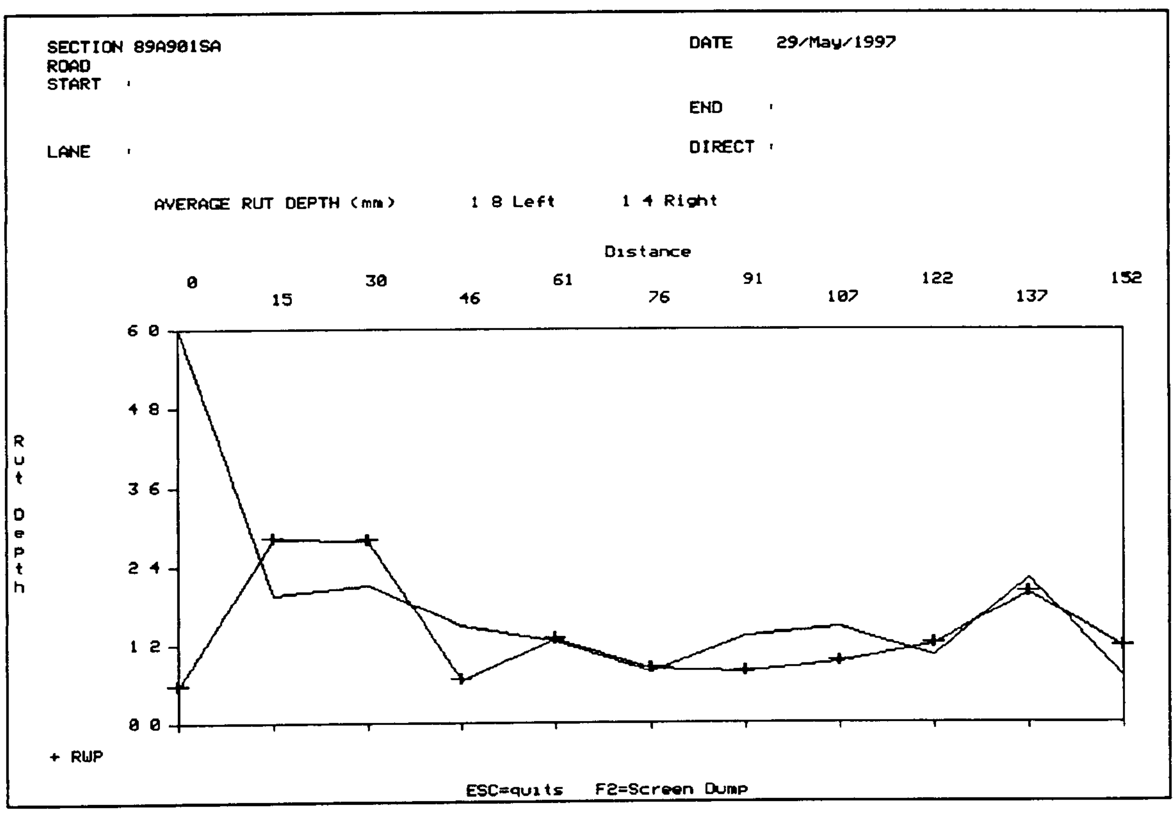


Figure 23 Rut Depth, Sections 890901 and 89A901, as Measured by the Dipstick

APPENDIX A

Correspondence, Contract Agreement, Equipment, and Construction Notes, Job Mix Formulas, FWD Survey, Deviation Reports

PAVEMENT
MANAGEMENT
SYSTEMS

November 15, 1995
50451110-13.9

Mr. Jean Pierre LeRoux
Ministere des Transports of Quebec
200 Dorchester Sud
4e Etage
Quebec, Quebec G1K 5Z1

RE: SPS-9A Projects - Superpave Design and Construction

Dear Mr. LeRoux:

In your telephone conversation of November 14, 1995, you expressed interest in the construction of one or more SPS-9A projects, each of which would include one or more supplemental test sections. I indicated that performance monitoring of the SPS-9A projects would include monitoring of the supplemental sections.

This office is prepared to assist you during your discussions of these projects, in setting up the layout in conformance with the experimental guidelines.

Enclosed are publications about Superpave Mix Design and Construction Specifications which may be helpful:-

- "Background of Superpave Asphalt Mixture Design and Analysis", FHWA-SA-95-003, February 1995.
- "Superpave Asphalt Mixture Design Illustrated - Level 1 Lab Methods", FHWA-SA-95-004, February 1995.
- "Guide Specification for Construction of Superpave Hot Mix Asphalt Pavements", draft FHWA report, August 1995.

Also enclosed is a copy of "The Long-Term Pavement Performance Program Roadmap - A Strategic Plan", FHWA-RD-95-200, September 1995, for the development of LTPP Products.

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

A Program Announcement for an LTPP Products Meeting in Irvine, CA, March 26-28, 1996 is included.

Your interest and cooperation in the various LTPP projects and program are much appreciated.

Yours Sincerely,

William A. Phang
Principal Investigator
Pavement Management Systems Limited

WP/tf

enclosure

C.C. I.J. Pecnik, RE, NARO, w/o enclosure
E. Lesswing, NARO, w/o enclosure
B. Abukhater, NARO, w/o enclosure

PAVEMENT
MANAGEMENT
SYSTEMS

November 20, 1995
50451110-13.9

Mr. Jean Pierre LeRoux
Ministere des Transports of Quebec
200 Dorchester Sud
4e Etage
Quebec, Quebec G1K 5Z1

RE: SPS-9 Instrumentation, Version 1.0

Dear Mr. LeRoux:

Enclosed is the "LTPP SPS-9 Instrumentation: Pavement Surface Layer and Air Temperature Measurements Version 1.0", dated October 1995.

The purpose of this instrumentation is to gather air and pavement surface temperature data at the SPS-9 site so as to verify that temperatures utilized in the SHRP Binder Selection process which are based on air temperatures from a nearby weather station are accurately translated to pavement temperatures.

The agency can view and collect the data using a laptop computer equipped with an SC32A Optically Isolated Interface. The LTPP-SMP ONSITE CR10 software for the download and the latest version of the LTPP SMPCHECK QC software will be made available to the agency.

The agency will send the output from the SMPCHECK to NARO for entry into the LTPP IMS.

Yours Sincerely,

William A. Phang
Private Investigator
Pavement Management Systems Limited

WP/tf

C.C. I.J. Pecnik, RE, NARO, w/o enclosure
E. Lesswing, NARO, w/o enclosure
B. Abukhater, PMSL, w/o enclosure
B. Henderson, PMSL, w/o enclosure

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

Gouvernement du Québec
Ministère
des Transports

JUN 13 1996

JOB #
FILE # 13-059

COPY

Quebec city, May 30 1996

Mr. W. A. Phang
Pavement Management Systems
415 Lawrence Bell Drive
Unit #3
Amherst, N.Y. 14221

Subject: SPS-9A candidate project nomination

Dear Sir,

We would like to present route 170 near Jonquiere for nomination as a candidate project for SPS-9A. Two (2) forms « SPS-9A Nomination Form » have been filled; one for a new construction on the north lanes (west bound) and the other for the south lanes (east bound) which involve either a simple bituminous overlay or removing the existing pavement, and adding a granular layer before laying new asphalt concrete layers, depending on the new profile. The actual road structure will be evaluated with a few boreholes at the start of construction.

If you need additionnal information, you can contact Marina Beaudoin, ing. at the Laboratoire Central, (418) 644-0181 and Jean-Pierre Boivin, ing. in Jonquière (418) 695-7916 who is the project manager

Yours sincerely,

Jean-Pierre Leroux, ing.

Jean-Pierre Leroux, ing.
Service des Chaussées

copy: Aristide Gobeil, ing.
Nelson Rioux, ing.
Marina Beaudoin, ing.
Jean-Pierre Boivin, ing.

SERVICE DES CHAUSSÉES, 930 CHEMIN STE-FOY, 5e ÉTAGE, QUÉBEC (QUÉBEC), G1S 4X9

JUL 2 6 1996

PMS

TECHNICAL MEMORANDUM

TO: Ivan Pecnik

FROM: Bill Phang

DATE: 25 July, 1996

REFERENCE: **SPS-9A PROJECT, NR 170 WB AND EB - JONQUIERE, QUEBEC**
FILE: 50451231-13.05.9

Two project nominations for SPS-9A Experiment were received from the Ministry of Transportation, Quebec, May 30, 1996. Clarifications asked for on June 18, 1996 were received on July 12, 1996.

The National Road 170 Westbound is new construction, twinning the existing two lane road which will be rehabilitated to become the Eastbound lanes of a 4 lane divided highway. The new construction Westbound lanes will be named project 890900. The rehabilitated Eastbound lanes will be project 89A900.

The Superpave Asphalt Binder from the Binder Selection program for the "Shipshaw, QE" location is a PG 52-46 at 98% reliability. It is believed that this grade is not available at this location. At a 50% reliability the Superpave Binder Selection program shows a PG 52-40 binder. This grade is available and will be used in the Superpave section 02. The grade established by QE MOT for the Superpave mix is a PG 52-34. This binder will be used in the alternative Superpave section 03. The agency mix in section 01 will be a penetration grade AC, most likely a 150-200 penetration grade.

The thickness of the surface course layer was planned to be 50mm. However, the QE MOT now intends to place the 65mm thickness required by the SPS-9A Experiment Guidelines.

The Superpave mix design will be prepared by the QE MOT, and they will also carry out the QC/QA testing.

We are advised that the new construction Westbound binder course layer was completed June 24, 1996, so the construction of the surface course is imminent, and NARO will need to coordinate the planning and construction activities on a tight schedule especially since the construction season at Jonquiere is short.

As long as the revisions indicated above are followed by the QE MOT, the project is expected to conform to the SPS-9A Guidelines, and the nominations should be approved as expeditiously as possible.

William A. Phang

William A. Phang
Principal Investigator

Attachment(s)

Copies: E. Lesswing, NARO
B. Abukhater, NARO
A. Rutka, NARO

SHRP SUPERPAVE Binder Selection

STATE PROV COUNTY	WATHER STATION	LONGI-TUDE (Deg)	LATI-TUDE (Deg)	ELEVA-TION (m)	AVERAGE AIR TEMP °C LOW AV	LOW SD	HIGH AV	HIGH SD
PQ 7068160	SHIPSHAW	71.22	48.45	23	-37	3	29	2

SHRP SUPERPAVE Binder Selection

STATE PROV COUNTY	WATHER STATION	50% RELIABILITY TEMPERATURES MAX AIR	MAX PVT	MIN AIR	MIN PVT	BINDER GRADE PG
PQ 7068160	SHIPSHAW	29	47	-37	-37	52-40

SHRP SUPERPAVE Binder Selection

STATE PROV COUNTY	WATHER STATION	98% RELIABILITY TEMPERATURES MAX AIR	MAX PVT	MIN AIR	MIN PVT	BINDER GRADE PG
PQ 7068160	SHIPSHAW	33	50	-41	-41	52-46

LONG TERM PAVEMENT PERFORMANCE
North Atlantic Region
415 Lawrence Bell Drive, Unit 3, Amherst, New York 14221
Tel. (716) 631-5205 Fax (716) 632-4808

JUL 29 1996

COPY

IVAN J. PECNIK, P.E.
LTPP Regional Engineer

MEMORANDUM

TO: Monte Symons - FHWA-LTPP

FROM: I.J. Pecnik P.E.
LTPP Regional Engineer, NA

DATE: July 25, 1996

SUBJECT: SPS-9A Nominations - Quebec
NR 170 WB & EB - Jonquiere, Quebec

COPIES TO: J.P. LeRoux - QE MTO
G. Rada - PCS/Law
L. Frechette - C-SHRP
NARO

Transmitted herewith for your review and/or approval please find the following in connection with SPS-9A nominations by the Province of Quebec:

- Memo - Phang to Pecnik 7/25/96 - Project Review & Recommendation
- Location Map
- Supporting Data -
  - Binder selection - 1 sheet
  - Preliminary discussions/clarifications correspondence - 6 sheets
- Project Nomination Forms - Quebec to RCOC - May 30, 1996 - 9 sheets

This office recommends acceptance of these projects. As construction of the westbound project is anticipated this year, and given the project location, early approval is requested.

Should additional information or clarification be required, contact Bill Phang at this office.

Your assistance is appreciated.

ITX Stanley

August 12, 1996
50451231-13.05.9

Mr. Jean Pierre LeRoux
Ministere des Transports de Quebec
930 Chemin Sainte Foy
Fifth Floor
Quebec, Quebec G1S 4X9

RE: SPS-9A Project, Jonquiere, Quebec

Dear Mr. LeRoux:

Your nominations of SPS-9A projects on National Route 170, Jonquiere, QE, were forwarded by Mr. I.J. Pecnik, to the LTPP Division Office for acceptance.

In view of the advanced status of the construction of NR 170 WB, we have prepared a set of **DRAFT** layout and materials sampling and testing plans for the new construction project 890900. These are forwarded for your information and in preparation for a meeting with your staff. You will notice that the construction station locations of the test sections layout are not placed on the figures as yet. Please let us know when you have established these stations.

The second SPS-9A project, the overlay on the NR 170 EB lanes will be named 89A900. The **DRAFT** layout of the test sections on this project is also forwarded enclosed. We would appreciate your determination of construction station locations for these test sections as well. The materials sampling and testing plans for this project 89A900 will be forwarded later.

ITX Stanley Ltd 415 Lawrence Bell Drive Suite 3 Amherst NY 14221-7805 Ph (716) 632-0804 Fax (716) 632-4808

Stanley Technology Group

We would appreciate an update on whether the construction schedule is delayed because of the recent flooding in the area.

Yours Sincerely,

William A. Phang
Principal Investigator
Pavement Management Systems Division

WAP/tf

C.C. I.J. Pecnik, RE-NARO, w/o enclosure
E. Lesswing, NARO, w/o enclosure
B. Abukhater, NARO, w/enclosure

COPY

Copy to BASIL

AUG 13 1996

JOB #
FILE # 13-05-9

August 13, 1996

Mr. William A. Phang
ITX Stanley Ltd.
415 Lawrence Bell Drive,
Suite 3, Amherst
NY, 1421

Re: SPS-9A site, route 170, Jonquière

Dear Mr. Phang,

I hereby want to confirm that the meeting for the SPS-9A site on highway 170 in Jonquiere will be held on Wesnesday, September 4, 1996, room 5.80 at the following address:

Ministere des Transports
Service des chaussées,
5th floor,
930 Chemin Ste-Foy,
Quebec, G1S 4X9

Marina Beaudoin, ing. ,from the Laboratoire Central, and Jean-Pierre Boivin, ing. from Jonquière, will be joining us for that meeting.

Time?
9:00

Yours sincerely,

Jean-Pierre Leroux, ing.

Jean-Pierre Leroux, ing.
Service des chaussées,
Ministère des Transports

ITX Stanley

TECHNICAL MEMORANDUM

TO: LTPP Contacts - CT, NJ, QE, NC

FROM: Bill Phang

DATE: 19 September 1996

REFERENCE: **SPS-9A MATERIALS TESTING AT LCL AND SRTC**
FILE: 50451231-13.9

Please be advised that the costs of sampling, packaging, shipping and testing of materials for the SPS-9A project are the responsibility of the agency, except as noted below:-

The Materials Research Library (MRL) in Reno, NV will supply special containers for asphalt samples and will pay the shipping charges both ways.

The LTPP Contractor Laboratory (LCL), Law Engineering, Atlanta, GA will carry out the laboratory testing and the FHWA-LTPP Division will pay the testing costs. The state agency will pay for shipping the materials and samples to Law Engineering, Inc. attn.: Mr. Richard Boudreau, 396 Plasters Ave., NE, Atlanta, GA 30324, telephone (404)817-0242, fax (404) 872-5927.

The Superpave Regional Test Center (SRTC) for the LTPP North Atlantic Region is at Penn State University. Please contact Dr. David Anderson, Penn State University, Research Office Building, University Park, PA 16802, telephone (814)863-1912, fax (814)865-3039 to arrange for Superpave testing. Agencies also pay for shipping costs.

North Carolina DOT has arranged for Superpave testing with the SRTC operated by NCAT at Auburn.

Should you have any questions, please all me at (716)632-0804 or speak to Mr. Ivan Pecnik at (716)631-5205.

Sincerely,
ITX Stanley Ltd.
Pavement Management Systems Division

William A. Phang
LTPP Principal Investigator

cc: I.J. Pecnik, P.E., RE-NARO
E. Lesswing, NARO
B. Abukhater, NARO

ITX Stanley

23 September 1996
File:50451231-8.00

Science Application International Inc.
301 Laboratory Road
P.O. Box 2501
Oak Ridge, Tennessee 37831

Attention: Rich Margiotta

Dear Mr. Margiotta:

Reference: IMS-8 Form

Please find enclosed one executed IMS-8 form for your processing. This is for the addition of the Quebec Ministry of Transportation Materials Testing Lab which will be performing laboratory tests on samples taken from the SPS-9A project for the North Atlantic Region. The number assigned to this lab is 8921.

If you have any questions, please contact the undersigned.

