PAVEMENT MANAGEMENT SYSTEMS

MEMORANDUM

TO:	Monte Symons	**DATE:**	March 17, 1993
FROM:	Bill Phang	**PROJECT:**	50450810
SUBJECT:	Construction Report	**FILE:**	13.17.5
		COPIES TO:	See Below

MD SHA SPS-5 and SMA Project 240500 - Construction Report

Fowarded enclosed is a construction report for the Maryland State Highway Administration SPS-5 Experiment Project 240500 located on US 15 NB between the Potomac River and US 340, Frederick, MD.

The report is essentially a summary of certain pertinent information regarding project location, test section layout, supplemental sections, weather during construction, construction sequencing, surface preparation techniques, asphalt job mix formulas, layer thicknesses, as-placed materials properties, equipment used in the construction, and materials sampling prior, during, and post construction.

The report is prepared in accordance with the draft SPS Construction Report guidelines, February 19, 1993, which envisages this report as a part of an overall SPS-5 experiment report. Should there be any suggested changes, additions, or amendments, please let me know.

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FEDERAL HIGHWAY ADMINISTRATION

Long Term Pavement Performance
Specifc Pavement Studies

Construction Report on SHRP 240500

Maryland Department of Transportation
State Highway Administration

SPS-5 Project
(Contract No: F-211-501-777)
US RTE. 15 NB, Frederick, MD
Summer of 1992

Report Prepared by :
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March 1993

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US 15 NBL, Frederick, MD
Summer of 1992

Introduction

The MD DOT SPS-5 project is the rehabilitation of an asphalt concrete pavement which is in fair condition. The project lies in the Wet-Freeze environmental area. In addition to the eight test sections of the main experiment which incorporates minimum and intensive surface preparation treatments, two thicknesses of overlay (2" and 5"), and overlays with virgin or 30/70 recycled asphalt mixes, there is a control section with no overlay, and five supplemental sections with same thickness agency overlay designs. One of these is with a virgin agency mix. Four others are with stone mastic asphalt (SMA) mixes using different additives (Vestoplast, Arbocel, Stryelf, and Arbocel/Styrelf), see Table 1.

The project is in the north bound lane of the two-lane roadway of US 15 beginning at the crossing of the Potomac River at Point of Rocks, and proceeding north 6.56 miles to the junction with US 340. This project is in Frederick County, MD, and lies within MD Highway District 7, see Figure 1. The roadway consists of two 12 foot asphalt surfaced lanes with 10 foot surface treated paved shoulders. The existing pavement is 4 1/2 inches of asphalt concrete on 4 inches of cement treated base on 6 inches of dense graded aggregate base on 6 inches of cement modified subgrade on a silt subgrade. Constructed by Genstar in 1971, it carries 9100 vehicles per day with 12 1/2 percent trucks, and an estimated 205,900 ESAL's per year each way. The asphalt surfacing exhibited severe and extensive longitudinal outer wheel track cracking with localized severe alligatored areas at transverse shrinkage cracks where some softening of the cement treated base had taken place.

There are two intersecting roadways within the project length, E. Basford Road, and Mountville Road. Both carry about 100 vehicles per day, mostly cars, which are not expected to significantly affect the AVC/WIM equipment data. A PAT bending plate WIM system is to be installed near 241991 in the spring of 1993.

The terrain is relatively flat and the alignment is generally tangent with slight grades, large radius curvature, and only shallow cuts and fills.

The project including the SPS-5 and the SMA test sections, was advertised for bids in the summer of 1991 using MD SHA's standard contract administration and construction procedures. A pre-bid meeting was held on July 19, 1991 to answer questions in special provision for the SPS experiment and SMA requirements of the project. Contract F211-501-777 was awarded to Genstar Stone Products Company of Hunt Valley, MD, and the notice to proceed was set as February 1992.

The MD SHA SHRP Coordinator and LTPP Contact is Mr. Albin Blazucki who coordinated the project tasks. The SHA Project Engineer was Mr. Rick MaGraw. The District Engineer was Mr. Douglas Rose.

The SPS-5 materials field and laboratory testing was done by Mr. Edmund C. Pick, Regional Engineer, Central and Northern Regional Laboratory, 2323 West Joppa Road, Brooklandville, MD 21022. Mix designs (prefixed N) for the SPS-5 SHRP test sections were done at this Brooklandville laboratory. Mix designs (prefixed W) for the SHA and SMA supplementary sections were done by Mr. Larry L. Michael, Regional Engineer, assisted by Mr. Dave Brown, Western Region Laboratory, 528 Main Street, Hancock, MD 21750.

Mr. Ronald Pope, General Manager, and Mr. Hank R. Serafini, General Superintendent Western Area, Genstar Stone Products Company, East South Street, Frederick, MD 21701 were in charge of the construction work. Materials sampling during construction was carried out by Mr. Glen Kallmeyer, SHA Laboratory Supervisor, with assistance from Mr. Shawn Kennedy, Genstar Quality Control Supervisor for the bulk samples for the Materials Reference Library in Austin, Texas.

Genstar's asphalt mix plant is a 450 tons per hour Astec drum mix plant with recycling ring and a coater box. As well there is an asphalt cement tank bypass to permit supply directly from a tanker truck. Paving equipment included Barber Greene 240 and Blaw Knox 172 pavers, Bomag 12 ton, Ingersoll Rand 10 ton, and Dynapac 10 ton steel wheel rollers. No vibratory compaction was required or used on this project except in patching. At times during the SMA work, a Barber Greene 60 ton capacity Materials Transfer Vehicle (MTV) was introduced ahead of the paver to avoid segregation.

Equipment for the various maintenance treatments included concrete diamond blade saws, Gradall, asphalt distributor, crack sealant kettle and hot lance, and milling machine. The milling equipment, an Ingersoll Rand MT6520 with 78" cutting head was supplied and operated by subcontractor G.A. and F.C. Wagman Inc. A power broom and a Tempco Vacuum Street Sweeper were used to control dust during milling.

Project Details

Layout

Beginning at the south end of the project and situated in the north bound lane, the test sections are laid out so that all of the minimum surface preparation sections are grouped together, followed by the intensive surface preparation sections as shown in the lower portion of Figure 2. The overlay sections are arranged so that the first two sections are one 2" lift. The next four sections consist of two 1 1/2" binder course mixes covered by a 2" surface course. The remaining sections are milled sections with one 1 1/2" replacement course covered by a 2" surface course. The mixes are either virgin or recycled mixes as required by the SPS-5 experiment. The beginning and ending stations of each surface preparation treatment, mix changes ad overlay thickness change tapers are shown in the lower part of Figure 2. The beginning and ending stations for each test section is shown in the upper part of Figure 2, and are tabulated in Table 1.

Materials Sampling and Testing

Locations for field materials sampling and testing for each of the test sections are summarized on the line diagrams in the center of Figure 2. The upper line diagram shows pre-construction sampling locations of 4" O.D., 6" O.D., 12" O.D. cores, test pits, and shoulder probes, designated C, A, BA, TP, and S respectively. The lower line diagram shows post-construction C type locations for obtaining 4" O.D. "as constructed" overlay test specimen.

The layout locations in Figure 2 are tabulated in Table 2.

Table 3 summarizes the samples obtained prior to construction, during construction, and post construction. It should be noted that two MD SHA laboratories were involved. The Brooklandville laboratory has the overall responsibility. The Hancock laboratory was responsible for the SMA mix designs.

The Laboratory materials testing plans are tabulated in Table 4 for pre-construction samples, and in Table 5 for During and Post Construction samples. These plans indicate which samples are to be tested by what SHRP Test and by what Protocol.

Samples taken for the Materials Library in Texas are listed in Table 6.

Construction

Dates of Construction Activities are shown in Table 7.

Surface Preparation

Patching identified in the contract generally involved removing the 4 1/2" layer of asphalt around a transverse shrinkage crack or a longitudinal wheel track crack, and any loose cement treated base material under the asphalt (usually 1-2"), and replacing with new asphalt. Photos 1, 2 and 3, illustrate the severity of these distresses.

There were 80 full width transverse cracks and 36 longitudinal cracks identified in the 6 1/2 mile project. Patches were generally 6' wide to permit use of a Gradall for removal and for compaction by small steel wheel rollers. Sawing for patching started early in April 1992, and patching was completed in late April.

Milling of the four intensive preparation test sections was done on April 1-2, 1993. The milling sequence to cover the two lanes and three feet of each shoulder required 6 passes of the Ingersoll-Rand MT6520 milling machine, as illustrated in Figure 3. Milling depths varied from about 1.4" to 1.9".

Mix Designs

Mix designs for the SPS-5 test sections were prepared by the Brooklandville North and Central Region laboratory in accordance with "Asphalt Concrete Mix Design and Field Control", the FHWA Technical Advisory, T5040-27, March 10, 1988. The mix designs for the SMA mixes were carried out in the Western Regional Laboratory, Hancock.

The aggregates used in the SPS-5 mixes are crushed limestone aggregates from the Genstar Frederick quarry. The aggregate blends used to make the mixes are shown in Table 8. The SMA mixes utilize a harder trap rock aggregate from Virginia, and the aggregate blend to make up the required SMA gradation is also shown in Table 8.