Sincerely,

ITX Stanley Ltd.
Pavement Management Systems Division

Edward P. Lesswing
Co-Principal Investigator

Enclosure

cc: A. Lopez, FHWA-LTPP, w/o enclosure
B. Ostrom, EBA Engineering, w/o enclosure
G. Rada, PCS/Law, w/o enclosure
J. Groeger, PCS/Law, w/o enclosure
W.A. Phang, NARO, w/o enclosure
G. Cimini, NARO, w/o enclosure
B. Abukhater, NARO, w/o enclosure

ITX Stanley Ltd 415 Lawrence Bell Drive Suite 3 Amherst NY 14221-7805 Ph: (716) 632-0804 Fax (716) 632-4808

Stanley Technology Group

FAX TRANSMITTAL

ITX Stanley

To: QE MTQ

Attention: Jean-Pierre LeRoux
Denis Proteau

Reference: SPS-9A Gyratory
Compaction Specimen
FILE: 50451231-13.05.9

Sender: Bill Phang

Fax No. (418)695-7926

Date: Sept. 24, 1996

1 page(s) total including cover sheet.

Original will **NOT** follow by mail.

Thank you for advising me that the Troxler GC equipment and molds limit the height of specimen which can be compacted to 3% air voids to about 135mm. So it is not possible to comply with the SPS-9A requirement for 140mm specimen.

The 3% air void specimen are intended for the SST-3, "Repeated Shear Test at Constant Stress Ratio (Tertiary Creep). Although the guidelines quotes the protocol as AASHTO-M003, P-005, the current protocol is AASHTO TP7-94, procedure C. The test specimen dimensional requirements are 150mm diameter and specimen heights of 50 ± 2.5mm for 19mm max. aggregate size, or 75.0 ± 2.5mm for 38mm max. aggregate size. Two 50mm test specimen can be cut from a 135mm GC specimen without difficulty, and this height is therefore acceptable.

William A. Phang
LTPP Principal Investigator

cc: I.J. Pecnik. P.E., RE-NARO
E. Lesswing, NARO
B. Abukhater. NARO
R. Graul, PCS/Law (301) 210-5032
M. Symons. FHWA-LTPP (703) 285-2767
A. Virani, ON MTQ (416)235-3996

ITX Stanley 415 Lawrence Bell Drive Suite 3 Amherst NY 14221 Ph: (716) 632-0804 Fax: (716) 632-4808

FAXED COPY 13.9

LONG TERM PAVEMENT PERFORMANCE
North Atlantic Region
415 Lawrence Bell Drive, Unit 3, Amherst, New York 14221
Tel. (716) 631-5205 Fax (716) 632-4808

IVAN J. PECNIK, P.E.
LTPP Regional Engineer

MEMORANDUM

RECEIVED 9 06 Oct. 9/96.

TO: Monte Symons - FHWA-LTPP

FROM: I.J. Pecnik P.E.
LTPP Regional Engineer, NA

DATE: September 30, 1996

SUBJECT: PG Grade Cost Differences

COPIES TO: NARO

Responding to your E-Mail request of Sept. 27, we advise as follows:

ON Orig. SHRP PG 58-46 — current AC cost $200/tonne
LTPP PG 58-34 – 90-100 pen grade mod. at the top end.

Both asphalts are created by modification. 58-46 estimated by ON MOT @ 180% of average binder cost (16% ± higher per ton of mix), 58-34 needs modifications for the high end (for a 150-200 pen binder) at an increase of 5-8% per ton of mix.

Net result is a differential (savings) of ± 10% per ton of mix ($4-$5 per ton in place).

QE Orig. SHRP PG 52-46 (52-40)
LTPP PG 52-34 — 85-100 pen grade

PG 52-46 requires extreme modification and is essentially impractical. Comparison was therefore made with produceable PG 52-40.

Information from QE indicates a differential of about 8% per ton of mix, similar to ON MOT.

NY Orig. SHRP PG 58-28
LTPP PG 58-22

Both asphalts are within specs for readily obtainable in the Buffalo area unmodified asphalts.

Post-it® Fax Note 7671	Date 10/9/96 # of pages ▸ 3
To BASEL ABUKHATER	From BILL PHANG
Co./Dept. ITX Stanley, Cambridge	Co. ITX STANLEY, AMHERST
Phone #	Phone # (716) 632-0804
Fax #	Fax # (716) 632-4808

Little if any price differential would occur although the same might not be true in downstate areas where other factors driving market prices could be in the equation.

LTPP PRODUCT UPDATE

March 1996

LOW TEMPERATURE AC PAVEMENT ALGORITHM

The low temperature algorithm recommended to be used in the SUPERPAVE binder selection process provides conservative and considerably more expensive binders in very low temperature regions. The Seasonal Monitoring Program (SMP) of the Long Term Pavement Performance (LTPP) program has collected pavement temperature and on site air temperature, continuously, for two years on thirty sites throughout North America. From the information collected at these sites, a revised low temperature algorithm has been proposed that significantly changes the required low temperature side of the PG grade of asphalt binder at most locations.

Background

The LTPP SMP is an intensive effort to collect high quality, consistent data to determine the effects of environment on pavement performance. The program consists of 64 for sites selected from the General Pavement Studies and Specific Pavement Studies. The sites are divided into two loops and are planned to be monitored on a monthly basis in alternate years. The initial loop was monitored for two seasons and the data collected from these sites is now available for analysis. The environmental data collected consists of on-site temperatures for the air, pavement, and subgrade; moisture and precipitation; frost penetration; and ground water table measurements. The pavement performance information collected consists of deflections, using the falling weight deflectometer, profile measurements, and distress surveys. Only the temperature data from the air and pavement was used to develop this product

Product Availability

The LTPP program has developed two products directed at revising the low temperature algorithm used in the SHRP binder selection A preliminary report, LTPP Seasonal AC Pavement Temperature Models (SAPT), has been prepared that discusses the development of a proposed revised model and provides limited comparison with different existing models. In addition, a easy-to-use data base combining data from the seasonal program and weather station data from the original SHRP binder selection information has been developed to assist researchers in further refinement of the model. This data base has been assembled on a single floppy disk in both ASCII (text) and Excel formats.

Target Audience: Pavement designers, materials engineers, asphalt producers and suppliers

Sources: FHWA Pavement Performance Division, telephone 703-285-2355, fax 703 285-2767

ITX Stanley

15 May 1997
File: 50451219-13.05.9

Ministere des Transports de Quebec
930 Chemin Sainte-Foy
5th Floor
Quebec, Quebec G1S 4X9 Canada

Attention: Mr. Denis Thebeau

Dear Mr. Thebeau:

Reference: SPS-9A Project, Jonquiere, Quebec
REVISED Materials Sampling and Testing Plans

We have recently been notified by the Federal Highway Administration that the testing to be done by the Superpave Regional Test Center is undergoing review. It is our understanding from your latest submission that you have not yet determined who would do the testing in question - the Superpave Regional Test Center or another laboratory.

Rather than schedule this testing, the Gyratory Compacted Specimens and cores noted on Table 8 (Project 89A900 and Project 890900) should be sent to the Materials Reference Library rather than the Superpave Regional Test Center or another laboratory. The specimens will remain in storage until Superpave Regional Test Center procedures are finalized.

Revised Materials Sampling and Testing Plans that reflect these changes are attached and supersede all previous versions.

Sincerely,
ITX Stanley Ltd
Pavement Management Systems Division

Ed Lesswing
LTPP Co-Principal Investigator

cc: W A Phang, P I -NARO w/enclosure
B. Abukhater, NARO, w/enclosure
W Bellinger, FHWA-LTPP w/enclosure
Ms. M. Beaudoin, MTQ, w/enclosure
G. Rada, PCS/Law, w/enclosure
A. Lip, NARO, w/enclosure

ITX Stanley

19 June 1997
File: 50451231-8.00

Science Application International Inc.
301 Laboratory Road
P.O. Box 2501
Oak Ridge, Tennessee 37831

Attention: Mr. Rich Margiotta

Dear Mr. Margiotta:

Reference: IMS-2 Form

Please find enclosed one executed IMS-2 form for your processing. This is for the addition of the following laboratory:

Secteur Laboratoire de Quebec
1665, boul. Hamel Ouest
Edifice No 6
Quebec City, Quebec
G1N 3Y7

This is a Quebec Ministry of Transportation Laboratory which will be performing laboratory tests on samples taken from the Quebec SPS-9A projects. The number assigned to this lab is 8922

If you have any questions, please contact the undersigned.

Sincerely,

ITX Stanley Ltd
Pavement Management Systems Division

Ed Lesswing
LTPP Co-Principal Investigator

cc A Lopez, FHWA-LTPP w/o enc
J Groeger, PCS/Law, w/o enc
B. Abukhater, NARO, w/o enc
B Ostrom EBA Eng., w/o enc
W A Phang, NARO, w/o enc
G Rada, PCS/Law w/o enc
G Cimini, NARO, w/o enc

ITX Stanley Ltd 415 Lawrence Bell Drive Suite 3 Amherst NY 14221-7805 Ph (716) 632-0804 Fax (716) 632-4808

Stanley Technology Group

Direction du
Saguenay-Lac-Saint-Jean-Est

Le 13 décembre 1995

EXCAVATION DE CHICOUTIMI INC.
1201, boulevard Saint-Paul
Chicoutimi (QC)
G7J 3Y2

Objet: Autorisation de débuter les travaux
Contrat : 3671-95-0906
Route : 170
Mun. : Jonquière et Larouche
C.E.P. : Jonquière et Lac-Saint-Jean

Monsieur,

Conformément à l'article 8.1 du CCDG, vous êtes par la présente autorisé à exécuter le contrat ci-haut mentionné à compter du 8 janvier 1996.

Tel que mentionné au devis spécial et en tenant compte de l'article 8.8 du CCDG, nous tenons à vous rappeler que les travaux faisant l'objet du présent contrat doivent être terminés soit le ou avant le 15 juillet 1997.

Vous devrez vous entendre avec notre représentant, monsieur Rémi Côté, ing., 3950, boulevard Harvey à Jonquière, au numéro de téléphone (418) 695-7916, pour l'établissement des modalités d'exécution et fournir un calendrier des travaux lors de la première réunion de chantier qui se tiendra jeudi, le 14 décembre 1995 à compter de 9 h à l'adresse mentionnée plus haut.

En qualité de maître d'oeuvre, selon la Loi sur la santé et la sécurité du travail, la responsabilité vous incombe d'éliminer, à la source, les dangers relatifs à la santé, la sécurité et l'intégrité physique des travailleurs dans les limites de votre chantier. Vous devez donc vous conformer aux instructions suivantes:

1. Faire parvenir au Service régional de l'inspection de la CSST, l'avis d'ouverture et de fermeture de votre chantier à l'aide du formulaire 1245 ci-annexé;

3950 Boul Harvey
Jonquière Qc
G7X 8L6

Tel (418) 695-7916
Fax (418) 695-7926

2. Faire parvenir une copie de la formule 1245 au Centre de services de Chicoutimi, sis au 1600, rue Bersimis.

3. Présenter un programme global de prévention de la C.S.S.T.;

4. Créer un comité de chantier s'il y a lieu.

Nous vous rappelons que vous devrez afficher le formulaire intitulé "Avis aux salariés, fournisseurs de matériaux, services, etc." à un endroit bien en vue durant toute la durée de votre contrat.

Nous comptons sur votre collaboration pour mener à bonne fin et dans les délais prescrits les travaux prévus au marché et nous vous prions d'agréer, Monsieur, nos salutations.

Le Directeur

Gilles Labarre, ing.

GL/MG/ht

p.j.

c.c.: M. Alain Vallières, ing., s.m.a.
Mmes Hélène Tremblay, M.E.F.
Hélène Belley, t.a.
M. Rémi Côté, ing.
Commission de la santé et sécurité au travail

Gouvernement du Québec
Ministère
des Transports

BORDEREAU DES QUANTITÉS ET DES PRIX
SOUMISSION

0079-E44
0079-804

Circonscription électorale	Municipalité	Localisation Rte	Tr.	Sect.
Jonquière	Jonquière	00170	01	330

Nature des travaux	Centre gestion	Date du devis	No plan
TERRASSEMENT, STRUCTURE DE CHAUSSÉE ET REVÊTEMENT SOUPLE	3671	95-09-14	CH-95-36-7102

Code carte	Tr.	No de contrat			No bord
44	1	3671	95	0906	00

Résumé des bordereaux DOCUMENT no 200

Art. bord.	Code ouvrage	Quantité estimée	Unité de mesure	Code	Désignation de l'ouvrage	Prix unitaire	Total
					01 - TERRASSEMENT, STRUCTURE DE CHAUSSEE ET REVETEMENT SOUPLE *EXCAVATION* DOCUMENT 210	--------	3 003 538.00
					02 - PROTECTION DE L'ENVIRONNEMENT DOCUMENT 214	--------	12 500.00
					03 - TRAVAUX COMPLÉMENTAIRES DOCUMENT 215	--------	70 107.00
					04 - REVÊTEMENT SOUPLE *PAVEMENT* DOCUMENT 220	--------	355 372.50
					05 - AMÉNAGEMENT PAYSAGER *LANDSCAPING* DOCUMENT 280	--------	13 447.50

Page: 200 - 1

Soumissionnaire Nom	Adresse	Date	Montant total bordereau
EXCAVATION DE CHICOUTIMI INC.	1201, BOUL. ST-PAUL CHICOUTIMI (QUEBEC) G7J 3Y2	LE 07-11-95	$ 3 454 965.00

CS-553

Single-Drum Smooth Vibratory Soil Compactor with Drum Drive

Material applications:
- ☐ Granular soils
- ☐ Semi-cohesive soils
- ☐ Gravel
- ☐ Rock

USE FOR
0-2½"
0-¾"

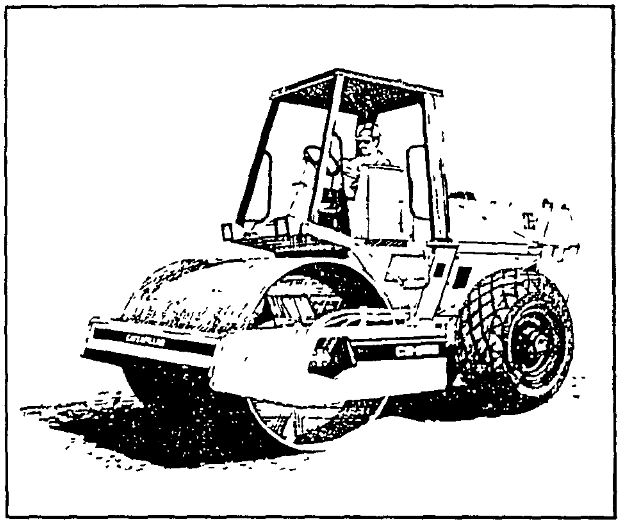
Typical applications:
- ☐ Highways
- ☐ Airports
- ☐ Large industrial developments
- ☐ Streets
- ☐ Dams
- ☐ Reservoirs

Estimated production range:

To 765 cubic meters/1000 cubic yards per hour

Standard features:
- ☐ Powerful, reliable Cat diesel engine
- ☐ Hydrostatic drum and rear wheel drive provides excellent tractive effort
- ☐ Hydraulic flow diverter ensures tractive power to both drum and rear wheels regardless of footing
- ☐ No-spin differential provides tractive effort to both wheels
- ☐ Hydrostatic two-speed transmission
- ☐ Hydrostatic full-power steering
- ☐ Excellent vibration isolation
- ☐ Enclosed engine compartment for reduced noise level
- ☐ Easy, open access to engine and hydraulic components
- ☐ Excellent operator's visibility and comfort
- ☐ Roll Over Protection Structure, ROPS/FOPS, is standard
- ☐ Back-up alarm and seat belt are standard

Options:
- ☐ Working light package
- ☐ EROPS cab with electric wiper, heater and defroster



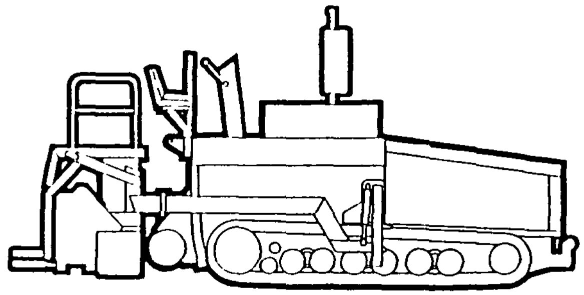
Brief dimensions:

Length	5207 mm	17'-1"
Width	2438 mm	8'
Height to top of ROPS	3251 mm	10'-8"
Drum Diameter	1524 mm	60"
Drum Width	2134 mm	84"

Brief specifications:

Engine Make	Caterpillar	
Model	3208, Diesel	
Power rating	115 kW	155 fwhp
Operating Weight	10 780 kg	23,770 lb
Dynamic Force	18 150 kg	40,000 lb
Total Applied Force	24 260 kg	53 500 lb
Total PLI	114 kg/cm	637 lb/in
Frequency	to 30 Hz	1800 vpm
Speeds		
Low	0 to 5 km/hr	0 to 3 mph
High	0 to 10,5 km/hr	0 to 6 5 mph
Inside Turning Radius	3660 mm	12'
Gross Gradeability Rating	45%	

[redacted] [redacted]
610-3



BG-245 SPECIFICATIONS

OPERATION

Paving width		
Standard	10'0"	3 05m
with Cut-Off Shoes	8'0"	2 44m
with Extensions	up to 28'0"	8 53m
Paving Thickness Range	½"-12"	13-305mm
Theoretical Hopper Enclosed Volume	206 cu ft	5 8m³
Paving Speeds	0-189fpm	57 6m/min
Travel Speeds	5 7mph	9 17kph
Turning Capability	Spin turn and counterrotation	
Screed Lifting Capacity	8,000 lb	3,624 Kg

CAPACITIES

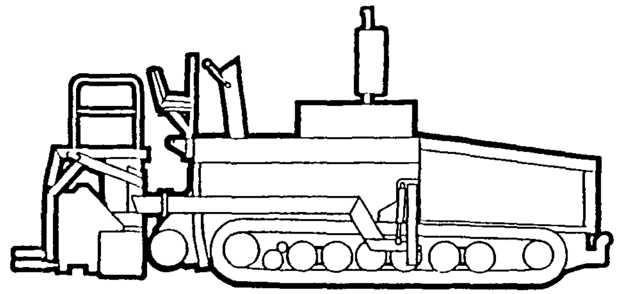
Fuel	41 gal	157 liter
Hydraulic Tank	45 gal	170 liter
Cooling System	3 2 gal	12 1 liter
Exposed Hydraulic Oil Cooler Area	578 sq in	37,920 mm²

DIMENSIONS

A Height (less exhaust stack)	8'-3"	2 54m
B Height (minimum shipping)	6'-8"	2 03m
C Length	18'-9¾"	5 74m
D Width (operating)	10'-6"	3 20m
E Width (shipping)	9'-10⅛"	3 0m
F Tread Width (to outside of drive wheels)	8'-6"	2 59m
G Truck Dumping Clearance	2'-½"	61m
H Crawler Centerline — Centerline	9'-8"	2 94m

WEIGHTS

Standard Machine (with 10'-0" basic screed)	29,600 lb	13,408 kg
Standard Machine (with 1020 Extend-A-Mat Screed)	32,000 lb	14,496 kg
Basic 10'-0" Screed	2,800 lb	1,268 kg
Model 1020 10'-0" Extend-A-Mat without end gates — extends up to 19'-6"	4,860 lb	2,203 kg



BG-265 SPECIFICATIONS

OPERATION

Paving width		
Standard	10'0"	3 05m
with Cut-Off Shoes	8'0"	2 44m
with Extensions	40'0"	12 2m
Paving Thickness Range	½"-12"	13-305mm
Theoretical Hopper Enclosed Volume	206 cu ft	5 8m³
Paving Speeds	0-164fpm	50m/min
Travel Speeds	5 5mph	8 85kph
Turning Capability	Spin turn and counterrotation	
Screed Lifting Capacity	12,200 lb	5,436 kg

CAPACITIES

Fuel	55 4 gal	209 7 liter
Hydraulic Tank	45 1 gal	170 7 liter
Cooling System	4 3 gal	18 liter
Exposed Hydraulic Oil Cooler Area	578 sq in	37,920 mm²

DIMENSIONS

A Height (less exhaust stack)	8'-3"	2 54m
B Height (minimum shipping)	6'-8"	2 03m
C Length	20'-2¾"	6 17m
D Width (operating)	10'-6"	3 20m
E Width (shipping)	9'-10⅛"	3 0m
F Crawler Width (to outside of crawler pads)	8'-10"	2 69m
G Truck Dumping Clearance	2'-1½"	64m
H Crawler Centerline to Centerline	10'-8"	3 25m

WEIGHTS

Standard Machine (with 10'-0" basic screed)	34,600 lb	15,673 kg
Standard Machine (with 1020 Extend-A-Mat Screed)	37,000 lb	16,761 kg
Basic 10'-0" Screed	2,800 lb	1,268 kg
Model 1020 10'-0" Extend-A-Mat Without end gates — extends up to 19'-6"	4,860 lb	2,203 kg

(3) Section IV of the manual contains instructions for correctly performing operations necessary to maintain, or repair the "CEDARAPIDS" Bituminous Paver.

> **NOTE:** Throughout the manual, reference is made to the front, back, right and left side of the paver and its components. To eliminate confusion, **the front is indicated by the hopper end of the paver, and the rear (or back) being the screed end.** With the operator seated on the paver with his back to the screed, **the right side of the paver is to the operator's right and the left side to his left.**

2. FUNCTION AND APPLICATION

a. The "CEDARAPIDS" Bituminous Paver is used for laying a uniform high density mat of bituminous material on highways, streets, airport projects along with other modern paving jobs that demand strict control of paving specifications and high capacity production.

b. It will level and compact the bituminous material up to a thickness of 10 inches, with paving width for standard paver adjustable from 6 to 10 feet, in 1½" increments with the use of cut-off shoes. Screed and screw extensions of 6 inches and 1 or 2 foot sizes may be added to increase paving width to 16 feet. Extensions can be used individually or in pairs with cut-off shoes.

3. CEDARAPIDS BITUMINOUS PAVER DIMENSIONS AND SPECIFICATIONS

a. CAPACITIES:

Mat Width — 6′ to 10′ standard; 16′ optional. For paving widths over 16′, consult factory.
Mat Thickness — to 10″
Paving Speeds — 11 F.P.M. to 102 F.P.M. (18 speed transmission)
Travel Speeds — 1.4 to 2.16 MPH (18 speed transmission)
Paving Speeds — 11 F.P.M. to 132 F.P.M. (24 speed transmission)
Travel Speeds — 1.7 MPH to 3.85 MPH (24 speed transmission)
Hopper — 9 Tons

b. WEIGHT:

Standard 10′ width paver (gasoline)— 23,900 lbs.
Standard 10′ width paver (diesel)— 24,300 lbs.
Extensions: to 16′ paving width—1240 lbs.

c. OVERALL DIMENSIONS:

Length—16′-5″
Width (without extensions)—10′-0″
Height (to top of engine)—7′-3″
(to top of seat)—6′-0″
Ground Clearance (with screed up)—5⅝″ to screws.

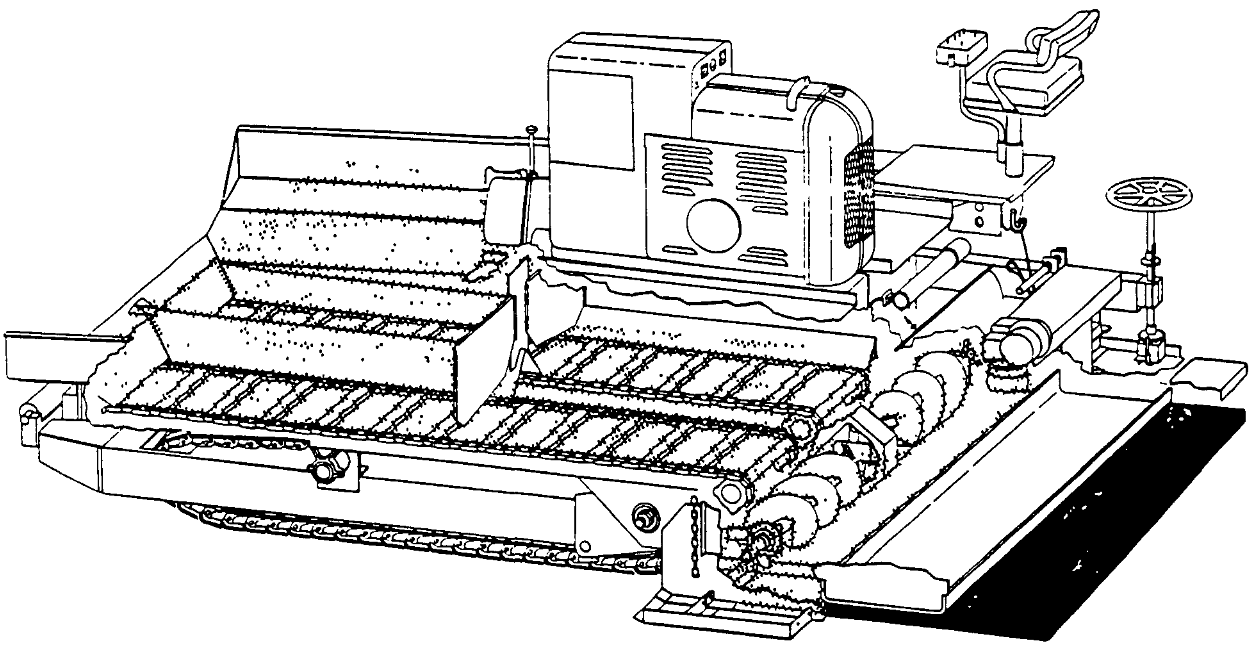


Figure 2
Flow Diagram

and surface course requirements on medium to large tonnage applications. It more than meets existing density specifications for any mix design on all lift thicknesses with proper surface finish. In many applications it can replace two or more static rollers behind the paver.

Compaction

The CC-42A offers a fully independent hydraulic vibration system producing up to 24,000 lbs of centrifugal force per drum at 2500 vibrations per minute. The machine features a balanced design of nominal amplitudes, frequency and the proper sprung and unsprung weight ratios. Its patented dual amplitude system and vibration frequency of 2500 impacts per minute allows selection of the optimum desired force for all mix designs. Low amplitude and constant high frequency are generally used for thin lifts, tender mixes and for finish work, while high amplitude is suitable for thick lifts and base and can be automatically shut off when changing direction ensuring a smooth surface during the reversal.

Traction

The hydrostatic propulsion system of the CC-42A features a variable displacement pump driven by a 125 hp diesel engine, and a fixed displacement hydraulic motor and planetary torque hub on each drum. A single operating control provides smooth acceleration to 8 mph and enables dynamic braking for accurate speed control on the steepest paving grades. The engine will not lug down on grades to 30% or at altitudes to 7000 feet.

Steering

The articulated center-point hydraulic steering system of the CC-42A provides easy handling and a short turning radius for excellent maneuverability. The machine works close to pre-placed curbing, abutments, walls, etc. The frame overhangs the drum edge by only 2 1/4" on the right side, while a curb clearance of 14 1/2" is standard.

system is designed for trouble free operation. Double inline filtration and adjustable spray nozzles, 12 volt epoxy-coated water pumps and low water alarm with automatic shut down are featured.

Owner-Operator Benefits

The CC-42A features a dual-seat operator station for superior visibility, safety and comfort. The station includes all operating controls at the steering console. Specially engineered shock absorber systems isolating the operator platform from the drums help reduce fatigue and increase operator efficiency.

Value features include permanently oil-lubricated drum assemblies and only eight 40-hour grease fittings to ensure superior reliability and minimum down-time. Operator service check points are conveniently located and quality components are used throughout.

For a demonstration of the CC-42A, contact your local Dynapac dealer.

GENERAL

Shipping Wt.:	21,000 lbs	(9,525 kg)
Drum Module Wt.:	11,307 lbs	(5,129 kg)
Tractor Module Wt.:	11,307 lbs	(5,129 kg)
Working Wt.:	22,615 lbs	(10,258 kg)

VIBRATION

Type:	Direct drive hydraulic motor, independent controls at operator console. Dual amplitude.	
Frequency:	2500 vpm	(41.6 Hz)
Nominal Amplitude		
High Amplitude:	.032 in.	(.8 mm)
Low Amplitude:	.016 in.	(.4 mm)
Centrifugal Force per Drum @2500 vpm		
High Amplitude:	24,000 lbs	(106,752 N)
Low Amplitude:	12,000 lbs	(53,376 N)
Centrifugal Force per Linear Inch		
High Amplitude:	364 pli	(4,112 N/cm)
Low Amplitude:	182 pli	(2,056 N/cm)
Static Force per Drum:	11,307 lbs	(50,294 N)
Static Force pli:	171 pli	(1,932 N/cm)
Sprinkler Capacity per Drum:	115 gal	(440 l)

PROPULSION

Type:	Hydrostatic, engine driven pump with motor driven planetary torque hub at each drum.	
Engine:	CAT D3208	
Rated Horse Power:	125 Hp @2400 rpm	
Travel Speed:	0-8 mph	(0-12.9 km/h)
Gradability:*	Up to 30%	
Fuel Tank Capacity:	60 gal	(230 l)

STEERING

Type:	Hydraulic, center-point articulated
Steering Angle:	±40°
Vertical Oscillation:	±12°

BRAKES

Service:	Hydraulic/dynamic
Parking:	Mechanical disc on drum

INSTRUMENTATION

Hourmeter • Tachometer • Fuel Gauge • Ammeter • Oil Pressure Light • Hydraulic Filter Gauge • Hydraulic Fluid Temperature Gauge • Water Temperature Gauge • Parking Brake Warning Signal • Speedometer • Frequency Meter • Vibration Indicator Lights

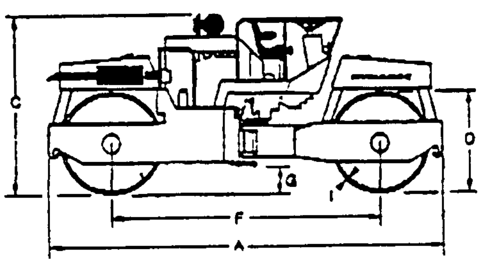
OTHER STANDARD EQUIPMENT

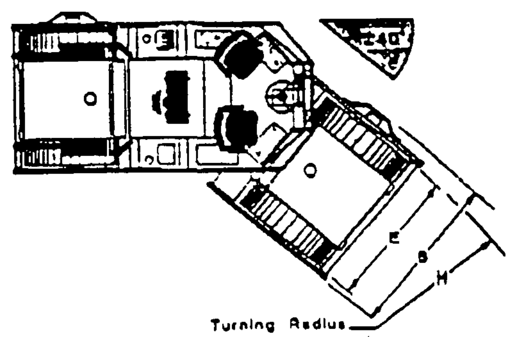
Horn • Neutral Start Safety Switch • 160 amp hour Battery • Neoprene Drum Wipers • Dual Bucket Seats • Tiedown Eyes • Speed Control Gate • Automatic Vibration Control • Vibration Quikstop • Noise Reduction • Tool Box • Low Water Alarm • Lockable Instrument Panel, Battery Box and Reservoir Filler Caps • Dry Type Air Cleaner with Vacuator.

OPTIONAL EQUIPMENT

Lights, Front and Rear • Operator Umbrella • ROPS • Operator Canopy • Special Paint.

A = 197" (5000 mm)
B = 77" (1955 mm)
C = 88" (2200 mm)
D = 48" (1220 mm)
E = 66" (1675 mm)
F = 136" (3450 mm)
G = 14½" (370 mm)
H = 234" (5950 mm)
I = ⅞" (22 mm)





90-250 TPH

DYNAPAC

DYNAPAC MFG INC • KELLY PLACE • STANHOPE, N.J. 07874
(201) 347-0700 • TELEX 13-6481

This publication has been revised and reprinted to conform to the standardized terms and definitions as recommended in the 1978 CIMA Vibratory Roller Handbook. Due to the Dynapac policy of continuing product improvement these specifications are subject to change without notice or obligation.

SA-216-1280

Printed in U.S.A.

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END

Technical Specifications

General dimensions

Overall length .... 4950 mm
Overall width .... 1820 mm
Overall height .... 2680 mm
Wheelbase .... 3795 mm
Ground clearance .... 230 mm
Outside turning radius .... 6820 mm

Tyres and wheels

7 tyres: 3 oscillating front wheels
4 traction rear wheels
Dimensions .... 11.00 x 20 - 18 ply
Pressure: maximum .... 120 PSI (8.5 kg/sq cm)
minimum .... 35 PSI (2.5 kg/sq cm)
Compaction width .... 1820 mm
Tyre overlap .... 42 mm

Weights and capacities

Weight without ballast .... 7670 kg
Weight with wet sand ballast .... 18190 kg
Weight with total ballast .... 21370 kg
Volume disposable for ballast .... 5.4 cu. mt
Water spraying reservoir capacity .... 370 liters
Fuel tank capacity .... 154 liters
Electrical system .... 12 volts

Wheel load

Without ballast .... 1095 kg
With wet sand ballast .... 2598 kg
With concentrate ballast .... 3053 kg

Engine

- **CP 21 - Perkins 4.236 - 4 cylinders**

Rated horsepower (SAE) .... 79 HP (59 kW) at 2400 rpm

- **CP 22 - Mercedes-Benz OM-352 - 6 cylinders**

Rated horsepower (DIN 6270 B) 106 HP (79 kW) at 2500 tr/min.

Transmission

- **CP 21** .... Clark 18 000
- **CP 22** .... ZF "Full Power Shift"

Speeds

CP 21 1 st) 5,0 km/h
2nd) 11,0 km/h
3 rd) 28,0 km/h

CP 22 1 st) 5,0 km/h
2nd) 12,0 km/h
3 rd) 29,0 km/h

Brakes

Service Air over hydraulic on the 4 rear wheels
Parking Mechanical on gear box.

Steering

Dual Control • Hydrostatic Type

Tyre pressure control system

Tyre pressure is adjusted with the machine in operation. The "On-the-Go Pressure Control System" can vary the tyre pressure from 35 to 120 PSI (2.5 kg/sq. cm to 8.5 kg/sq. cm)
CP21 and CP22 are equipped with a TU-FLO-500 air compressor.