Tables 9, 10 and 11 contain the Job Mix Formula gradations and tolerances, and examples of extraction plant reports for Recycled and Virgin Binder Course Mixes (BFR and BFV), Recycled and Virgin Surface Course Mixes (SCR and SCV), and SMA Mixes (Vestoplast, Styrelf, Arbocel, and Arbocel/Styrelf) respectively Properties of the asphalt cements used are shown in Table 12. An AC5 Elf asphalt cement was used in the Recycled mixes while an AC20 Chevron asphalt cement was used in the Virginia mixes. The same AC20 Chevron (Perth Amboy, NJ) asphalt cement was used in two of the SMA formulations (Vestoplast, Arbocel) while an AC20 Styrelf asphalt cement (Pennsauken, NJ) was used in the Styrelf formulations.

Mix Production

The Genstar Frederick asphalt plant is located about 8 1/2 miles east of the north end of the project. Trucks generally take 20-25 minutes to travel from the plant to the job site. Paving was accomplished while maintaining normal traffic flow.

Control of mixes and placement at the job site was accomplished at the plant by preparing and storing calculated quantities of say a virgin mix, moving the mix in 20 ton truck batches to the job site with computer printed tickets specifying mix design number and intended lane for placement. This information is checked on-site prior to placing the mix. On completion of placing this calculated quantity, a change to recycled mix is made as required. Lifts were generally placed in one day. The milled replacement lift was placed on May 06, the first binder lift placed on May 07, the second binder lift generally placed on May 11, and the surface course placed on June 01, 1992. See Table 7 for details of placement dates.

Reclaimed asphalt pavement is generally used in asphalt mixes in Maryland at up to a level of 20 percent, so RAP material is a stock item at the Genstar Frederick plant. The RAP is introduced in the mixing drum through the recycling collar. Additions to SMA mixes of pelletized additives such as Vestoplast and Arbocel are also made through the recycling collar.

Mineral filler, recovered fines, and powdered additives such as lime are added through an auger into the heated aggregate discharge.

In this Astec plant which is fitted with a coater box, the asphalt binder is introduced when the heated aggregates are discharged from the drier drum into the coater box, (a continuous paddle mixer). The calculated quantity of finished mix is loaded into a silo for delivery into trucks as needed.

Paving

Details of time and date of paving, mix temperatures at plant and in the mat, air temperature, nuclear density measurements, percent compaction (and percent compaction of nearby cores) are contained in Tables 13 and 14 for Replacement Binder Courses, and for Surface Courses respectively. Table 14 also contains the profile index of the finished surface course, which were generally less than 7.

Paving of milling replacement was completed in the morning of May 06, 1992, and binder courses in the mornings of May 07 and May 11, 1992. Surface courses were laid on June 01 and completed on June 03, 1992.

Nuclear density measurements of each lift of binder or surface course generally showed more than 92% compaction. Cores taken nearby generally showed about 94% compaction.

Table 15 provides similar information for the SMA mixes. Both Nuclear Density and Cores indicated very high in-place densities of about 94% and 95% respectively. Profile Indices of the SMA mixes were below 3. Paving of these SMA test sections were completed June 09 and 10, 1992, during an Open House organized by the MD SHA, Genstar Stone Products Company, Maryland Asphalt Association and Federal Highway Administration.

Table 16 provides actual overlay thicknesses determined from levels taken at 5 points across the lane and at 50 foot intervals along the 500 foot test section. Layer thicknesses of the original pavement are taken from field sampling bore hole and test pit logs, and estimates of milling depths are based on thickness of milling replacement from post-construction cores. As well, Table 16 indicates the extent of surface preparation patching in each test section.

The binder mixes, virgin or recycled, did not present any problems in placement or compaction. The surface course mixes demonstrated some tenderness which required the finish roller to be held back about 500 feet from the breakdown. The SMA mixes all showed a tendency for pick up, but these stone particles would drop off and be rolled back into the pavement. More release agent was added to the water for rollers compacting Styrelf mixes. Rollers were held back for the Arbocel mix to minimize pickup. During SMA paving a materials transfer vehicle (MTV) was placed ahead of the paver to minimize segregation, as illustrated in photo 4.

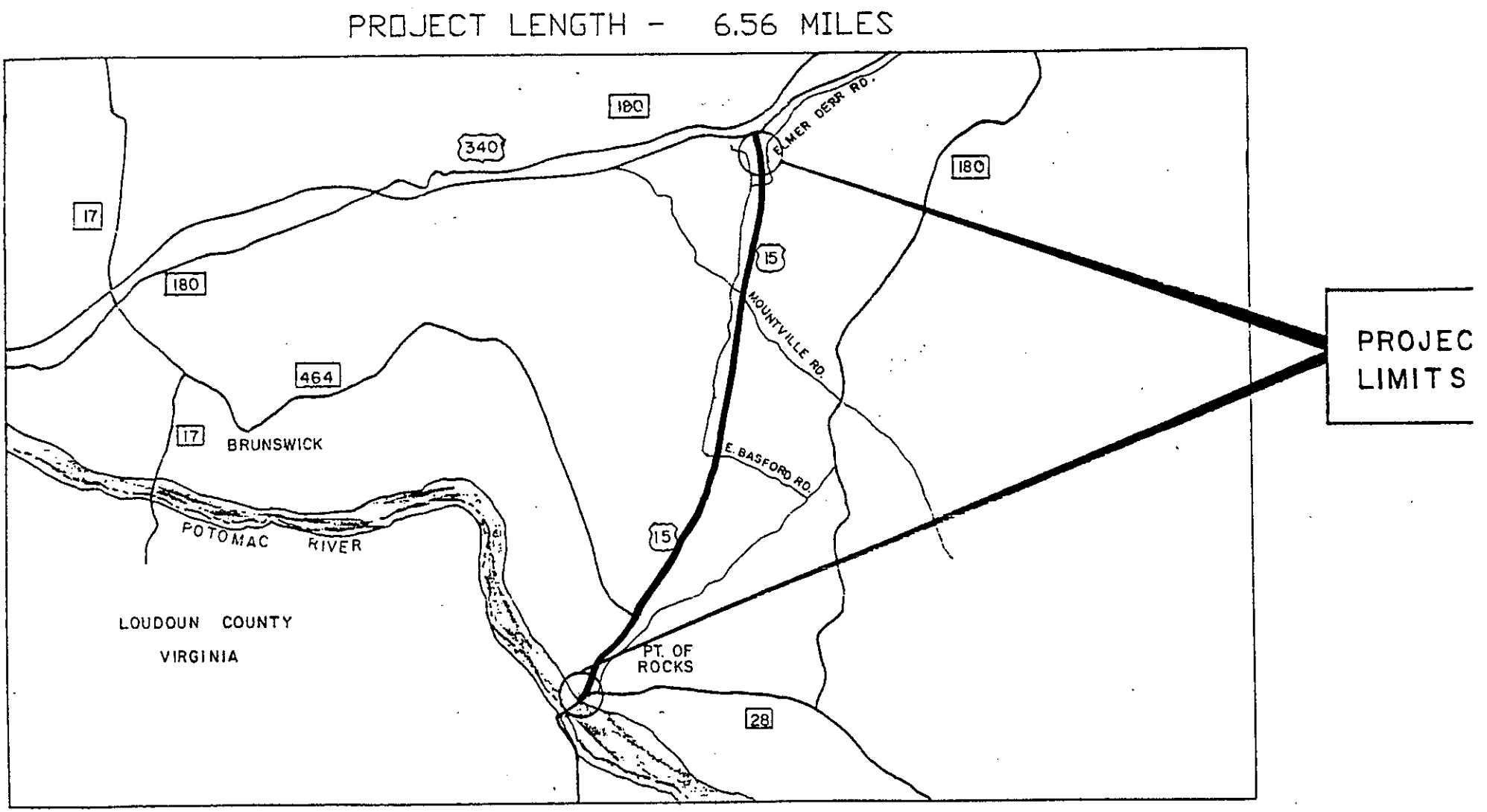
Supplemental Section 240511

Section 240511 was originally laid out between construction stations 253+00 to 258+00, but the calculated quantity of the SMA Vestoplast mix ran out at 256+00. The section was subsequently relocated from station 250+00 to 255+00. However prior data on this section is only available from station 253+00 to 255+00.

Initial Performance

An inspection of the SPS-5 after four months of traffic showed some flushing and rutting in the wheel paths in all of the 30/70 recycled asphalt mixes as described in Table 17. Some tightening of the surface was indicated in the virgin mix in 240505. There is no change in the SMA mixes.