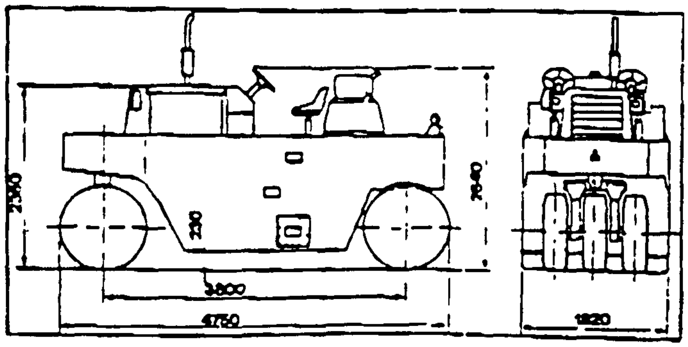
Optionals

- Front and rear lights • Water sprinkler system
- Tyre scrapers • Second operator's seat
- Additional second air compressor • Operator's cab
- Spare wheel • Permanent ballast of iron
- Protective canopy for operator
- Special air filter for desert conditions

Tyre contact areas and ground contact pressures chart

wheel load	35 2.46	50 3.35	70 4.92	90 6.33	105 7.38	120 8.44	PSI kg/cm²
1143 kg	56	50	41	34	33	31	TCA
2.500 lbs	43	47	57	69	72	75	GCP
1.360 kg	68	60	48	42	39	37	TCA
3.000 lbs	44	50	62	71	77	81	GCP
1.810 kg	85	78	63	63	48	44	TCA
4.000 lbs	47	51	63	75	83	90	GCP
2.270 kg	104	91	75	63	58	54	TCA
5.000 lbs	48	65	67	79	86	93	GCP
2.730 kg	118	103	86	73	68	63	TCA
6.000 lbs	51	58	70	82	88	95	GCP
3 052 kg		113	93	85	75	69	TCA
6 714 lbs		61	73	80	91	97	GCP

TCA - Tyre Contact Area (SQ IN)
GCP - Ground Contact Pressure (PSI)



DYNAPAC
DYNAPAC EQUIPAMENTOS INDUSTRIAIS LTDA
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Telefax 11491-8110 - Taboão da Serra - SP - Brazil

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A/S Fernand

Technical Specifications

Transportation

Shipping weight — 6,100 kg

Traction

Operating weight (roller with operator, 50% fuel and water) — 6,500 kg
Weight of each drum module — 3,250 kg
Gradability — 30%

Drum dimensions

Drum width — 1,400 mm
Drum diameter — 1,040 mm
Drum shell thickness — 16 mm

Vibration (Compaction characteristics)

Hydraulic motor mounted to vibratory shaft. Independent control for each drum at operator console, with dual amplitude

Static linear load (front and rear) — 23.4 kg/cm
Nominal amplitude, high — 0.7 mm
low — 0.35 mm

Vibration frequency — 3,000 vpm (50 Hz)
Centrifugal force (per drum)
At high amplitude — 7,000 kp (69 000 N)
At low amplitude — 3,500 kp (34 500 N)

Maneuverability

Hydraulic steering - articulated frame
Steering angle — ± 40°
Vertical oscillation — ± 12°
Outside turning radius — 4,570 mm
Lateral min overhang — 60 mm
Speed (forward/reverse) — 0-11,3 km/h

Engine (Diesel)

Perkins 4 236 - 4 cylinders
Rated horsepower (SAE) — 76,5 hp (57 kW) at 2.400 rpm
Max. horsepower (SAE) — 79 hp (59 kW) at 2.600 rpm
Fuel tank capacity — 150 liters
Hydraulic oil reservoir capacity — 150 liters
Electrical system — 12 V

Transmission

Sundstrand hydrostatic with double planetary gearbox reduction in drums

Sprinkler system

Pressurized electric water pumps with independent controls at operator console. Sound alarm when both water tanks are empty
Water tank capacity (per drum) — 340 liters

Optionals

Fiberglass canopy • cabin

Practical capacities

Soil compaction

Practical capacity = 0,75 x theoretical capacity (max.).
For the reduction factor of 0,75, we consider 10% overlap and an effective operating time of 50 min/h.
Operating speed = 5 km/h.

PRACTICAL CAPACITY (m³/h) — NORMAL VALUES = [illegible]

Number of passes	Practical surface capacity m²/h	(Compacted) layer thickness in cm					
		10	20	30	40	50	75
2	4160	510	1030	1540	2070	2590	3850
4	2080	260	510	770	1030	1290	1930
6	1440	170	350	520	690	870	1290
8	1120	130	260	390	520	640	970

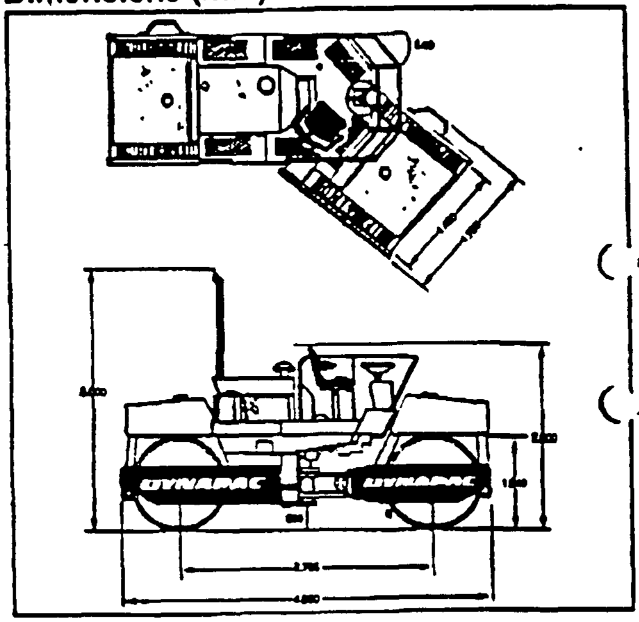
Asphalt compaction

Practical capacity = 0,6 x theoretical capacity (max)
For the reduction factor of 0,6, we consider 25% overla[p] and an effective operating time of 50 min/h.
Operating speed = 6 km/h.

PRACTICAL CAPACITY (t/h) — NORMAL VALUES = [illegible]

Number of passes	Practical surface capacity m²/h	(Compacted) layer thickness in cm						
		2.5	3.5	5	7.5	10	15	20
2	4000	280	390	570	850	1160	1720	2290
4	2000	160	200	280	430	570	850	1130
6	1390	100	130	200	280	380	570	760
8	990	70	100	150	210	280	430	570

Dimensions (mm)



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Telefax 11491-8110 - Taboão da Serra - SP - Brazil

CC 21

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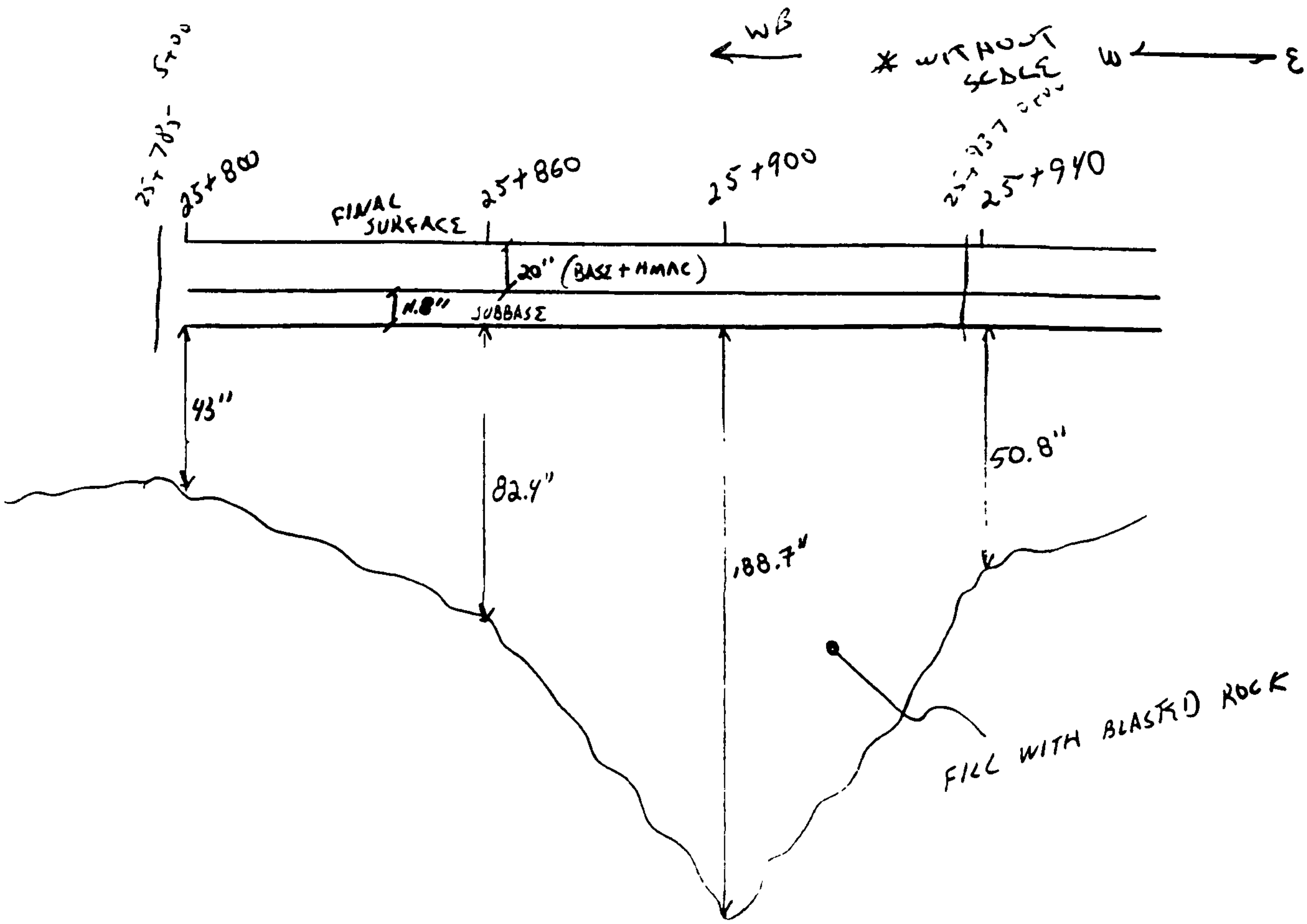
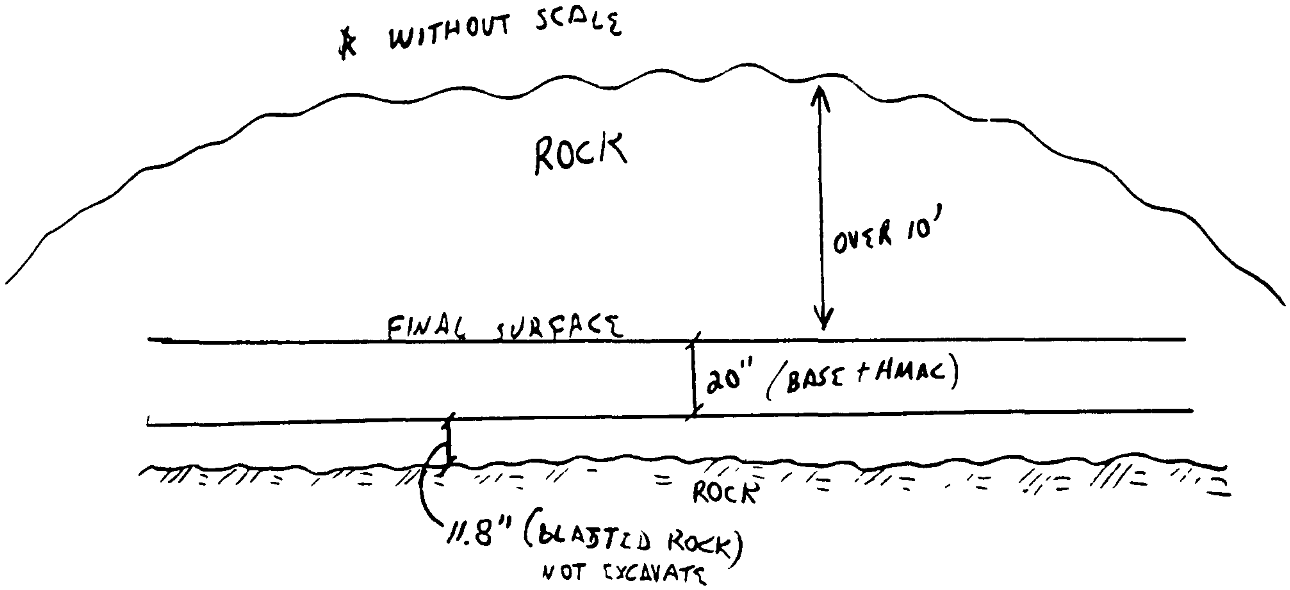
SPS-9A CONSTRUCTION DATA SHEET 19 SUBGRADE EXCAVATION AND BACKFILLING SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [0 9] [0 3]



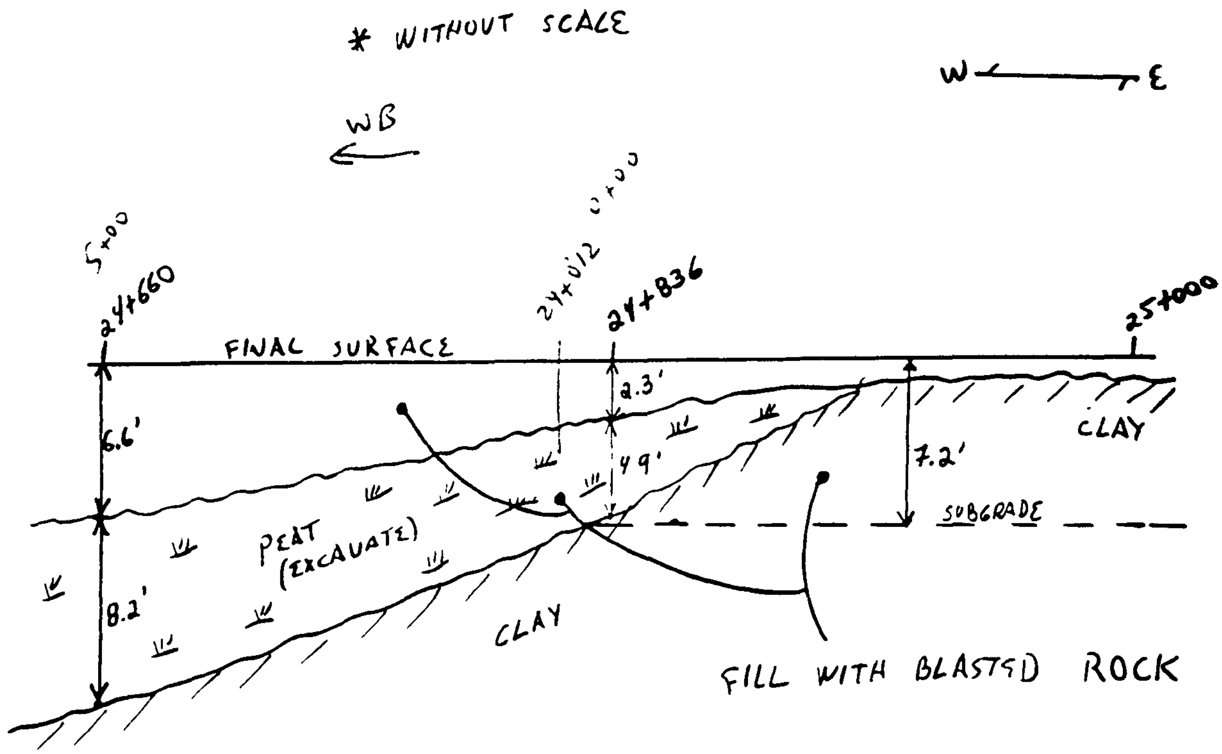
PREPARER Jean-Pierre Boivin EMPLOYER MTQ DATE 96-12-02

SPS-9A CONSTRUCTION DATA SHEET 19 SUBGRADE EXCAVATION AND BACKFILLING SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [0 9] [0 2]