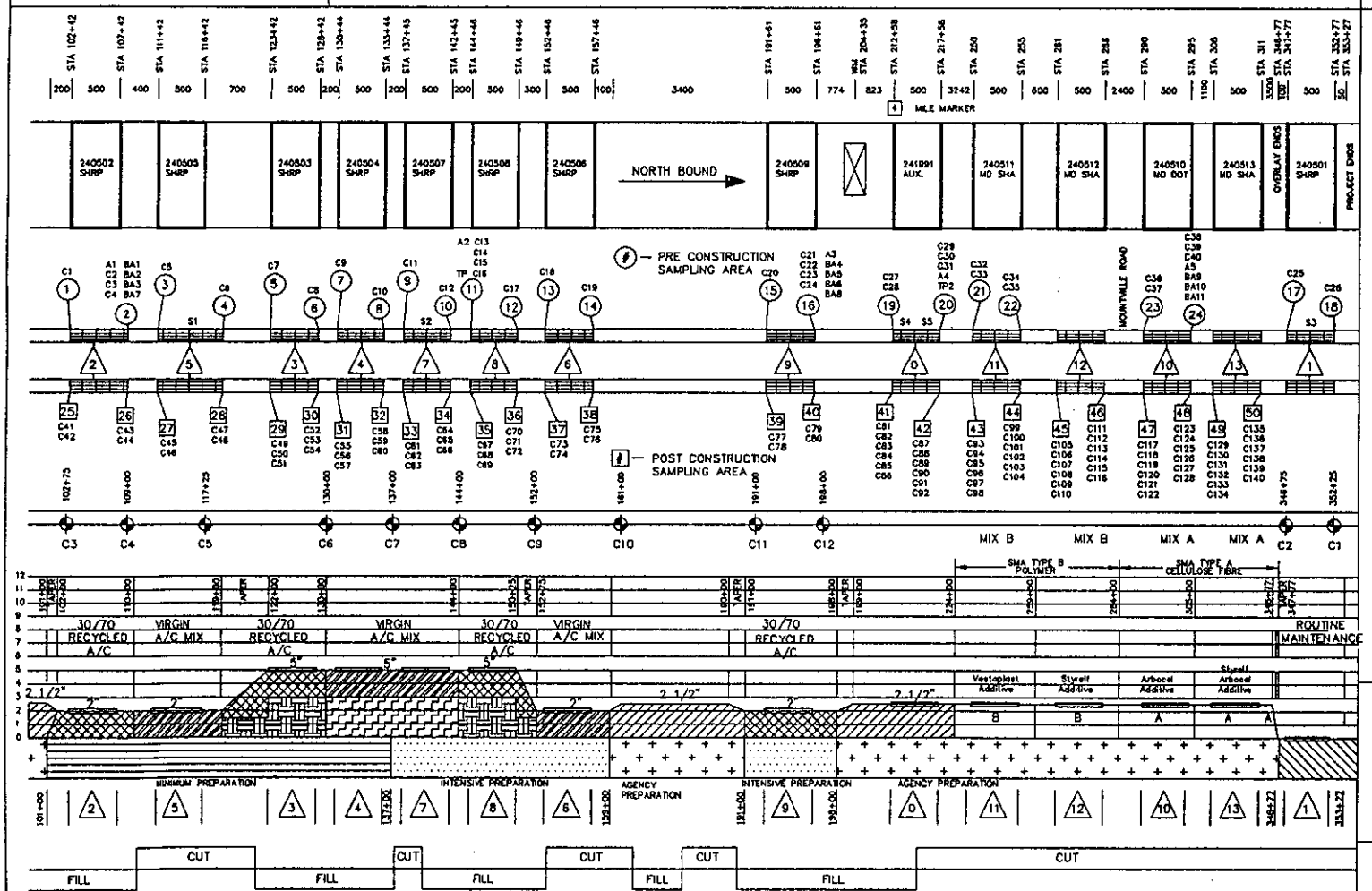
FIGURE 1: MD SHA SPS–5 Project: Contract F 211–501–777
US RTE. 15 From Potomac River to US RTE. 340



SCALE 1: 100,000 LOCATION MAP FREDERICK COUNTY

FIGURE 2 – MD SHA SPS-5 AND SMA PROJECT

TEST SECTION LAYOUT, MATERIALS SAMPLING LOCATIONS REHABILITATION STRATEGIES



PAVEMENT MANAGEMENT SYSTEMS LIMITED

- VERIFICATION CORE (WHEEL PATH)
- SIGN OF TYPE NOTED (REF. MARK)

PRE-OVERLAY

- MIN. SURFACE PREPARATION (EXISTING A/C)
- INTENSIVE SURFACE PREPARATION (EXISTING A/C)
- AGENCY PREPARATION (EXISTING A/C)
- NO PREPARATION

REHAB TREATMENTS

- MIX A = 30/70 RECYCLED A/C SURFACE COURSE
- MIX B = 30/70 RECYCLED A/C BASE COURSE (1 1/2" LIFTS)
- MIX C = VIRGIN A/C MIX SURFACE COURSE
- MIX D = VIRGIN A/C MIX BASE COURSE (1 1/2" LIFTS)
- AGENCY OVERLAY [A] [B]
- TEST SECTION DESIGN CODE

U.S. 15 SOUTH OF U.S. 340
NORTH BOUND (SOUTH FREDERICK)

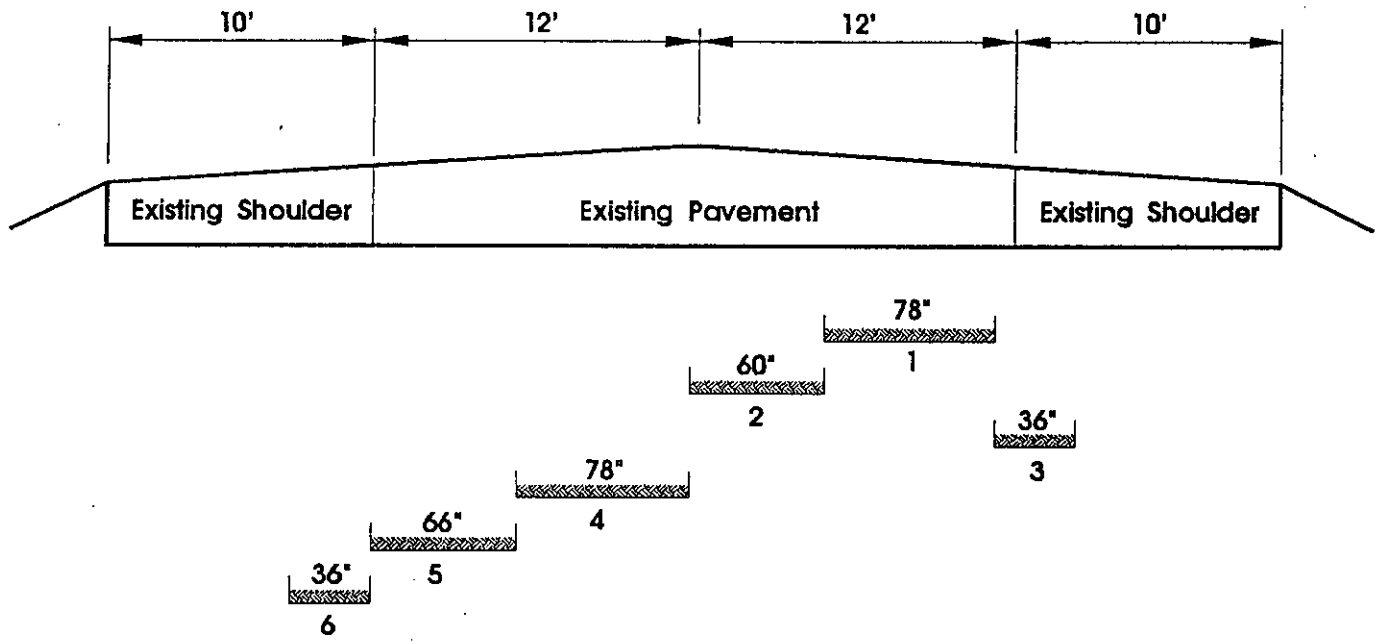
PLOT DATE: MAR/09/93

SPS-5-01

SHRP SPS-5 TEST SECTIONS ONLY. DRAWING NOT INTENDED TO BE USED FOR CONSTRUCTION PURPOSES

STRATEGIC HIGHWAY RESEARCH PROGRAM NORTH ATLANTIC REGION

MILLING SEQUENCE - SHRP SECTIONS 7,8 and 6



NOTE: For section 09, Milling started at the outside edge of pavement.

FIGURE 3

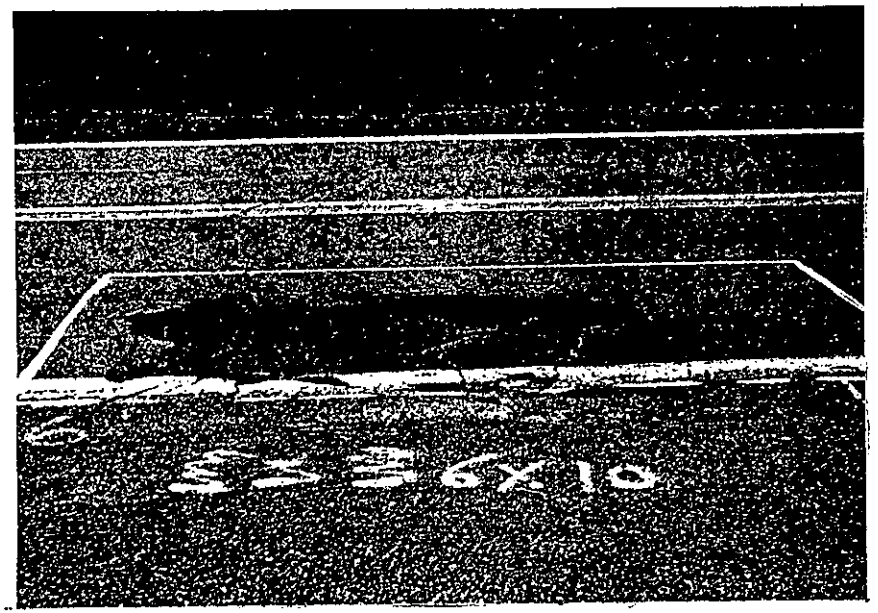


Photo 1 Illustrating Alligator Cracking in Outer Wheel Path at Transverse Shrinkage Crack

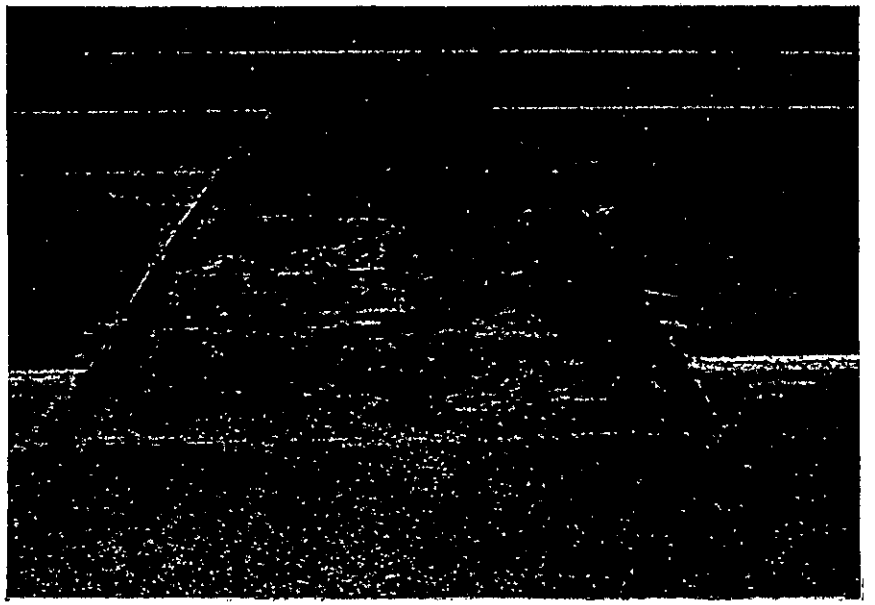


Photo 2 Illustrating Softening of Cement Treated Base Underneath Alligatored Area

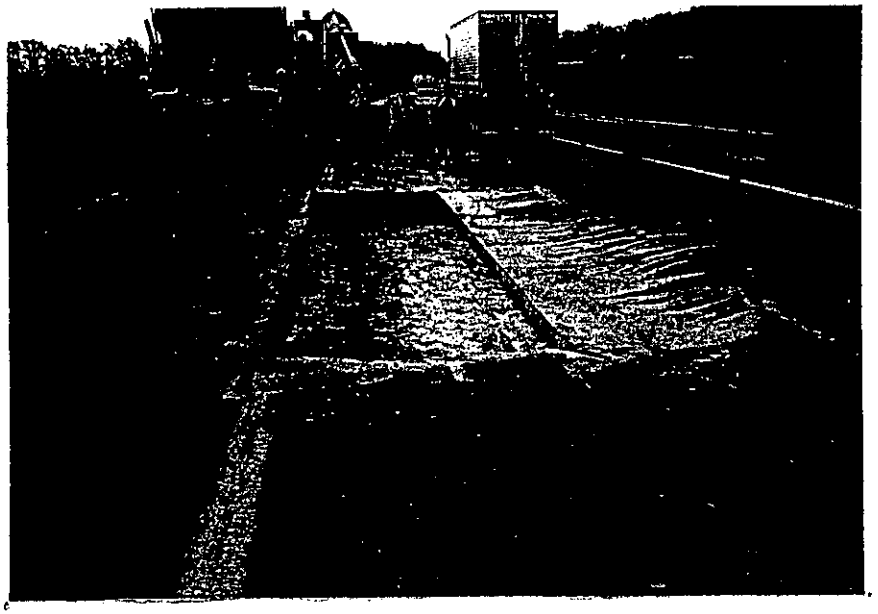


Photo 3 Illustrating Longitudinal Wheel Track Fatigue Cracks Extend Into Cement Treated Base

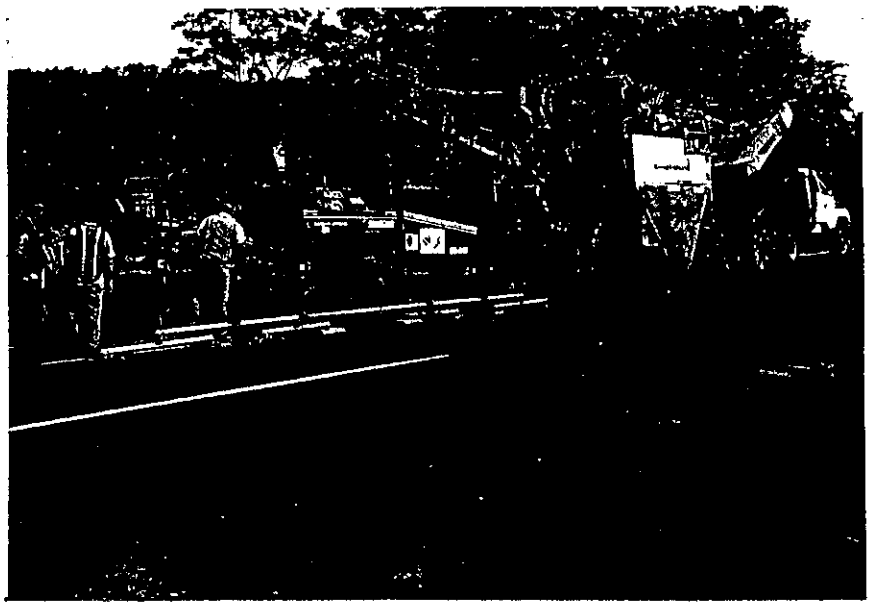


Photo 4 The Paving Train With A Materials Transfer Vehicle (MTV)

TABLE 1

Maryland SPS–5, and SMA Test Section Layout
US15 NBL, Frederick

CONSTRUCTION STATION	SHRP ID	SURFACE PREPARATION	OVERLAY THICKNESS	OVERLAY MATERIAL
SPS–5				
102+42 to 107+42	240502	Minimum (6 patches)	2 inches	30/70 Recycled AC, Mix A – SCR
111+42 to 116+42	240505	Minimum (5 patches)	2 inches	Virgin AC, Mix C – SCV
123+42 to 128+42	240503	Minimum	2 inches 3 inches	30/70 Recycled AC, Mix A – SCR 30/70 Recycled AC, Mix B – BFR
130+44 to 135+44	240504	Minimum (3 patches)	2 inches 3 inches	Virgin AC, Mix C – SCV Virgin AC, Mix D – BFV
137+45 to 142+45	240507	Intensive (milling)	2 inches 3 inches	Virgin AC, Mix C – SCV Virgin AC, Mix D – BFV
144+46 to 149+46	240508	Intensive (milling)	2 inches 3 inches	30/70 Recycled AC, Mix A – SCR 30/70 Recycled AC, Mix B – BFR
152+46 to 157+46	240506	Intensive (milling)	2 inches	Virgin AC, Mix C – SCR
191+61 to 196+61	240509	Intensive (milling)	2 inches	30/70 Recycled AC, Mix A
Supplemental				
212+58 to 217+58	241991	Agency preparation	2 inches	Agency Mix Design
250+00 to 255+00	240511	Agency preparation	2–1/2 inches	Stone Matrix Asphalt, B (Vestoplast)
261+00 to 266+00	240512	(2 patches)	2–1/2 inches	Stone Matrix Asphalt, B (Styrelf)
290+00 to 295+00	240510	Agency preparation	2–1/2" inches	Stone Matrix Asphalt, A (Arbocel)
306+00 to 311+00	240513	Agency preparation	2–1/2 inches	Stone Matrix Asphalt, A (Styrelf and Arbocel)
Control				
347+77 to 352+77	240501	None	No	None

TABLE 2
SPS–5 LAYOUT, US 15 NBL, FREDERICK, MD

March 01, 1993

STA.	SHRP ID NO.	SECT. LENG.	PAVEMENT PREP.	O/L THICKN.	OVERLAY MATERIAL	* SAMP. AREA	PRE–CONST. SAMPLES	POST–CONST. SAMPLES
101+00				Begin Taper 2–1/2"	30/70 Recycled AC Mix A (SCR)			
102+00			Begin Minimum	End		1/25	C1	C41, C42
102+42	240502	500	Prep.	2"	30/70 Recycled AC Mix A (SCR)			
107+42								
110+00					30/70 Recycled Ends. Begins Virgin AC Mix C (SCV)	2/26	C2, C3, C4, A1, BA1–3	C43, C44
						3/27	C5	C45, C46
111+42	240505	500	Minimum	2"	Virgin AC Mix C (SCV)		S1	
116+42								
119+00				Begins Taper 2"–5"	Virgin AC Mix (SCV) Ends. Begins 30/70 Recycled AC Mix B+Mix A	4/28	C6	C47, C48
122+00				Ends	Begins 1–1/2" Mix B binder (BFR)			
					1–1/2" Mix B binder (BFR)	5/29	C7	C49, 50, 51
123+42	240503	500	Minimum	5"	2" Mix A Surf. (SCR)			
128+42								
130+00					Recycled Ends. Begins Virgin 1–1/2" Mix D binder (BFV) 1–1/2" Mix D binder (BFV)	6/30	C8	C52, 53, 54
					2" Mix C surf. (SCV)	7/31	C9	C55, 56, 57
130+44	240504	500	Minimum	5"	Virgin Mixes			
135+44								
137+00			Minimum End. Begins Intensive Prep.			8/32	C10	C58, 59, 60