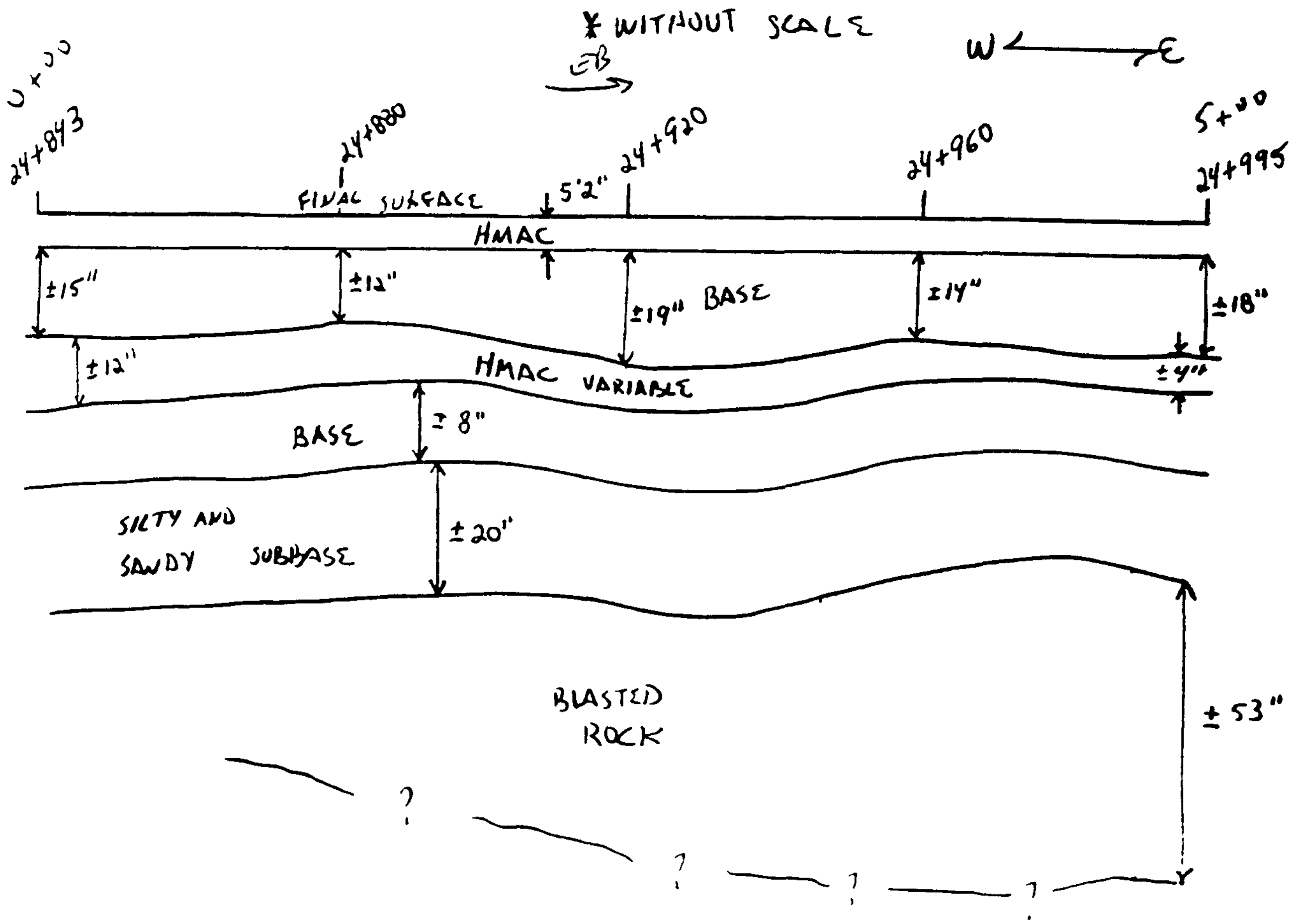


PREPARER Jean-Pierre Boivin EMPLOYER MTQ DATE 96-12-02

SPS-9A CONSTRUCTION DATA SHEET 19 SUBGRADE EXCAVATION AND BACKFILLING SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [0 9] [0 1]

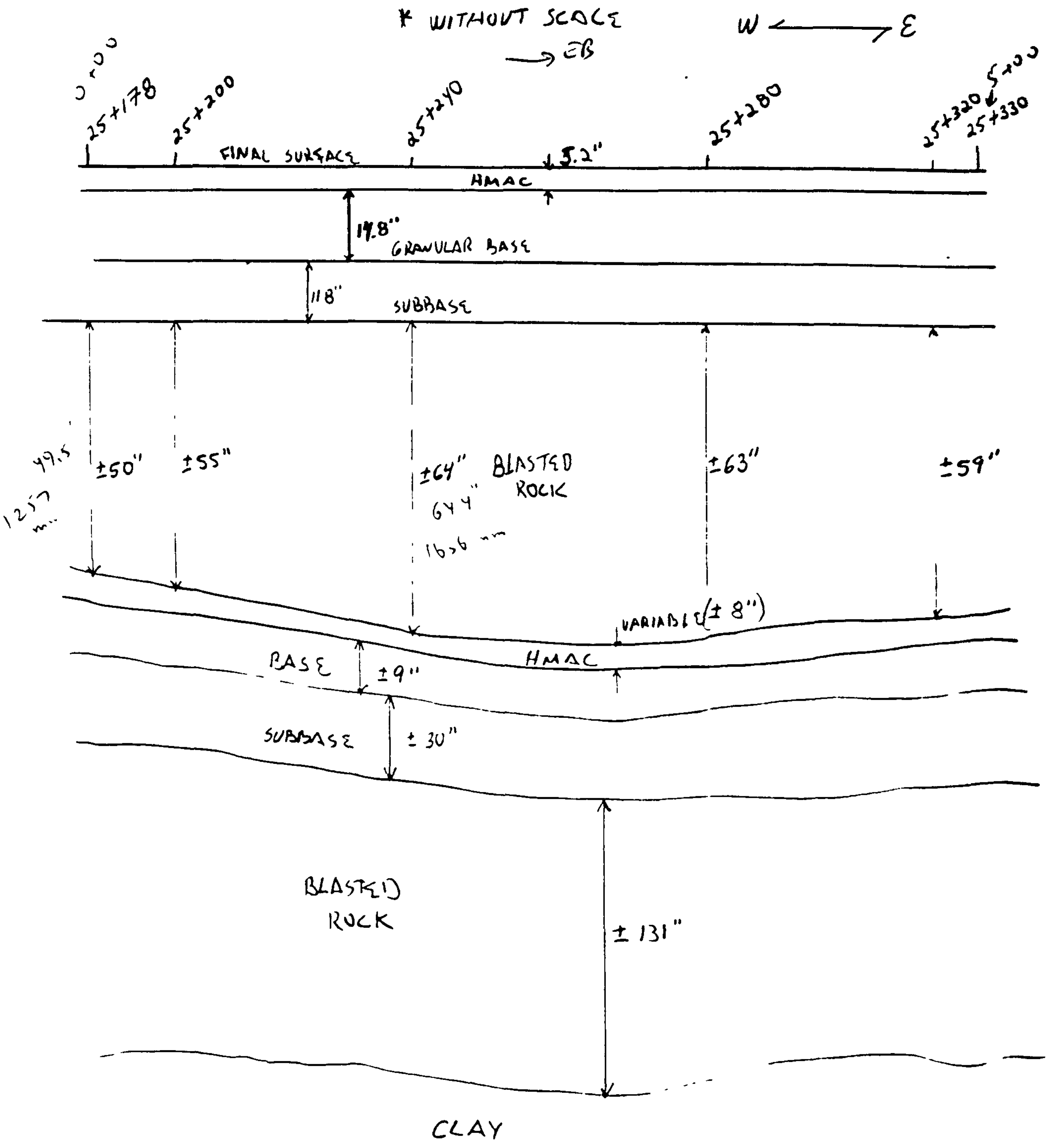


SPS-9A CONSTRUCTION DATA SHEET 20 PRE-OVERLAY SURFACE PREPARATION SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [A 9] [0 3]



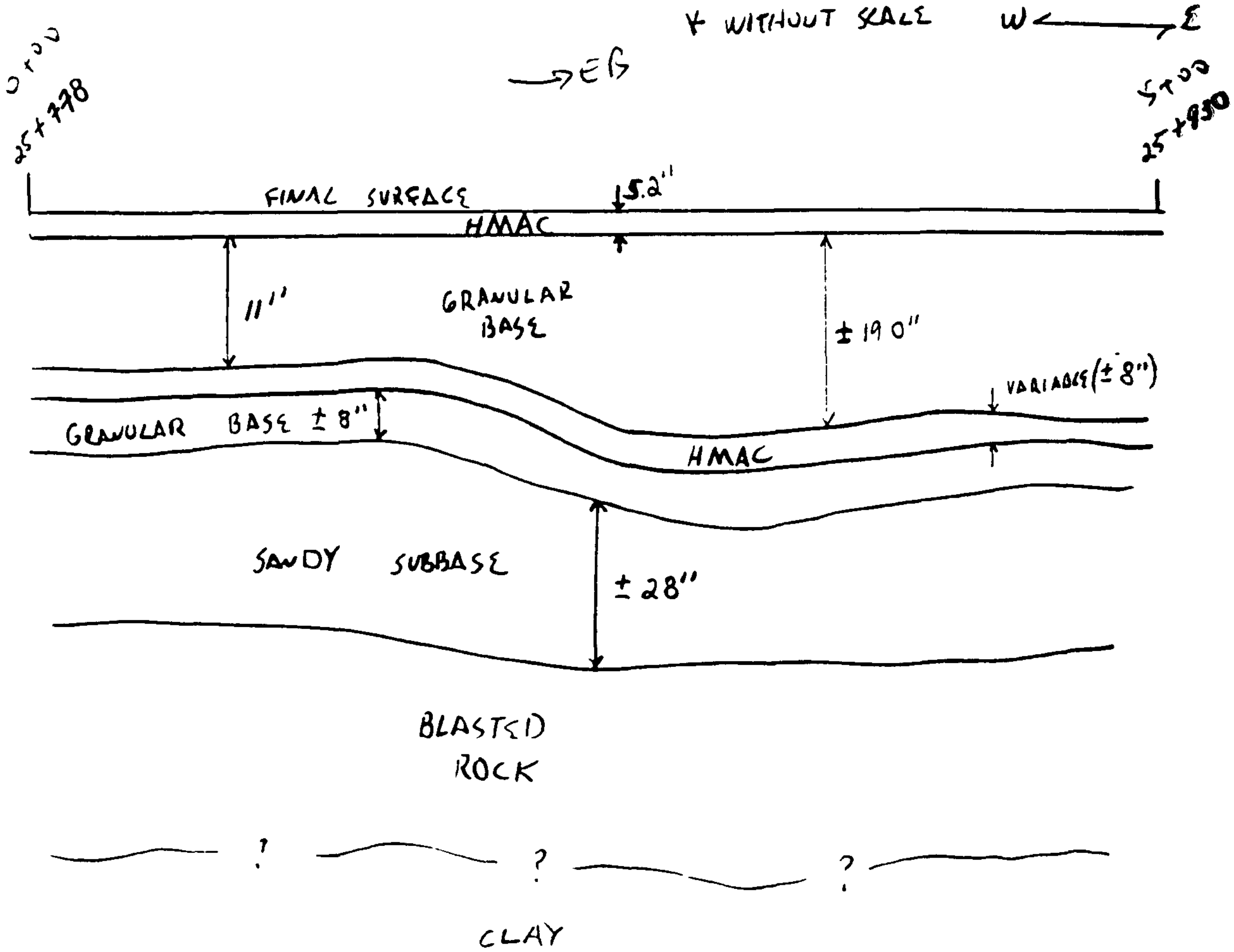
PREPARER Jean-Pierre Boivin EMPLOYER MTQ DATE 96.12.02

SPS-9A CONSTRUCTION DATA SHEET 20 PRE-OVERLAY SURFACE PREPARATION SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [A 9] [0 2]



PREPARER Jean-Pierre Boivin EMPLOYER MTQ DATE 96-12-02

SPS-9A CONSTRUCTION DATA SHEET 20 PRE-OVERLAY SURFACE PREPARATION SKETCH	* STATE CODE * SPS PROJECT CODE * TEST SECTION NO.	[8 9] [A 9] [0 1]



PREPARER Jean-Pierre Boivin EMPLOYER MTQ DATE 96 12-02

A-35

Gouvernement du Québec
Ministere des transports
Direction des sols et ma

contrat. . . . . 3071-95- ...
no centrale . .: 5
type de mélange: MB-2
no de formule..: 51
....: 94
no du lot.. ..: 50

ÉCHANTILLON

no lab	date a m j	chaînage
60243	960520	
60244	960520	
60245	960520	
60246	960520	

moyenne du lot.......:
formule ....
écart mesuré (em)..:
écart tolérable (et).:
écart critique (ec)..:
facteur de correction:

no de lab
chaînage
...
densité
compacité

-une valeur ombragée in
-une valeur ombragée in
% de bitume : Reprise sur : 60242 (
densité brute : Reprise sur : 60246 (2

USINE NO	003
ENDROIT	CANTON TREMBLAY
CALIB:	5
TAMIS	20

INTER-CITE CONSTRUCTION LTEE

FORMULE DE MELANGE 96

WEST BOUND 890900

NO. DE FORMULE:	MB20-	
TYPE DE MELANGE:	MB-	
GRANUL. MODIFIEE	0/1	1
FORMULE SPECIALE	0/1	1

CALIBRE		PROVENANCE	NO	GRANULOMETRIE A FROID (millimetres) 25	20	16	12.5	10	5	2.5	1.25	(Microns) 630	315	160	80	%	D.G.B. usine	ABSORPTION EAU
sable	S	BANC. J P TREM	6	100	100	100	100	100	99 7	99	97	85	47	10	2 0	23.0	2.675	0.63
5-0	C	CARR PIC CONST	1	100	100	100	100	100	95 1	65	39	24	17	12	9 2	28.0	2.639	0 69
10-5	P	CARR PIC CONST	2	100	100	100	100	94	22 8	8	5	4	3	2	2 0	0.0	2.648	0 49
12 5-10	P	CARR PIC CONST	3	100	100	100	91	43	3 5	2	2	2	2	2	1 2	24.0	2.656	0.48
16-12.5	P	CARR PIC CONST	4	100	10C	94	41	11	1 8	1	1	1	1	1	0 9	0.C	2.677	0 39
20-16	P	CARR. PIC CONST	5	100	94	55	15	2	1 0	1	1	1	1	1	0 4	25.0	2.683	0.36
		COMBINE		100	99	89	77	62	50.6	42	34	27	16	6	3.4	100.0	2.662	0.509

42 34

	GRANULOMETRIE A CHAUD 25	20	16	12.5	10	5	2.5	1.25	630	315	160	80
FORMULE	100	99	89	77	62	50 6	[illegible]	34	27	16	7	4.2
EXIGENCES GRANULOM	100	98/100	64/92	55/85	48/78	34/55	24/[illegible]	[illegible]	9/31	6/23	4/15	3/8

CARACTERISTIQUES PHYSIQUES DU MELANGE A CHAUD.

	T G	% BITUME	% VIDES	V.C.B	STAB	DEFOR	DENS. BRUTE	DENS MAXIMUM
FORMULE	419	4 50	3 1	75 4	13194	3 16	2.432	2 498
C C D G		+4 2	2-5	-85	+9000	2-4		

AUTRES INFORMATIONS	
DENSITE EFFECTIVE GRANULAT	2 681
% BITUME EFFECTIF	4 25 %
FILM DE BITUME EFFECTIF	7 89 MC
%BITUME ABSORBE	0 27 %
V.A M	12 7 %
COMPACTIBILITE.	1.38
TAUX DE POSE MINIMUM	108 1 kg/m2
SURFACE SPECIFIQUE TOTALE	5.51 m2/kg
TYPE DE BITUME(penetration)·	PG 52-34

FEUIL DE BITUME MINIMUM

TG	SST	VAM
6 91	6 81	6.51

[NA]

[NA] MC CONVENTIONNEL

GRANULATS BITUMINEUX. E B C

% BITUME:	
PENETRATION	
Pa 85/100	
Pa 150/200	

REMARQUES:

- FACTEUR DE CORRECTION = +0.15
- PARTICULIER F.M.. # 32

FORMULE PRESENTE :
PAR:

REPRESENTANT DE L'ENTREPRENEUR
DATE: 06/12/96

96-06-01
ORM./4.10.11A

copies:
INTER-CITE CONSTRUCTION LTEE

ection des sols et mater

ÉCHANTILLON
no date
lab

USINE NO 005
ENDROIT CANTON TREMBLAY
CALIB 5
TAMIS 20

INTER-CITE CONSTRUCTION LTEE
FORMULE DE MELANGE 96

EAST BOUND 89A900

NO. DE FORMULE:	MB16-52N-96	
TYPE DE MELANGE:	MB-	16
GRANUL. MODIFIEE	0/1	1
FORMULE SPECIALE	0/1	1

CALIBRE		PROVENANCE	GRANULOMETRIE A FROID (millimetres)							(Microns)						D.G.B.	ABSORPTION
			25	20	16	12 5	10	5	2 5	1 25	630	315	160	80	%	usine	EAU
sable	S	BANC J P TREMBLAY	100	100	100	100	100	99 5	99	96	84	44	9	1 7	21.0	2.675	0.63
5-0	C	PIC CONST CALCAIRE	100	100	100	100	100	95	66	39	26	18	13	10 0	31 0	2.639	0.69
10-5	P	PIC CONST CALCAIRE	100	100	100	100	99	26	7	4	3	3	2	1.9	17.0	2 648	0.49
12 5-10	P	PIC CONST CALCAIRE	100	100	100	95	50	3	2	2	1	1	1	1 0	13.0	2 656	0 48
16-12 5	P	PIC CONST CALCAIRE	100	100	96	41	9	2	1	1	1	1	1	0 7	18 0	2.677	0.39
		COMBINE	100	100	99	89	77	55 5	43	33	27	16	7	4 0	100.0	2.657	0 537

	GRANULOMETRIE A CHAUD											
FORMULE	100	100	99	89	77	55.5	43	33	27	16	7	4.4
EXIGENCES GRANULOM	100	100	98/100	80/92	62/82	40/60	29/47	20/38	14/31	10/26	5/17	3/8

	CARACTERISTIQUES PHYSIQUES DU MELANGE A CHAUD.							
	T G	% BITUME	% VIDES	V C B	STAB.	DEFOR.	DENS. BRUTE	DENS MAXIMUM
FORMULE	452	4 80	3 2	75 4	12816	3.03	2.425	2.500
C C D G		+4 7	2 0-5 0	-85	9000	2-4		

AUTRES INFORMATIONS	
DENSITE EFFECTIVE GRANULAT	2 698
% BITUME EFFECTIF	4 25 %
FILM DE BITUME EFFECTIF	7 79 MC
%BITUME ABSORBE	0 58 %
V A.M.	13 1 %
COMPACTIBILITE.	1 32
TAUX DE POSE MINIMUM	89.3 kg/m2
SURFACE SPECIFIQUE TOTALE	5 59 m2/kg
TYPE DE BITUME(penetration):	80/100

FEUIL DE BITUME MINIMUM

6 74	6 77	6 44
TG	SST	VAM

[NA]

[NA] MC

GRANULATS BITUMINEUX. E B C

% BITUME:	
PENETRATION	
Pa 85/100	
Pa 150/200	

REMARQUES:
* = ESTIME
- FACTEUR DE CORRECTION = +0 20
- M T Q. F M.: # 13
- PIERRE DE CALCAIRE
- BITUME CONVENTIONNEL

FORMULE PRESENTE :
PAR:
REPRESENTANT DE L'ENTREPRENEUR
DATE: 07/04/96

Gouvernement du Québec
Ministère
des Transports
Direction Lab. des chaussées

Méthode de conception d'un enrobé bitumineux
Niveau 1 "SUPERPAVE"
Projet numéro : 90 , Méthode volumétrique
NORME: AASHTO Provisional Method TP4, Edition 1B (Sept. 1993)

Numéro de laboratoire	Numéro de projet	Numéro de contrat
96-862	626441	Superpave

Caractéristiques de l'enrobé

Pb (%)	Dgb	Dmax	% 0.080mm	Dbit	Dge	Pbe	Fines/Pbe
4,20	2,712	2,561	4,5	1,010	2,746	3,76	1,197

Essai à la presse à cisaillement (girations et hauteurs)

Ni =	7
Nd =	76
Nm=	117

Échantillon	Hi	Hd	Hm
4.2A	115,4	106,1	105,0
4.2B	115,4	106,1	104,9
4.2C	115,2	106,0	104,9

Détermination de la densité brute selon la norme AASHTO T 166-88 (méthode B)

Numéro de l'échantillon		4.2A	4.2B	4.2C
Masse sèche	A	4468,9	4468,3	4468,3
Masse (pycnomètre + éprouvette + eau)	B	9664,4	9657,1	9655,5
Masse S.S.S.	C	4472,9	4472,3	4473,6
Masse d'eau à 25°C pycnomètre no: 1898	D	6985,2	6985,2	6985,2
Densité brute = A / (C + D - B)	E	2,491	2,482	2,478
Densité brute moyenne			2,484	

Tableau des résultats

	%Dm@Nm	Rap.Hauteur	Db@Nd	%Dm@Nd	Rap.Hauteur	Db@Ni	%Dm@Ni
Échantillon	Db/Dm	(Hm/Hd)	Db(Hm/Hd)	Dm@Nd/Dm	(Hm/Hi)	Db(Hm/Hi)	Db@ Ni/Dm
4.2A	97,3	0,990	2,465	96,3	0,910	2,267	88,5
4.2B	96,9	0,989	2,454	95,8	0,909	2,256	88,1
4.2C	96,8	0,990	2,452	95,7	0,911	2,256	88,1
Moyenne	97,0		2,457	95,9		2,260	88,2
Exigence	< 98%			= 96%			< 89%

Équipements
Balance no 000011
Étuves 000611,000248,000247
Malaxeur no 001725
Démouleur no 003473
Presse 004907, bain 000453
Autres

Vides (%) à Nd =	4,1	Exigences
VAM (%) à Nd =	13,2	
VCB (%) à Nd =	69,2	

Échantillon préparé par:	Denis Proteau
Essai effectué par:	Denis Proteau
Date de l'essai:	10 Septembre 1996

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

Gouvernement du Québec
Ministère
des Transports
Direction Lab. des chaussées

Méthode de conception d'un enrobé bitumineux
Niveau 1 "SUPERPAVE"
Projet numéro : 90 , Méthode volumétrique
NORME: AASHTO Provisional Method TP4, Edition 1B (Sept. 1993)

Numéro de laboratoire	Numéro de projet	Numéro de contrat
96-862	626441	Superpave

Caractéristiques de l'enrobé

Pb (%)	Dgb	Dmax	% 0.080mm	Dbit	Dge	Pbe	Fines/Pbe
4,70	2,712	2,534	4,5	1,010	2,738	4,37	1,031

Essai à la presse à cisaillement (girations et hauteurs)

Ni =	7
Nd =	76
Nm=	117

Échantillon	Hi	Hd	Hm
4.7A	114,7	104,9	103,6
4.7B	114,0	104,1	102,9
4.7C	114,1	104,5	103,3

Détermination de la densité brute selon la norme AASHTO T 166-88 (méthode B)

Numéro de l'échantillon		4.7A	4.7B	4.7C
Masse sèche	A	4430,3	4427,2	4430,4
Masse (pycnomètre + éprouvette + eau)	B	9639,3	9642,9	9639,6
Masse S.S.S.	C	4433,4	4428,9	4432,8
Masse d'eau à 25°C pycnomètre no: 1898	D	6985,2	6985,2	6985,2
Densité brute = A / (C + D - B)	E	2,490	2,500	2,491
Densité brute moyenne			2,494	

Tableau des résultats

Échantillon	%Dm@Nm Db/Dm	Rap.Hauteur (Hm/Hd)	Db@Nd Db(Hm/Hd)	%Dm@Nd Dm@Nd/Dm	Rap.Hauteur (Hm/Hi)	Db@Ni Db(Hm/Hi)	%Dm@Ni Db@ Ni/Dm
4.7A	98,3	0,988	2,459	97,0	0,903	2,249	88,8
4.7B	98,6	0,988	2,470	97,5	0,903	2,257	89,0
4.7C	98,3	0,988	2,462	97,2	0,905	2,256	89,0
Moyenne	98,4		2,464	97,2		2,254	88,9
Exigence	< 98%			= 96%			< 89%

Équipements
Balance no 000011
Étuves 000611,000248,000247
Malaxeur no 001725
Démouleur no 003473
Presse 004907, bain 000453
Autres

		Exigences
Vides (%) à Nd =	2,8	
VAM (%) à Nd =	13,4	
VCB (%) à Nd =	79,4	

Echantillon préparé par:	Denis Proteau
Essai effectué par:	Denis Proteau
Date de l'essai	10 Septembre 1996

Gouvernement du Québec
Ministère
des Transports
Direction Lab. des chaussées

Méthode de conception d'un enrobé bitumineux
Niveau 1 "SUPERPAVE"
Projet numéro : 90 , Méthode volumétrique

NORME: AASHTO Provisional Method TP4, Edition 1B (Sept. 1993)

Numéro de laboratoire	Numéro de projet	Numéro de contrat
96-862	626441	Superpave

Caractéristiques de l'enrobé

Pb (%)	Dgb	Dmax	% 0.080mm	Dbit	Dge	Pbe	Fines/Pbe
5,20	2,712	2,516	4,5	1,010	2,740	4,84	0,930

Essai à la presse à cisaillement (girations et hauteurs)

Ni =	7
Nd =	76
Nm=	117

Échantillon	Hi	Hd	Hm
5.2A	112,9	103,1	101,9
5.2B	111,9	102,6	101,5
5.2C	112,8	103,0	101,9

Détermination de la densité brute selon la norme AASHTO T 166-88 (méthode B)

Numéro de l'échantillon		5.2A	5.2B	5.2C
Masse sèche	A	4382,8	4377,2	4380,7
Masse (pycnomètre + éprouvette + eau)	B	9612,9	9613,8	9612,4
Masse S.S.S.	C	4384,0	4378,4	4381,9
Masse d'eau à 25°C pycnomètre no: 1898	D	6985,2	6985,2	6985,2
Densité brute = A / (C + D - B)	E	2,495	2,502	2,497
Densité brute moyenne			2,498	

Tableau des résultats

Échantillon	%Dm@Nm Db/Dm	Rap.Hauteur (Hm/Hd)	Db@Nd Db(Hm/Hd)	%Dm@Nd Dm@Nd/Dm	Rap.Hauteur (Hm/Hi)	Db@Ni Db(Hm/Hi)	%Dm@Ni Db@ Ni/Dm
5.2A	99,2	0,988	2,466	98,0	0,902	2,250	89,4
5.2B	99,4	0,989	2,474	98,3	0,906	2,267	90,1
5.2C	99,2	0,989	2,470	98,2	0,903	2,253	89,6
Moyenne	99,3		2,470	98,2		2,257	89,7
Exigence	< 98%			= 96%			< 89%

Équipements
Balance no 000011
Étuves 000611,000248,000247
Malaxeur no 001725
Démouleur no 003473
Presse 004907, bain 000453
Autres

		Exigences
Vides (%) à Nd =	1,8	
VAM (%) à Nd =	13,7	
VCB (%) à Nd =	86,6	

Échantillon préparé par:	Denis Proteau
Essai effectué par:	Denis Proteau
Date de l'essai:	10 Septembre 1996

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

Gouvernement du Québec
Ministère
des Transports
Direction Lab. des chaussées

Méthode de conception d'un enrobé bitumineux
Niveau 1 "SUPERPAVE"
Projet numéro : 90 , Méthode volumétrique
NORME: AASHTO Provisional Method TP4, Edition 1B (Sept. 1993)

Numéro de laboratoire	Numéro de projet	Numéro de contrat
96-862	626441	Superpave

Caractéristiques de l'enrobé

Pb (%)	Dgb	Dmax	% 0.080mm	Dbit	Dge	Pbe	Fines/Pbe
5,70	2,712	2,516	4,5	1,010	2,765	5,02	0,896

Essai à la presse à cisaillement (girations et hauteurs)

Ni =	7
Nd =	76
Nm=	117

Échantillon	Hi	Hd	Hm
5.7A	108,9	100,5	100,2

Détermination de la densité brute selon la norme AASHTO T 166-88 (méthode B)

Numéro de l'échantillon		5.7A		
Masse sèche	A	4335,2		
Masse (pycnomètre + éprouvette + eau)	B	9582,8		
Masse S.S.S.	C	4336,1		
Masse d'eau à 25°C pycnomètre no: 1898	D	6985,2		
Densité brute = A / (C + D - B)	E	**2,494**		
Densité brute moyenne			**2,494**	

Tableau des résultats

Échantillon	%Dm@Nm Db/Dm	Rap.Hauteur (Hm/Hd)	Db@Nd Db(Hm/Hd)	%Dm@Nd Dm@Nd/Dm	Rap.Hauteur (Hm/Hi)	Db@Ni Db(Hm/Hi)	%Dm@Ni Db@ Ni/Dm
5.7A	99,1	0,997	2,486	98,8	0,921	2,296	91,2
Moyenne	**99,1**		**2,486**	**98,8**		**2,296**	**91,2**
Exigence	**< 98%**			**= 96%**			**< 89%**

Équipements
Balance no 000011
Étuves 000611,000248,000247
Malaxeur no 001725
Démouleur no 003473
Presse 004907, bain 000453
Autres

Vides (%) à Nd =	1,2	Exigences
VAM (%) à Nd =	13,6	
VCB (%) à Nd =	91,2	

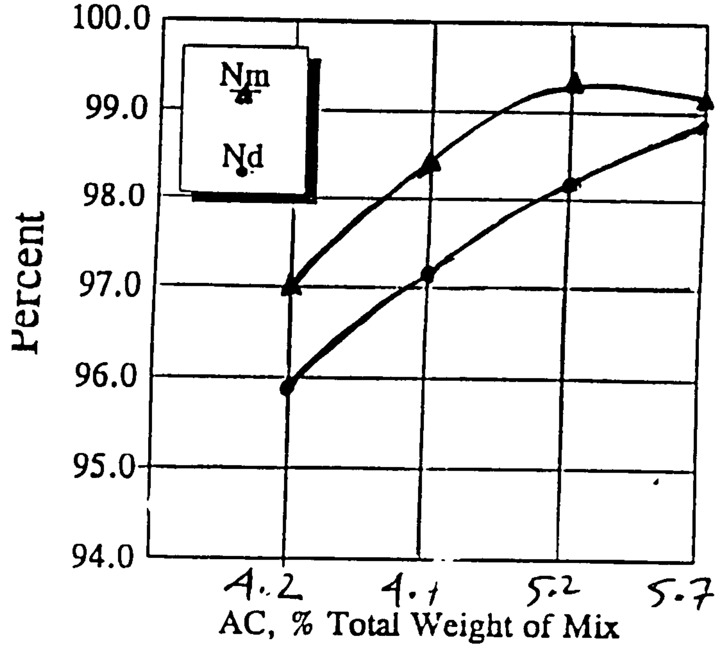
Échantillon préparé par:	Denis Proteau
Essai effectué par:	Denis Proteau
Date de l'essai:	10 Septembre 1996

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

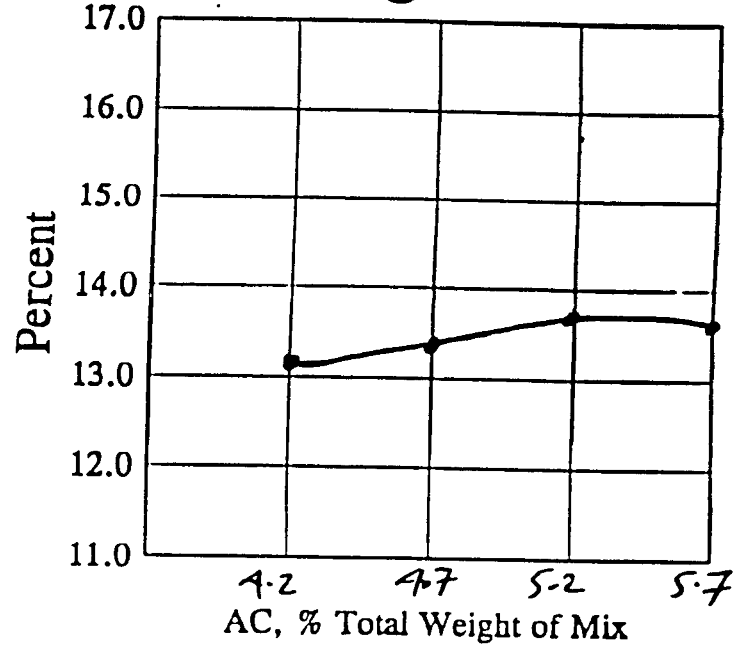
SuperPave Level 1 Design Summary

Design AC	Gmm	% Gmm @ Ni	% Gmm @ Nd	VMA @ Nd	VFA @ Nd	% Gmm @ Nm
4.25						

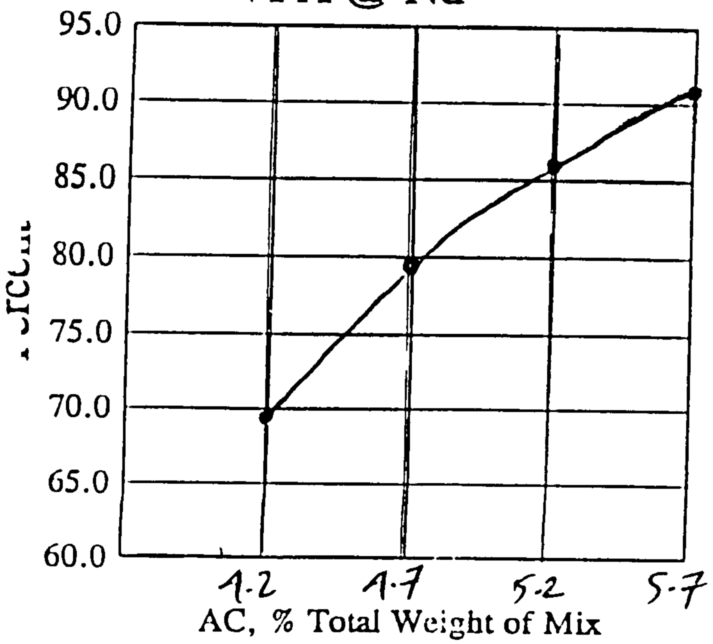
% of Gmm



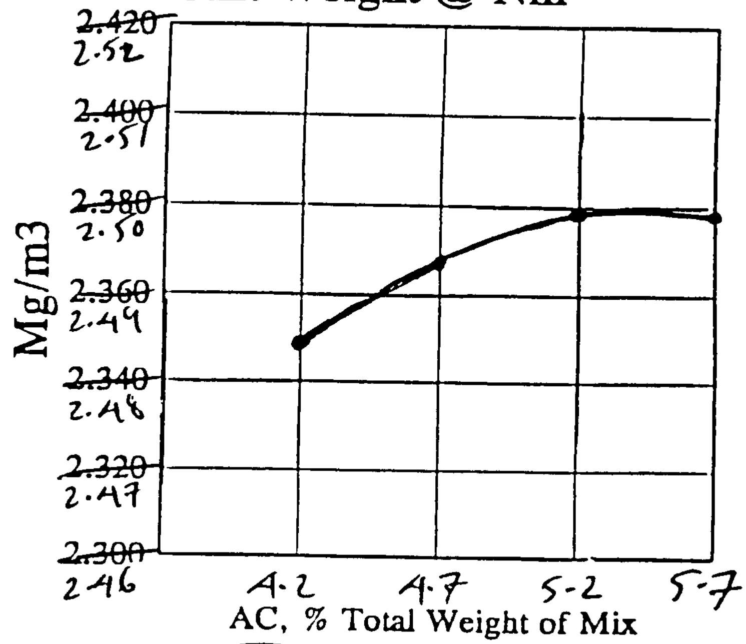
VMA @ Nd



VFA @ Nd



Unit Weight @ Nm



89A901, 890901

Gouvernement du Québec
Ministère des Transports
Laboratoire des chaussées

TÉLÉCOPIE

Date: *1996/09/11*

Nombre de pages (celle-ci comprise): 2

A: *M. Fernand Tremblay*

Téléphone:

Télécopieur: *(418) 549-2540*

De: *Marina Beaudoin*
MATÉRIAUX DE CHAUSSÉES
2700, Einstein,
Sainte-Foy (Québec)
G1P 3W8

Téléphone: *(418) 644-0181*

Télécopieur: *(418) 646-6692*

cc: *M. Jean-Pierre Boivin*

Notes:	☐ Urgent	☐ Pour information	☐ Réponse au plus vite	☐ Veuillez commenter

OBJET : Formulation EB-14, contrat # 3671-95-0906

Nous avons reçu les granulométries de vos classes granulaires. Il y a une différence entre la granulométrie du 0-3 réalisée par le secteur enrobés et votre granulométrie de cette même classe 0-3.