* Sample area – Pre/Post Construction (see Figure 2)

TABLE 2 (cont.)
SPS–5 LAYOUT, US 15 NBL, FREDERICK, MD

March 01, 1993

STA.	SHRP ID NO.	SECT. LENG.	PAVEMENT PREP.	O/L THICKN.	OVERLAY MATERIAL	* SAMP. AREA	PRE–CONST. SAMPLES	POST–CONST. SAMPLES
137+00			Begin Intensive Prep.		Replace milled depth with Mix D BFV	9/33	C11	C61, 62, 63
137+45 142+45	240507	500	Intensive	5"	Virgin AC 1–1/2" Mix D binder (BFV) 1–1/2" Mix D binder (BFV) 2" Mix C surf. (SCV)	S2		
144+00			Replace Milled With recycled Mix B (BFR)	5"	Virgin Ends Begins Recycled 1–1/2" Mix B binder (BFR) 1–1/2" Mix B binder (BFR) 2" Mix A surface (SCR)	10/34 11/35	C12 C13,14,15,16 A2, TP1	C64, 65, 66 C67,68,69
144+46 149+46	240508	500	Intensive	5"	Recycled Mixes			
150+25 152+75			Replace Milled with	Begin 5"–2" Taper End 2"	Recycled Mixes Ends. Begins Virgin Mix C (SCV)	12/36 13/37	C18	C70,71,72 C73,74
152+46 157+46	240506	500	Virgin D (BFV) Intensive	2"	Virgin Mix C (SCV)			
159+00 160+00			Intensive Ends Begins Agency Prep.	Begin Taper 2"–2–1/2" End	Virgin Mix C (SCV) Virgin Mix C (SCV) Begin Agency Mix	14/38	C19	C75,76
				2–1/2"	Agency Mix			
190+00 191+00			Agency Prep Ends. Begin Intensive	Begin Taper 2–1/2"–2" End	Agency Mix Ends. Begin Recycled Mix A (SCR)			

TABLE 2 (cont.)
SPS–5 LAYOUT, US 15 NBL, FREDERICK, MD

March 01, 1993

STA.	SHRP ID NO.	SECT. LENG.	PAVEMENT PREP.	O/L THICKN.	OVERLAY MATERIAL	* SAMP. AREA	PRE–CONST. SAMPLES	POST–CONST. SAMPLES
191+00			Begin Intensive Replace Milled With Recycled B (BFR)	2"	Recycled 2" Mix A surface (SCR)	15/39	C20	C77,78
191+61 196+61	240509	500	Intensive	2"	Mix A surface (SCR)			
198+00			Intensive Ends Begins Agency Prep.	Begin Taper 2"–2 1/2"		16/40	C21,22,23,24 A3,BA4, BA5,BA6	C79,80
199+00				End	Mix A Surface Ends. (SCR) Begin Agency Mix (SCV)			
				2 1/2"	Agency Mix (SCV)	19/41	C27,28	C81,82,83 84,85,86
212+58 217+58	241991	500	Agency Prep.	2 1/2"	Agency Mix (SCV)	S4, 5		
224+00			Agency Prep.	2 1/2"	Begin SMA Vestoplast	20/42	C29,30,31 A4,TP2	C87,88,89 90,91,92
251+00						21/43	C32,33	C93,94,95 96,97,98
250+00 255+00	240511	500	Agency Prep.	2 1/2"	1" SMA levelling 1–1/2" SMA Vestoplast	S6		
258+00			Agency Prep.	2 1/2"	SMA Vestoplast Ends. Begins SMA Styrelf	22/44 –/45	C34,35 – –	C99,100,101 102,103,104 C105,106,107 108,109,110
261+00 266+00	240512	500	Agency Prep.	2 1/2"	1" SMA levelling 1 1/2" SMA Styrelf			
284+00			Agency Prep.	2 1/2"	SMA Styrelf Ends, Begins SMA Arbocel	–/46 23/47	– – C36, 37	C111, 112, 113 114, 115, 116 C117, 118, 119 120, 121, 122

TABLE 2 (cont.)
SPS-5 LAYOUT, US 15 NBL, FREDERICK, MD

STA.	SHRP ID NO.	SECT. LENG.	PAVEMENT PREP.	O/L THICKN.	OVERLAY MATERIAL	* SAMP. AREA	PRE-CONST. SAMPLES	POST-CONST. SAMPLES
290+00 295+00	240510	500	Agency Prep.	2-1/2"	1" SMA levelling 1-1/2" SMA Arbocel	S	7	
						24/48	C38,39,40 A5,BA9,10,11	C123,124,125 126,127,128
305+00			Agency Prep.	2 1/2"	SMA Arbocel Ends. Begins SMA Styrelf/Arbocel			
						-/49		C129,130,131 132,133,134
306+00 311+00	240513	500'	Agency Prep.	2 1/2"	1" SMA levelling 1 1/2" SMA Styrelf/Arbocel			
						-/50		C135,136,137 138,139,140
346+77					Overlay Ends	17	C25	No
347+77 352+77	240501	500'	No		No		S3	
353+27					Project Ends	18	C26	No

TABLE 3
Summary of Materials Samples Retrieved
MD SHA SPS–5 and SMA, US 15 Frederick, MD

Material and Sample Description (N&CL – Brooklandville, MD)	Number of Samples	Sample Locations
ASPHALT CONCRETE		
Pre–Construction		
4" O.D. cores	40	C1–C40
12" O.D. cores	11	BA1–BA11
12"x12" blocks	2	TP1–TP2
Field Stripping Ratings		
6" O.D. cores	4	A2(0), A3(0), A4(1), A5(1)
During Construction		
(100 lbs. uncompacted)		
Bulk Sampling	8	At Plant – SCV, SCR, BFV, BFR
* Sent to WRL – Hancock, MD		* SMA – Vestoplast * SMA – Styrelf * SMA – Arbocel * SMA – Arbocel/Styrelf
Post Construction		
4" O.D. cores	100	C41–C140
CEMENT TREATED BASE		
Pre–Construction		
4" O.D. cores	40	C1–C40
12" O.D. cores	11	BA1–BA11
UNBOUND GRANULAR BASE		
Bulk Samples	6	TP1, TP2, BA1–BA11
STABILIZED SUBGRADE		
Bulk Samples	6	TP1, TP2, BA1–BA11
SUBGRADE		
Bulk Samples	6	TP1, TP2, BA1–BA11
Thin–wall tubes	5	A1(2), A2(2), A5(1)
Splitspoon samples	5	A3(2), A5(1), BA4(2)
SHOULDER AUGER PROBES		
(Depth to Rigid Layer)	4	A1(6.5'), S2–S6(>20'), S7(16.5')
ASPHALT CEMENT		
AC–20, AC–5, Styrelf	3	At Plant

March 02, 1993

TABLE 4

MD. SPS–5 Laboratory Testing Plans (Pre–Construction)

March 02, 1993

Material Type and Properties	SHRP Test Designation	SHRP Protocol	# of Tests per Layer	Materials Source/ Sample Type Designation
Pre–Construction				
I. ASPHALT CONCRETE				
A. ASPHALTIC CONCRETE:				
Core Examination/Thickness	AC01	P01	26	All C type cores
Bulk Specific Gravity	AC02	P02	9	[C3 C4 C5] [C13 C14 C15] [C22 C23 C24] (see note 3)
Maximum Specific Gravity	AC03	P03	3	[BA1–3] [TP] [BA4–6]
Asphalt Content (Extraction)	AC04	P04	3	[BA1–3] [TP] [BA4–6]
Creep Compliance	AC06	P06	3	C2 C9 C20 (see note 1)
Resilient Modulus	AC07	P07	6	[C3–C4] [C14 C15] [C23 C24]
Tensile Strength	AC07	P07	6	[C3 C4 C5] [C13 C14 C15] [C22 C23 C24]
Field Moisture Damage	AC08	P08	3	A1 A2 A3
B. EXTRACTED AGGREGATE:				
Type and Classification:				
Coarse Aggregate	AG03	P13	3	[BA1–3] [TP] [BA4–6]
Fine Aggregate	AG03	P13	3	[BA1–3] [TP] [BA4–6]
Gradation and Aggregate	AG04	P14	3	[BA1–3] [TP] [BA4–6]
NAA Test for Fine Aggregate Particle Shape	AG05	P14A (note 2)	3	[BA1–3] [TP] [BA4–6]
C. ASPHALT CEMENT:				
Abson Recovery	AE01	P21	3	[BA1–3] [TP] [BA4–6]
Penetration at 77 and 115F	AE02	P22	3	[BA1–3] [TP] [BA4–6]
Specific Gravity (60F)	AE03	P23	3	[BA1–3] [TP] [BA4–6]
Viscosity at 77F	AE04	P24	3	[BA1–3] [TP] [BA4–6]
Viscosity at 140F, 275F	AE05	P25	3	[BA1–3] [TP] [BA4–6]

NOTES:

1. Creep compliance will be performed when suitable procedures are developed – cores will be stored
2. National Aggregate Association will perform tests at no cost to State
3. Cores within brackets are from the same Sampling Area

TABLE 4

MD. SPS-5 Laboratory Testing Plans (Pre-Construction) cont.