Je vous fais parvenir les proportions que vous devriez utilisées selon vos granulométries (Voir **combiné 2** de la page suivante) afin d'obtenir le combiné granulométrique équivalent de celui que nous vous avons proposé.

Suite à cette différence entre les granulométries de la classe granulaire 0-3, nous avons demandé de réaliser une extraction sur une éprouvette ayant servie à la formulation du mélange EB-14 afin de déterminer le combiné réel.

Salutations

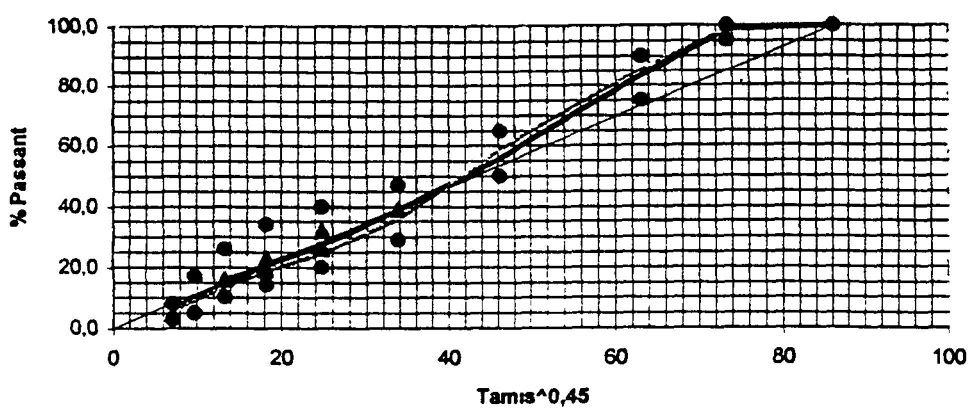
Gouvernement du Québec
Ministère
des Transports
Direction Lab. des chaussées

Analyse granulométrique

Initiales
prop.

	Classes granulaires						Combinés		Fuseau		MVMax	
	0-3 mm	3-6 mm	5-10 mm			10-14	1	2			Puissance	
Comb. 1	40,0%	15,0%	30,0%			15,0%	100,0%		Min	Max	0.45	
Comb. 2	35,0%	25,0%	27,0%			13,0%		100,0%	%	%	%	
Tamis(mm)												Tamis(mm)
20,00	100	100	100			100	100,0	100	100	100	100	20,00
14,00	100	100	100			91	98,7	99	95	100	85	14,00
10,00	100	100	87			16	83,5	86	75	90	73	10,00
5,00	99	83	11			3	55,8	59	50	65	54	5,00
2,50	88	13	5			2	39,0	36	29	47	39	2,50
1,25	63	6	4			2	27,6	25	20	40	29	1,25
0,630	47	5	3			2	20,8	19	14	34	21	0,630
0,315	34	4	3			2	15,4	14	10	26	15	0,315
0,160	22	3	2			2	10,2	9	5	17	11	0,160
0,080	13,1	2,1	1,5			1,2	6,2	5,7	3	8	8	0,080

MVMax : Courbe de la masse volumique maximale



Remarque : **Formulation méthode LC**
Granulat : Inter-Cité **% Liant : 4,9**
granulométries de inter-cité

Copies à:

No: Laboratoire : 96-862
No: Projet : 626441

Préparé par: Denis P. et Marc P.
Approuvé par :
Date : 5 Septembre 1996

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

Gouvernement du Québec
Ministère
des Transports

89A902
89A903

SupICC.xls

Sainte-Foy, le 12 septembre 1996

À : Monsieur Fernand Tremblay
Inter Cité Construction

DE : Marina Beaudoin, ing.
Secteur Enrobés

OBJET : Formulation Superpave pour projet SPS-9
Contrat #3671-95-0906, route 170, Larouche

Vous trouverez ci-joint le combiné granulométrique à utiliser pour les sections où la formulation Superpave est requise. Les proportions indiquées ont été ajustées en fonction des résultats de vos granulométries. La teneur en bitume de 4,25% peut être sujet à un changement mineur.

Étant donné la différence entre votre granulométrie du 0-3 mm et celle du secteur Enrobés, une extraction sera réalisée sur une des éprouvettes ayant servie à la formulation Superpave.

Tout en espérant que ces renseignements seront conformes à vos besoins, nous demeurons à votre entière disposition pour tous renseignements supplémentaires.

Recevez, Monsieur, l'expression de nos sentiments les meilleurs.

Marina Beaudoin

c.c. Monsieur Jean-Pierre Boivin, ing.

Service des materiaux de chaussees
2700 rue Einstein Sainte-Foy (QUEBEC) Canada G1P 3W8
Telephone (418) 644-0181 Telecopieur (418) 646-6692

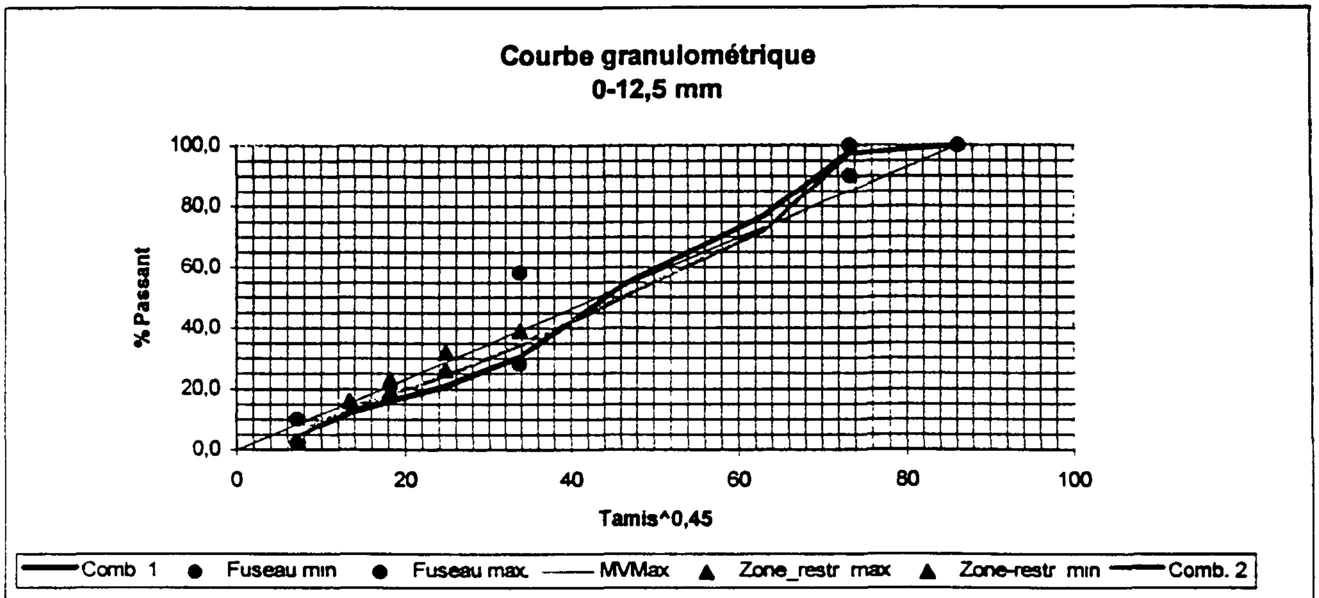
Gouvernement du Québec
Ministère des Transports
Direction Lab. des chaussées

Analyse granulométrique

LC

	Classes granulaires						Combinés		Fuseau		MVMax	
	0-3 mm	3-6 mm	5-10 mm			10-14	1	2			Puissance	
Comb. 1	29,0%	27,0%	20,0%			24,0%	100,0%		Min	Max	0.45	
Comb. 2	35,0%	15,0%	20,0%			30,0%		100,0%	%	%	%	
Tamis(mm)												Tamis(mm)
20,00	100	100	100			100	100	100	100	100	100	20,00
14,00	100	100	100			91	98	97	90	100	85	14,00
10,00	100	100	87			16	77	72			73	10,00
5,00	99	83	11			3	54	50			54	5,00
2,50	88	13	5			2	31	34	28	58	39	2,50
1,25	63	6	4			2	21	24			29	1,25
0,630	47	5	3			2	16	18			21	0,630
0,315	34	4	3			2	12	14			15	0,315
0,160	22	3	2			2	8	9			11	0,160
0,080	13,1	2,1	1,5			1,2	5,0	5,6	2	10	8	0,080

MVMax : Courbe de la masse volumique maximale



Remarque : **Formulation Superpave**
Granulat : Inter-Cité **% Liant : 4,25**
granulométries de inter-cité

Copies à: ____________ ____________ ____________

No: Laboratoire : 96-862
No: Projet : 626441

Préparé par: **Denis P. et Marc P.**
Approuvé par : ____________
Date : **12 Septembre 1996**

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

Gouvernement du Québec
Ministère
des Transports

890902
890903

Sainte-Foy, le 22 septembre 1996

À : Monsieur Fernand Tremblay
Inter Cité Construction

DE : Marina Beaudoin, ing.
Secteur Enrobés

OBJET : **Deuxième formulation Superpave** pour projet SPS-9
Contrat #3671-95-0906, route 170, Larouche

Vous trouverez ci-joint le nouveau combiné granulométrique à utiliser pour la formulation Superpave du site 890900 (voie nord) des sections 890902 (25+375 @ 25+680) et 890903 (25+710 @ 26+015). Les proportions indiquées ont été ajustées en fonction des résultats de vos granulométries. **La teneur en bitume est de 4,40%** pour ces sections.

Tout en espérant que ces renseignements seront conformes à vos besoins, nous demeurons à votre entière disposition pour tous renseignements supplémentaires.

Recevez, Monsieur, l'expression de nos sentiments les meilleurs.

Marina Beaudoin

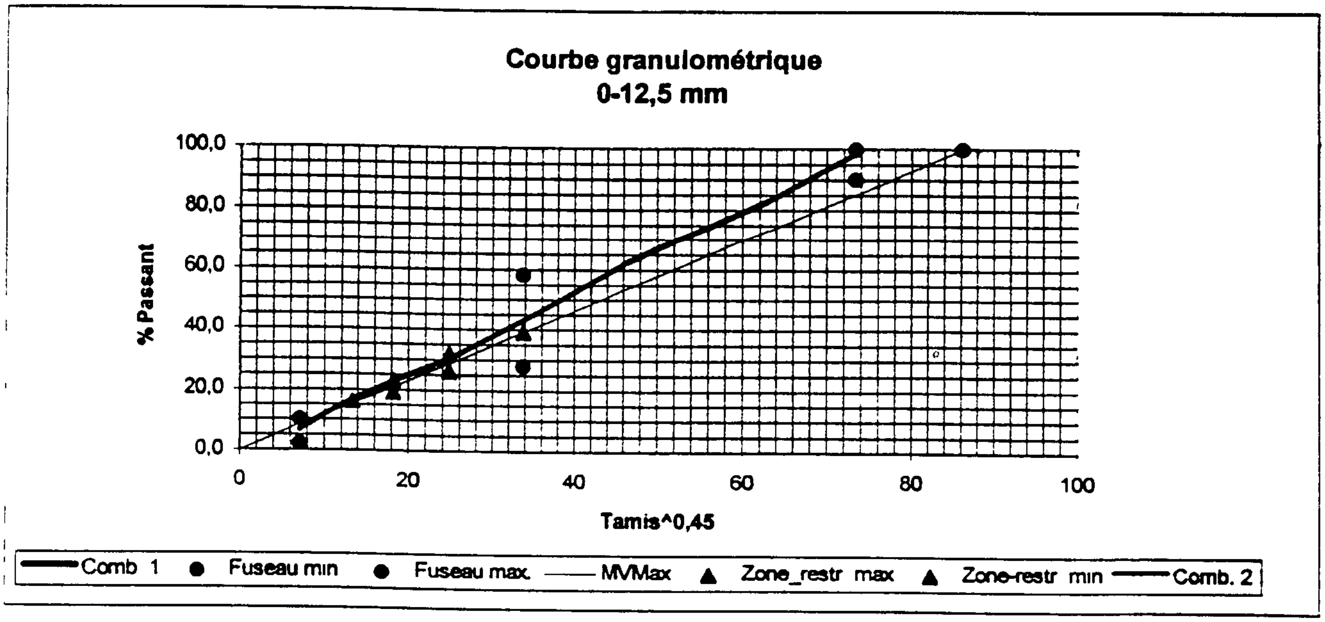
c.c. Monsieur Jean-Pierre Boivin, ing.

Service des matériaux de chaussées
2700, rue Einstein, Sainte-Foy (QUEBEC) Canada G1P 3W8
Téléphone (418) 644-0181 Télécopieur (418) 646-6692

Analyse granulométrique

	Classes granulaires						Combinés		Fuseau		MVMax	
	0-3 mm	3-6 mm	5-10 mm			10-14	1	2			Puissance	
Comb. 1	45,0%	18,0%	20,0%			17,0%	100,0%		Min	Max	0.45	
Comb. 2									%	%	%	
Tamis(mm)												Tamis(mm)
20,00	100	100	100			100	100		100	100	100	20,00
14,00	100	100	100			91	98		90	100	85	14,00
10,00	100	100	87			16	83				73	10,00
5,00	99	83	11			3	62				54	5,00
2,50	88	13	5			2	43		28	58	39	2,50
1,25	63	6	4			2	31				29	1,25
0,630	47	5	3			2	23				21	0,630
0,315	34	4	3			2	17				15	0,315
0,160	22	3	2			2	11				11	0,160
0,080	13,1	2,1	1,5			1,2	6,8		2	10	8	0,080

MVMax : Courbe de la masse volumique maximale



Remarque : Formulation Superpave
Granulat : Inter-Cité — % Liant : 4,40
granulométries de inter-cité

Copies à: Sections 890902 et 89090 No: Laboratoire : 96-862
No: Projet : 626441

Préparé par: Denis P. et Marc P.
Approuvé par : Maura Beaudoin
Date : 19 Septembre 1996

Service des matériaux de chaussées
Parc technologique du Québec Métropolitain, 2700, rue Einstein, Sainte-Foy, (QC) G1P 3W8
Tél.: (418) 644-0181 Télécopieur (Fax): (418) 646-6692