March 02, 1993

Material Type and Properties	SHRP Test Designation	SHRP Protocol	# of Tests per Layer	Materials Source/ Sample Type Designation
II. BOUND (TREATED) BASE AND SUBBASE				
Type and Classification of Material and Treatment	TB01	P31	6	C1, C4, C11, C15, C20, C24
Pozzolanic/Cementitious: Compressive Strength	TB02	P32	6	C1, C4, C11, C15, C20, C24
Asphalt treated: Dynamic Modulus (77F)	TB03	P33		
HMAC: Resilient Modulus	AC07	P07		
III. UNBOUND GRANULAR BASE AND SUBBASE				
Particle Size Analysis	UG01	P41	3	[BA1-3] [TP] [BA4-6]
Sieve Analysis	UG02	P41	3	[BA1-3] [TP] [BA4-6]
Atterberg Limits	UG04	P43	3	[BA1-3] [TP] [BA4-6]
Moisture-Density Relations	UG05	P44	3	[BA1-3] [TP] [BA4-6]
Resilient Modulus	UG07	P46	3	[BA1-3] [TP] [BA4-6]
Classification	UG08	P47	3	[BA1-3] [TP] [BA4-6]
Permeability	UG09	P48	3	[BA1-3] [TP] [BA4-6]
Natural Moisture Content	UG10	P49	3	[BA1-3] [TP] [BA4-6]
IV. SUBGRADE				
Sieve Analysis	SS01	P51	3	[BA1-3] [TP] [BA4-6]
Hydrometer to 0.001mm	SS02	P42	3	[BA1-3] [TP] [BA4-6]
Atterberg Limits	SS03	P43	3	[BA1-3] [TP] [BA4-6]
Classification	SS04	P52	3	[BA1-3] [TP] [BA4-6] A1 A2 A3
Moisture-Density Relations	SS05	P55	3	[BA1-3] [TP] [BA4-6]
Resilient Modulus	SS07	P46	3	[BA1-3] [TP] [BA4-6]
Unit Weight	SS08		3	[BA1-3] [TP] [BA4-6] A1 A2 A3
Natural Moisture Content	SS09	P49	3	S1 S2 S3
Depth to Rigid Layer				

TABLE 5

MD. SPS–5 Laboratory Testing Plans (Post–Construction)
Includes Tests for Auxilliary and Supplementary Sections

Revised March 02, 1993

Material Type and Properties	SHRP Test Designation	SHRP Protocol	# of Tests per Layer	Materials Source/ Sample Type Designation
A. ASPHALTIC CONCRETE:				
Core Examination/Thickness	AC01	P01	76	All cores
Bulk Specific Gravity	AC02	P02	76	All cores
Maximum Specific Gravity	AC03	P03	12	BV1, BV2, BV3, BR1, BR2, BR3, BMD(1+2), BSMAA(1+2), BSMAB(1+2)
Asphalt Content (Extraction)	AC04	P04	12	BV1, BV2, BV3, BR1, BR2, BR3, BMD(1+2), BSMAA(1+2), BSMAB(1+2)
Moisture Susceptibility	AC05	P05	12	BV1, BV2, BV3, BR1, BR2, BR3, BMD(1+2), BSMAA(1+2), BSMAB(1+2)
Creep Compliance	AC06	P06	5	[C61–63] [C70–72] [C81–83] [C93–95] [C105–107]
Resilient Modulus	AC07	P07	28	[C50–C51] [C53–C54] [C56–C57] [C59–C60][C85–C86][C88–C89] [C97–C98] [C100–C101] [C109–C110] [C112–C113][C121–C122][C124–C125] [C133–C134] [C136–C137]
Tensile Strength	AC07	P07	28	[C49–C51] [C52–C54] [C55–C57] [C58–C60] [C84–C86] [C87–C89] [C96–C98][C99–C101][C108–C110][C111–C113][C120–C122][C123–C125] [C132–C134][C135–C137]
B. EXTRACTED AGGREGATE:				
Bulk Specific Gravity:				
Coarse Aggregate	AG01	P11	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Fine Agregate	AG02	P12	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Type and Classification:				
Coarse Aggregate	AG03	P13	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Fine Aggregate	AG03	P13	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Gradation of Aggregate	AG04	P14	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
NAA Test for Fine Aggregate Particle Shape	AG05	P14A (note 2)	12	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
C. ASPHALT CEMENT:				
Abson Recovery	AE01	P21	5	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Penetration at 77 and 115F	AE02	P22	5	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Specific Gravity (60F)	AE03	P23	5	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Viscosity at 77F	AE04	P24	5	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)
Viscosity at 140F, 275F	AE05	P25	5	BV1,BV2,BV3,BR1,BR2,BR3,BMD(1+2),BSMAA(1+2),BSMAB(1+2)

NOTES:

1. Creep compliance will be performed when suitable procedures are developed – cores will be stored
2. National Aggregate Association will perform tests at no cost to State
3. BV, BR – Bulk samples of Virgin and Recycled Mixes taken during construction
4. BMD – Bulk Sample during contruction of standard Maryland Overlay Mix (2 samples)
5. BSMAA, BSMAB, BSMAC, BSMAD – Bulk samples during construction of 4 SMA (2 samples each)

TABLE 6
Materials Library Sampling

SHRP Region:	N.A.	State:	Maryland	State Code	24
				SPS Project	05
Highway:	15	Location:	Frederick	Test Section No. or as per remarks	00
Lane:	NBL				

Uncompacted SPS–5 and SMA Bituminous Paving Mixtures

Mix	Material	Sample Location	Sample Size	Date Sampled	Mix Design Numbers and or remarks
SCR – Mix A	HMAC	Truck	3–5 gal pails	06/01/92	240500. N92143SCROIT App'd Design No. – 220405 State SCR – W92143SCROIT
BFR – Mix B	HMAC	Truck	3–5 gal pails	05/06/92	240500. N92143BFROIT App'd Design No. 220248 State BFR – W92143BFROIT
SCV – Mix C	HMAC	Truck	3–5 gal pails	06/01/92	240500. N92143SCVOIT App'd Design No. 220338 State SCV – W92143SCVOIT
BFV – Mix D	HMAC	Truck	3–5 gal pails	05/06/92	240500. N92143BFVOIT App'd Design No. – 220241 State BFV – W92143BFVOIT
SCV – Agency	HMAC	Truck	3–5 gal pails	05/12/92	241991. Same gradation as SCV – Mix C.
SFV – Agency					W92143SFVOIT Wedge and/or levelling course. No samples of aggregate or HMAC were taken. SF gradation can be made from SCV aggregate samples
SMA Vestoplast	HMAC	Truck	3–5 gal pails	05/13/92	240511. W92143SMA01T
SMA Styrelf	HMAC	Truck	4–5 gal pails	05/13/92	240512. W92143SMA03T
SMA Arbocel	HMAC	Truck	3–5 gal pails	05/13/92	240510. W92143SMA02T
SMA Styrelf–Arbocel	HMAC	Truck	4–5 gal Pails	05/13/92	240513. W92143SMA04T

TABLE 6
Materials Library Sampling (cont.)

SHRP Region:	N.A.	State:	Maryland	State Code	24
				SPS Project	05
Highway:	15	Location:	Frederick	Test Section No. or as per remarks	00
Lane:	NBL				

Combined Coarse and Fine Aggregates

Mix	Material	Sample Location	Sample Size	Date Sampled	Mix Design Numbers and or remarks
SCR–Mix A	CO & fine Aggregate	Conveyor by Pass chute	2–55 gal drums	06/01/92	SC RAP only, 240500
BFR – Mix B	CO & fine Aggregate	Belt	3–5 gal pails	05/06/92	
SCV – Mix C	CO & fine Aggregate	Conveyor by Pass chute	2–55 gal drums	06/01/91	240500
BFV – Mix D	CO & fine Aggregate	Belt	3–5 gal pails	05/06/92	240500
SMA	CO & fine Aggregate	Conveyor by Pass chute	2–55 gal drums	05/13/92	240500. Type A & B binder and surface courses have same gradation. This aggregate used in all SMA mixes

AC and Additives

SMA Vestolpast	Vestoplast	Plant Bag	1–5 gal pail	May 1992	240511
SMA Arbocel	Arbocel	Plant Bag	1–5 gal pail	May 1992	240500
SPS–5 Several	Aglime	Plant	1–5 gal pail	May 1992	240500
Several	AC 20	Storage tank	11–5 gal pails	May 1992	240500, Chevron
Several	AC 5	Storage tank	11–5 gal pails	May 1992	240500
SMA Two	Styrelf Mod AC	Storage tank	11–5 gal pails	May 1992	240500, ELF (240512, 240513)