GRANULOMETRIE
TAMIS A LA PUISSANCE 0.45

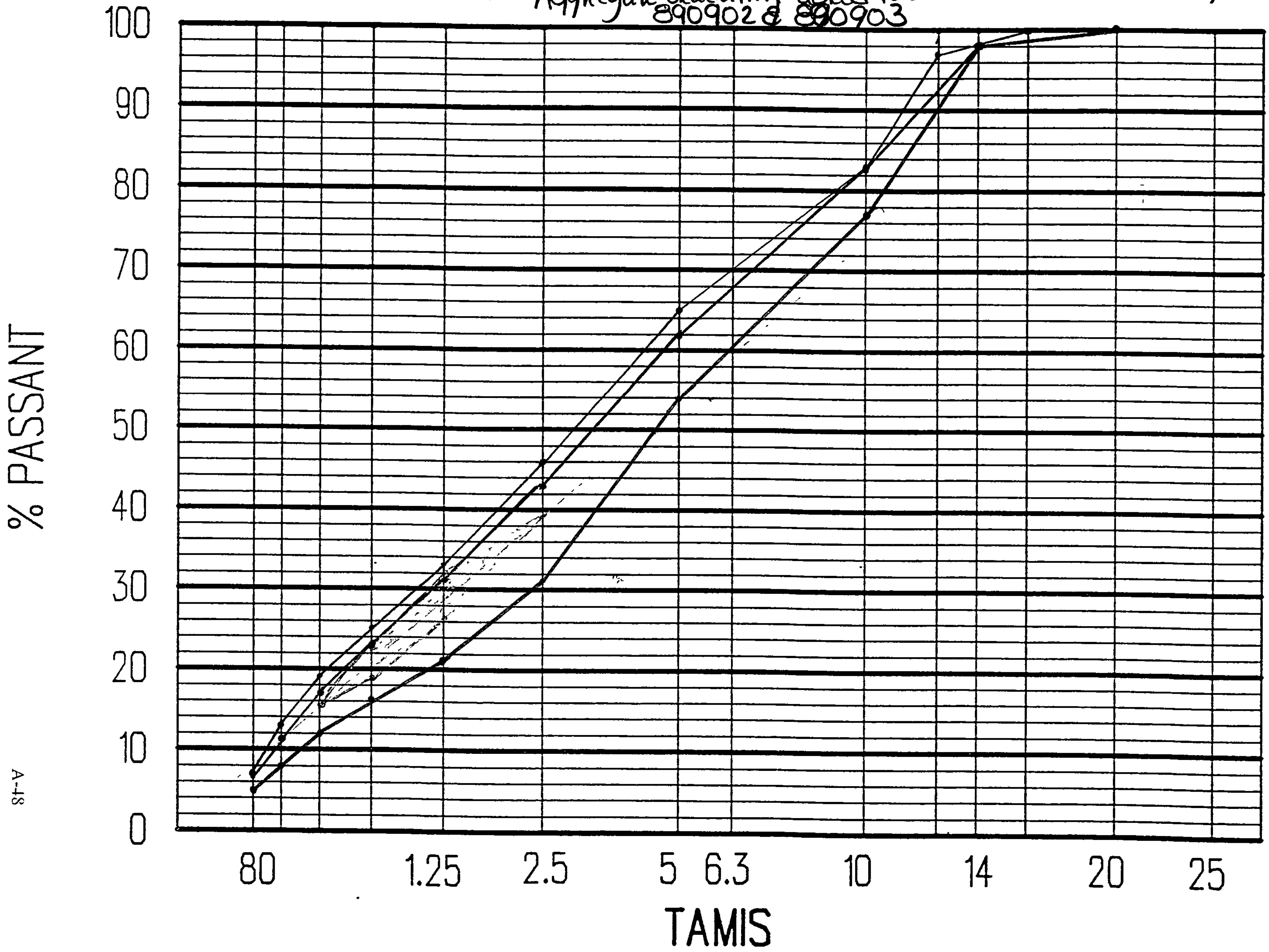
Agg... the contractor (89A902 & 89A903)

— Extracted Aggregate of SGC specimen at 4,2% AC

— Aggregate Gradation asked for 890902 & 890903

89A902 & 89A903

890902 & 890903



FHWA-LTPP
ITXSL-NARO

FALLING WEIGHT DEFLECTOMETER DATA COLLECTION AND PROCESSING SUMMARY

STATE / PROVINCE: QE / 890900 & 89A900
Name / Code No

FLEXIBLE PAVEMENTS

13-Apr-98
Page 1/1

SHRP ID	SURVEY DATE mm/dd/yy	MEAN VALUES FOR DROP HT 2 (mils)				TEMPERATURE		EFFECTIVE SN	SN STD DEV	SUBGRADE MODULUS psi	MODULUS STD DEV psi	MODULUS OF TEST PIT NO.		COMMENT NUMBER
		S1	S1 STD DEV	S7	S7 STD DEV	(mean) D1	(min/max) D1					1	2	
890901	5/28/97	5 79	0 46	0 64	0 04	70	63/75	8 51	0 31	55572	3556			
890902	5/28/97	5 71	0 43	0 36	0 04	83	81/87	8 28	0 26	96697	9406			
890903	5/28/97	7 66	1 02	0 72	0 07	87	86/88	7 85	0 39	49747	4651			
89A901	5/29/97	8 02	0 89	1 06	0 17	85	81/90	12 87	0 56	38953	11115			
89A902	5/29/97	7 88	0 97	0 61	0 07	69	61/76	12 23	0 51	72791	9213			
89A903	5/28/97	11 09	1 40	1 87	0 32	84	83/85	11 82	0 47	20273	4288			

COMMENTS:

LTPP SPS Project Deviation Report Project Summary Sheet	State Code 89 Project Code 0900
Project Classification Information	
SPS Experiment Number. 9A	State or Province: Quebec
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 and 8):	
Construction Start Date: 96-02-04	Construction End Date: 96-09-24
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 ☒ NA
Materials Data:	☒ All Scheduled Samples Obtained and Tested ☐ Incomplete/No Test Data
Construction 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 ☐ NA
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	☐ Preconstruction Tests Performed ☐ Construction Tests Performed ☒ Post-construction Tests Performed
Profile Measurements:	☐ Preconstruction Tests Performed ☒ Post-construction Tests Performed
Distress Measurements:	☐ Preconstruction Tests Performed ☒ Post-construction Tests Performed
Maint. & Rehab. Data:	☐ Complete Submission ☐ Incomplete ☐ Data Not Available ☒ NA
Report Status	
Materials Sampling and 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 ☐ NA

Page 1 of 5 Preparer Basel Abukhater ITXSL - NARO Date 98-04-20

LTPP SPS Project Deviation Report Site Location Guidelines Deviations	State Code 89 Project Code 0900

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

Site Location Guideline Deviation Comments

No Deviations

Page 2 of 5 Preparer Basel Abukhater Date 98-04-20
ITXSL - NARO

LTPP SPS Project Deviation Report Construction Guidelines Deviations	State Code 89 Project Code 0900

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

Construction Guidelines Deviation Comments

(1) NARO representative was only available on site during the surface layer paving.

(2) Storm and Flooding in area caused delay and some damage in July 1996. The monitoring test sections were not affected.

Page 3 of 5 Preparer Basel Abukhater ITXSL - NARO Date 98-04-20

LTPP SPS Project Deviation Report Data Collection and Materials Sampling and Testing Deviations	State Code 89 Project Code 0900

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

Data Collection & Material Sampling and Testing Deviation Comments

(1) Pre construction sampling and testing were performed in May 97, eight months after construction was completed.

(2) Reheating time of hot mix asphalt concrete samples before gyratory compaction should not exceed 30 minutes. All samples were heated to more than 3 hours.

(3) A California type Profilograph test was not performed on all sections as is required by the guidelines.

(4) Deflection, profile, and distress survey monitoring were supposed to be performed 1-3 months, less than 3 months, and less than 6 months, respectively after construction is completed. All monitoring activities were delayed due to the fact that construction was completed late September and the weather prevents any work from being done between the months of November and April in the area.

Page 4 of 5 Preparer Basel Abukhater ITXSL-NARO Date 98-04-20

LTPP SPS Project Deviation Report **Other Deviations**	State Code 89 Project Code 0900

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

Other Deviation Comments

NO other deviation.

Page 5 of 5 Preparer Basel Abukhater ITXSL - NARO Date 98-04-20

LTPP SPS Project Deviation Report **Project Summary Sheet**	State Code 89 Project Code A900

Project Classification Information

SPS Experiment Number. 9A	State or Province: Quebec
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 and 8)	
Construction Start Date: August 96	Construction End Date. 96-09-18

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 ☐ NA
Materials Data.	☒ All Scheduled Samples Obtained and Tested ☐ Incomplete/No Test Data
Construction 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 ☐ NA
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	☐ Preconstruction Tests Performed ☐ Construction Tests Performed ☒ Post-construction Tests Performed
Profile Measurements:	☐ Preconstruction Tests Performed ☒ Post-construction Tests Performed
Distress Measurements:	☐ Preconstruction Tests Performed ☒ Post-construction Tests Performed
Maint. & Rehab. Data:	☒ Complete Submission ☐ Incomplete ☐ Data Not Available ☐ NA

Report Status

Materials Sampling and 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 ☐ NA

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ITXSL-NARO

LTPP SPS Project Deviation Report Site Location Guidelines Deviations	State Code 89 Project Code A900

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

Site Location Guideline Deviation Comments

No Deviations

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LTPP SPS Project Deviation Report **Construction Guidelines Deviations**	State Code 89 Project Code A900

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

Construction Guidelines Deviation Comments

(1) NARO representative was only available on site during the surface layer paving of two of the three sections 89A902 & 89A903 starting Sep. 18, 1996.

(2) Storm and Flooding in area caused delay and some damage in July 1996 The monitoring test sections were not affected.

(3) The as-compacted thickness of the binder ~~and~~ plus surface layer (cores) at interval A (0 months) was shy for Section ~~for~~ 89A902 and exceeded the limit for 89A901 and at ~~for~~ 89A903 at interval B (6 months) when compared to the average value of the other test sections in the project as required and specified in the Guidelines.

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LTPP SPS Project Deviation Report **Data Collection and** **Materials Sampling and Testing Deviations**	State Code 89 Project Code A900

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

Data Collection & Material Sampling and Testing Deviation Comments

(1) Pre construction sampling and testing were performed in May 97, eight months after construction was completed.

(2) The surface layer mix had high air voids for sections 89A902 and 89A903 (Superpave and Alternate Superpave sections).

(3) Reheating time of hot mix asphalt concrete samples before gyratory compaction should not exceed 30 minutes. All samples were reheated to more than 2 hours Section 89A902 samples were reheated to 5 hours.

(4) A California type Profilograph test was not performed on all sections as is required by the guidelines.

(5) Deflection, profile, and distress survey monitoring were supposed to be performed 1-3 months, less than 2 months, and less than 6 months, respectively after construction is completed. All monitoring activities were delayed due to the fact that construction was completed late September and the weather prevents any work from being done between the months of November and April in the area.

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LTPP SPS Project Deviation Report
Other Deviations

State Code 89
Project Code A900

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

Other Deviation Comments

No other deviations.

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APPENDIX B

Photographs

Photo 1 - Three pavers paving fast lane and inside shoulder, slow SPS-9A lane, and outside shoulder.

Photo 2 - Three pavers paving fast lane and inside shoulder, slow SPS-9A lane, and outside shoulder, roller on fast lane.

Photo 3 - Bulk sampling of plant hot mix asphalt concrete from paver hopper to pans.

Photo 4 - Placing bulk hot mix asphalt concrete samples in insulated container in MTQ van for delivery to laboratory for immediate compaction in the gyratory machine.

Photo 5 - Sampling of the combined aggregate from the conveyor belt at the asphalt plant.

Photo 6 - Sampling of the asphalt cement from the tanker at the asphalt plant.

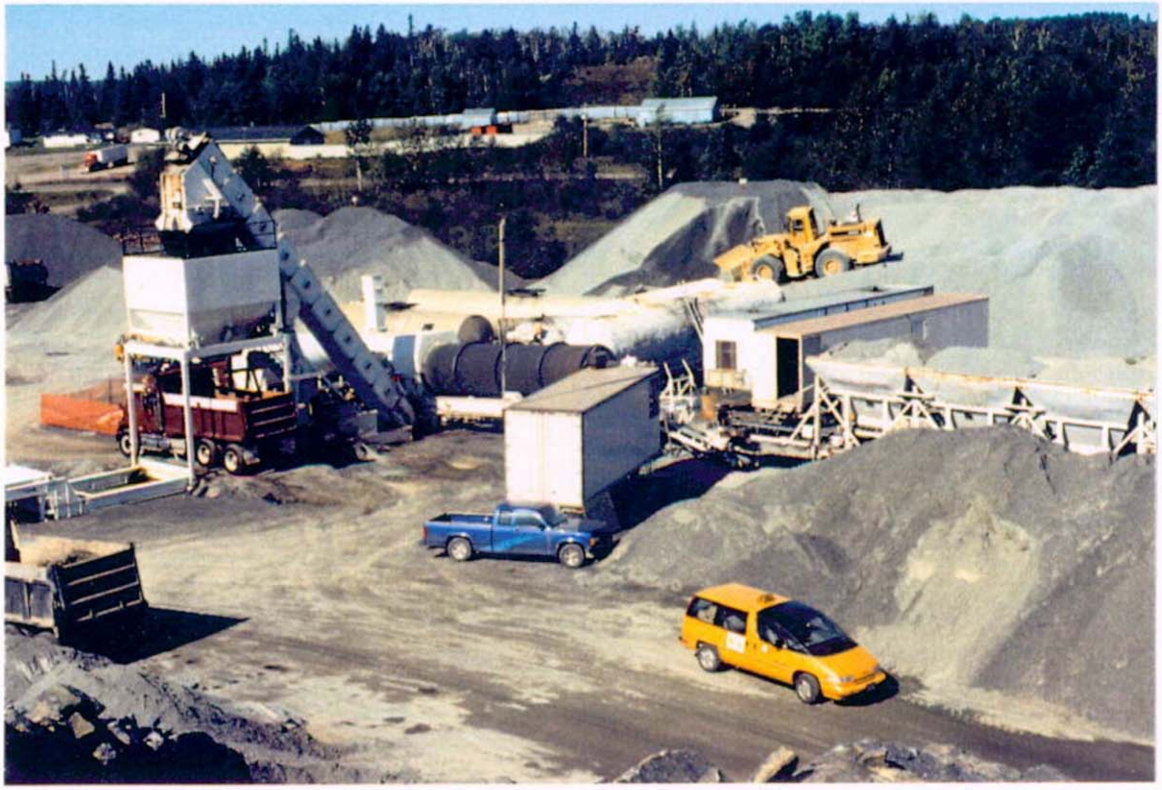

Photo 7 - MTQ # 125 Boeing MS100 four bin portable drum mix asphalt plant at Larouche, QE.

Photo 8 - MTQ # 125 Boeing MS100 four bin portable drum mix asphalt plant at Larouche, QE.

Photo 9 - Coring 152 mm cores at interval A, 0 months, at the new construction west bound project.

Photo 10 - 17 cores collected from the sampling area before section 890902 at interval A, 0 months, showing the arrow indicating direction of traffic.

Photo 11 - Pavement markings and coring at interval A, 0 months.

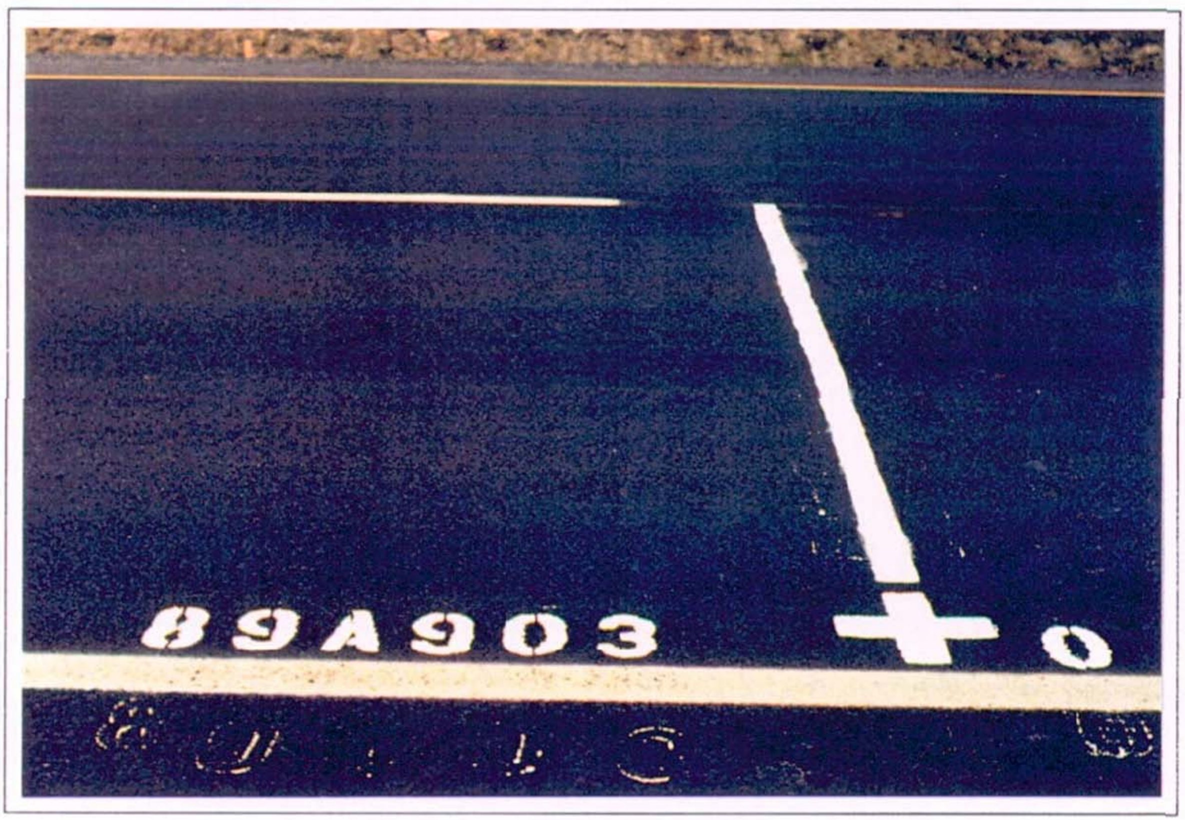

Photo 12 - Pavement markings at station 0+00 of section 89A903 on the east bound overlay project.