TABLE 7
MD SPS–5, SHRP Treatment Dates – US15 NBL

Section	Material	Type Treat.	When Patch Compl'd.	Milled	Replace Layer	First Binder	Second Binder	Surface Course
240502	2" R	Minimum	04/10/92					06/01/92
240505	2" V	Minimum	04/10/92					06/01/92
240503	5" R	Minimum	None			05/07/92	05/11/92	06/01/92
240504	5" V	Minimum	04/14/92			05/07/92	05/07/92	06/01/92
240507	5" V	Intensive	04/14/92	04/01/92	05/06/92	05/07/92	05/11/92	06/01/92
240508	5" R	Intensive	04/14/92	04/01/92	05/06/92	05/07/92	05/11/92	06/01/92
240506	2" V	Intensive	04/14/92	04/01/92	05/06/92			06/01/92
240509	2" R	Intensive	04/22/92	04/02/92	05/06/92			06/03/92
241991	2–1/2" V	Minimum	None			W/L 05/04/92		05/12/92
240501	Maint.	Normal	05/07/92					
				SMA Sections				
245011	Vestoplast	Minimum	04/24/92			05/13/92		06/09/92
240512	Styrelf	Minimum	04/24/92			05/13/92		06/09/92
240510	Arbocel	Minimum	None			05/13/92		06/10/92
240513	Arbocel+ Styrelf	Minimum	None			05/13/92		06/10/92

Weather Notes on Paving Dates

05/04/92 – Cloudy, bright with some sunshine
05/06/92 – Cloudy, cool
05/07/92 – Cloudy, cool, 40°– 47°F
05/11/92 – Sunny, warm
05/12/92 – Sunny, warm, 70°F
0/5/13/92 – Sunny, warm, 75°F
06/01/92 – Cloudy, warm
06/09/92 – Cloudy, warm, humid
06/10/92 – Sunny, pleasantly warm

TABLE 8
Aggregate Blends for SPS–5 and SMA Mixes

	SCV	SCR	BFV	BFR	SMA
Genstar Frederick #57			35%	35%	
Genstar Frederick #7	30%	35%	25%	10%	
Genstar Frederick #8	25%				
Genstar Frederick #10	35%		30%		
Genstar Frederick, Wash #10		35%	10%	25%	
Davidson Concrete Sand	10%				
Frederick RAP – Stock #1–92		30%		30%	
VA Trap Rock #68					43%
VA Trap Rock #8					35%
Frederick Birdeye					11%
Texas Aglime					11%
Asphalt Content (Total)	5.1%	5.0%	4.6%	4.4%	6.5%

February 19, 1993

TABLE 9
SPS–5 Mix Designs and Plant Reports
Recycled and Virgin Binder Courses
(Total Percent Passing Each Sieve)

SIEVE SIZE	MIX TYPE – BFR MIX LAB No. N92143BFROIT						MIX TYPE – BFV MIX LAB No. N92143BFVOIT W92143BFVOIT					
		JOB MIX TOLERANCE		PLANT REPORT				JOB MIX TOLERANCE		PLANT REPORT		
	JMF			28	29	32	JMF			27	30	33
1	100	100		100	100	100	100	100		100	100	100
3/4	96	89	100	93	95	94	96	89	100	97	97	96
1/2	76	69	83	73	71	73	75	68	82	78	76	75
3/8	64	57	71	60	59	61	60	53	67	58	62	63
#4	46	39	53	43	44	42	42	35	49	39	43	44
#8	30	26	33	29	29	29	25	21	29	23	25	26
#16	19	15	23	20	20	20	15	11	19	15	17	14
#30	13	9	17	14	14	15	10	6	14	10	12	12
#50	8	4	12	9	9	10	7	3	11	7	9	8
#100	5	1	9	6	6	7	5	1	9	6	6	6
#200	4.5	2.5	6.5	5.3	5.0	4.8	4.2	2.2	6.2	4.7	4.5	4.5
% AC in RAP	1.43											
% AC	2.97											
Total AC	4.4	4.0	4.8	4.12	4.59	4.52	4.7	4.3	5.1	4.37	4.63	4.89
Type AC	AC5						AC20					
AC Source	ELF			Chevron	Chevron	Chevron	Chevron					
MARSHALL Design												
Max SP.GR	2.545						2.539					
Apparent SP. GR	2.431						2.420					
Bulk SP. GR	2.378						2.382					
Optimum AC %	4.4						4.7					
% Air Voids	6.6						6.0					
using APP. SP. GR	4.5						4.6					
Stability, lbs.	1933						1990					
* Blows	50						50					
Flow	12						12					

TABLE 10
SPS–5 Mix Designs and Plant Reports
Recycled and Virgin Surface Courses
(Total Percent Passing Each Sieve)

SIEVE SIZE	MIX TYPE – SCR MIX LAB No. N92143SCROIT JMF	JOB MIX TOLERANCE	PLANT REPORT 49	MIX TYPE – SCV MIX LAB No. W92143SCVOIT N92143SCVOIT JMF	JOB MIX TOLERANCE	PLANT REPORT 35	36	50	51
1									
3/4	100	100	100	100	100	100	100	100	100
1/2	97	90–100	96	97	90 100	97	97	98	98
3/8	84	77–91	84	86	79 93	88	87	87	86
#4	57	50 64	55	50	43 57	51	50	48	49
#8	36	32 40	36	33	29 37	34	33	33	31
#16	23	19 27	23	23	19 27	22	22	25	22
#30	15	11 19	16	15	11 19	14	15	16	15
#50	9	5 13	10	8	4 12	9	9	8	9
#100	6	2 10	7	6	2 10	6	7	7	7
#200	4.9	2.9 6.9	5.9	5.1	3.1 7.1	5.4	5.3	5.5	4.9
% AC in RAP	1.43								
% AC	3.57								
Total AC	5.0	4.6 5.4	5.36			5.26	5.22	5.39	5.39
Type AC	AC5			AC20					
AC Source	ELF			Chevron					
MARSHALL Design									
Max SP.GR	2.519			2.504					
Apparent SP. GR	2.427			2.402					
Bulk SP. GR	2.393			2.374					
Optimum AC %	5.0			5.1					
% Air Voids	4.8			5.2					
using APP. SP. GR	3.7			4.0					
Stability, lbs.	2363			2150					
* Blows	75			75					
Flow	11			10					

TABLE 11
SMA Mix Designs and Plant Reports (WRL)
(Total Percent Passing Each Sieve)

SIEVE SIZE	MIX SMA W/VESTOPLAST							MIX SMA W/STYRELF	
	JMF	BAND		PLANT REPORT NBL (EXT) W/L	PLANT REPORT NBL (EXT) MAY 13	PLANT REPORT NBL (BELT) SC	PLANT REPORT NBL (BELT) JUNE 09	JMF	PLANT REPORT (BELT) SC JUNE 09
3/4	100	100		100	100	100	100	100	100
1/2	84	82	88	89	88	85	85	84	86
3/8	68			71	69	66	68	68	68
#4	28	28	32	30	30	31	33	28	31
#8	15	20	24	18	18	16	18	15	17
#16	12.6			15	15	14	15	12.6	14
#30	2.3			14	14	13	14	12.3	13
#50	12.0			13	14	13	13	12.0	12
#100	11.1			12	13	12	11	11.1	11
#200	9.2	9	11	9.2	10.1	9.2	7.7	9.2	7.8
AC%	6			5.96	5.88	5.78	6.45	6.0	6.41
Additive	7% AC								
Anti–Strip	0.2							0.2	
AC Type	AC20								
AC Source									
MARSHALL Design									
Max SG	2.636			2.557		2.570	2.566	2.634	2.556
BLK SG	2.55							2.538	
Optimum ASphalt	6.0			6.0		6.0	6.0	6.0	
% Air Voids	4.6			3.0		2.5	2.40	3.6	2.90
VMA				17.7		17.5	17.4		17.8
Stability, lbs.	1524			1599		1700	1775	1866	1906
# Blows	50			50		50	50	50	50
Flow	11			11.2		10.2	10.8	12.5	10.8

Note:
1. Ext. – Sampled at Truck
2. Belt – Sampled at Belt

WRL – Western Regional Laboratory

TABLE 11 (cont.)
SMA Mix Designs and Plant Reports (WRL)
(Total Percent Passing Each Sieve)

SIEVE SIZE	MIX SMA ARBOCEL					MIX SMA ARBOCEL W/STYRELF			
		PLANT REPORT NBL		PLANT REPORT SBL			PLANT REPORT NBL		
	JMF	W/L	MAY 13 (BELT)	SC (BELT) JUNE 08	SC (EXT) JUNE 08	JMF	WL MAY 13 (BELT)	NBL (EXT)	NO SC REPORT
3/4	100	100	100	100	100	100	100	100	
1/2	84	88	88	89	88	84	89	92	
3/8	68	71	71	72	73	68	68	75	
#4	28	30	30	31	32	28	28	33	
#8	15	16	16	14	19	15	17	20	
#16	12.6	14	14	12	16	12.6	15	17	
#30	12.3	14	14	11	15	12.3	15	16	
#50	12.0	13	13	11	14	12.0	14	15	
#100	11.1	12	12	10	13	11.1	14	14	
#200	9.2	9.7	9.7	7.8	10.3	9.2	10.4	10.4	
AC%	6.5	6.41	6.25	6.75	6.14	6.5	6.25	6.45	
Additive	7.8% of 6.5%								
Anti–Strip	0.2								
AC Type									
AC Source									
MARSHALL Design									
Max SG	2.618	2.547	2.532	2.578	2.563	2.611	2.532		
BLK SG	2.500					2.503			
Optimum ASphalt	6.5					6.5			
% Air Voids	4.37	2.4	2.10	2.70	1.5	4.1	2.10		
VMA		18.4	17.7	18.5	17.2		17.7		
Stability, lbs.	1357	1374	1523	1831	1744.0	1896	1523		
# Blows	50	50	50	50	50	50	50		
Flow	12.3	13.5	13.5	14.0	14.0	10	13.5		

TABLE 12
SPS–5 and SMA Asphalt Cement Properties

	SHRP/SHA VIRGIN	SHRP RECYCLED	SMA VESTOPLAST AND ARBOCEL	STYRELF SMA
1. Asphalt Grade	AC20	AC5	AC20	AC20
2. Asphalt Source	Chevron	ELF	Chevron (Perth Amboy, NJ)	Pennsauken, NJ
3. Viscosity of Asphalt at 140 °F (Poises)	2138	668	2138	70851.
4. Viscosity of Asphalt at 275 °F (Centistokes)	427.00	254.91	427.00	1671
5. Penetration at 77 °F	77.	180.	77.0	58
6. Penetration at 39.2 °F	14.	18.	14.	30
7. Ring and Ball Softening Point	119.5	108	119.5	155

TABLE 13
Construction Data Summary
AC Replacement and Binder Courses

Section	Date	Paving Time		Mix Temp.		Air	QC Measurements		Nearby	Prof	Remarks
		Start	Finish	At Plant °F	Laydown °F	Temp. °F	Nuclear Density	% Comp.	Cores (% comp.)	Index	
MLIING REPLACEMENT											
240507	05/06/92	8:30 AM	9:10 AM	320	283	48	145.3	91.7	93%	N/A	cores at 137+27, 143+05
240508	05/06/92	9:10 AM	9:42 AM	320	282	50	149.5	94.4	94.7		144+25, 150+90
240506	05/06/92	9:44 AM	10:00 AM	320	279	50	141.4	89.3	93.0		152+30, 159+00
240509	05/06/92	10:30 AM	10:48 AM	306	277	50	143.0	90.9	93.4		191+00, 197+75
FIRST BINDER COURSE											
241991	05/14/92										No laydown data
240503	05/07/92	7:57 AM	8:25 AM	310	270	40	148.5	93.8		N/A	
240504	05/07/92	8:38 AM	8:55 AM	310	269	41	144.5	92.6			
240507	05/07/92	9:09 AM	9:25 AM	310	260	42	147.5	93.2			
240508	05/07/92	9:34 AM	9:47 AM	305	264	42	147.1	92.9			
SECOND BINDER COURSE											
240503	05/11/92	9:45 AM	10:10 AM	305	285	65	150.3	94.8		N/A	
240504	05/11/92	10:12 AM	10:35 AM	310	285	65	144,6	92.0			
240507	05/11/92	10:42 AM	10:57 AM	310	288	66	147.7	93.0			
240508	05/11/92	11:07 AM	11:24 AM	310	290	66	148.1	93.3			

TABLE 14
Construction Data Summary
AC Surface Course

Section	Date	Paving Time		Mix Temp.		Air	QC Measurements		Nearby	Prof	Remarks
		Start	Finish	At Plant ° F	Laydown ° F	Temp. ° F	Nuclear Density	% Comp.	Cores (% comp.)	Index	Cores (NBL)
241991	05/12/92	8:49 AM	9:15 AM	300	281	55	142.1	91.1	94.2	5	206+80, 199+5
240502	06/01/92	9:35 AM	10:00 AM	305	292	64	145.3	92.4	94.3	12	
240505	06/01/92	10:13 AM	10:42 AM	305	295	64	141.9	90.2	93.8	7	
240503	06/01/92	11:35 AM	11:50 AM	305	289	71	144.8	92.1	94.3	7	101+75, 129+65
240504	06/01/92	11:56 AM	12:16 PM	305	292	72	144.6	92.0	93.8	4	116+95, 136+50
240507	06/01/92	12:30 PM	12:45 PM	305	297	72	143.3	91.1		4	
240508	06/01/92	1:07 PM	1:25 PM	300	293	72	146.2	92.9		5	
240506	06/01/92	1:38 PM	1:56 PM	300	295	72	144.6	92.0		3	
240509	06/03/92	10:14 AM	10:42 AM	305	297	75	147.0	93.5	96.6	9	191+20, 196+60

TABLE 15
Construction Data Summary
SMA Wedge and Level and Surface Courses

Section	Date	Paving Time		Mix Temp.		Air	QC Measurements		Nearby	Prof	Remarks
		Start	Finish	At Plant ° F	Laydown ° F	Temp. ° F	Nuclear Density lbs/cu. ft.	% Comp.	Cores (% comp.)	Index	
WEDGE AND LEVELLING COURSE											
240510	05/13/92	12:20 AM	12:45 AM	300	291	70				N/A	central strip showed 95.2%
240511	05/13/92	10:09 AM	10:22 AM	285	269	57			95.2		
240512	05/13/92	10:35 AM	10:56 AM	285	271	59					
240513	05/13/92	1:17 PM	1:31 PM	320	304	77					
SURFACE COURSE											
240510	06/10/92	8:30 AM	8:49 AM	315	285	74	148.0	94.2	96.2	2	
240511	06/09/92	2:57 PM	3:06 PM	295	274	80	153.4	93.7	94.6	1	
240512	06/09/92	3:38 PM	3:58 PM	295	273	82	153.5	93.7	95.5	3	
240513	06/10/92	9:18 AM	9:40 AM	315	288	75	148.9	94.3	95.3	2	

TABLE 16
MD SHA SPS–5 and SMA Project
US15 NBL, Frederick
Summary of Rehabilitation Treatments and Layer Thicknesses

SHRP I.D.	LAYER THICKNESS, INS.						REHABILITATION TREATMENT		
	OVERLAY		ORIG. AC	C.T. BASE	DGAB	STAB. SS	Patches	Surface	Overlay Mix
	01	04	03	05	06	06	No/Ft.	Prep.	Designations
SPS–5									
240502	1.8"	–	4.6"	4.2"	5.3"	8.5"	5/354	None	2" SCR
240505	1.9"	–	4.4"	3.6"	5.3"	8.5"	5/312	None	2" SCV
240503	1.7"	3.2"	4.4"	3.9"	5.3"	8.5"	None	None	2" SCR 3"BFR
240504	1.6"	2.9"	4.7"	4.2"	5.1"	7.0"	2/678	None	2" SCV 3" BFV
240507	1.8"	4.6"	3.1" (4.7")	6.4"	5.1"	7.0"	6/360	Milled	2" SCV 3" BFV and 1–1/2" BFV
240508	1.5"	4.0"	2.8" (4.7")	4.3"	5.0"	9.0"	1/72	Milled	2" SCR 3" BFR and 1–1/2" BFR
240506	2.2"	1.4"	3.1" (4.5")	4.2"	6.5"	7.2"	5/288	Milled	2" SCV 1–1/2" BFV
240509	1.8"	1.7"	3.7" (4.5")	3.5"	6.5"	7.2"	3/144	Milled	2" SCR 1–1/2" BFR
Supplemental									
241991	1.3"	1.6"	4.8"	3.8"	5.0"	5.8"	None	W&L	2" SCV 1–1/2" BFV
240511	1.7"	1.0"	4.5"	3.9"	5.8"	5.9"	2/144	W&L	2" SMA Vestoplast 1" SMA Vestoplast
240512	1.5"	1.0"	4.5"	3.9"	5.8"	5.9"	2/156	W&L	2" SMA Styrelf 1" SMA Styrelf
240510	2.0"	0.7"	4.0"	3.9"	5.8"	5.9"	None	W&L	2" SMA Arbocel 1" SMA Arbocel
240513	1.7"	1.2"	4.5"	3.9"	5.8"	5.9"	None	W&L	2" SMA Styrelf + Arbocel 1" SMA Styrelf + Arbocel
Control									
240501	0	0	4.4"	4.2"	5.6"	6.9"	5/241	Normal Maint.	

Notes:
( ) Original AC thickness prior to milling
SCR – Surface, Coarse, 30/70 Recycled
SCV – Surface, Coarse, Virgin
BFR – Binder, Fine, 30/70 Recycled
BFV – Binder, Fine, Virgin
W&L – Wedge and Levelling

March 02, 1993

TABLE 17
SPS–5 US 15 Frederick, Maryland
Initial Pavement Performance

Test Section	Mix	Treatment	Pavement Condition
240502	30/70 RAP	2" Min.	NBL – medium flushing in wheel paths, SL rutting SBL – State RAP mix – O.K.
240505	Virgin	2" Min.	NBL – surface under wheel paths is tight – no flushing
240503	30/70 RAP	5" Min.	NBL – heavy flushing – medium rutting SBL – no flushing
240504	Virgin	5" Min.	NBL – RAP from section 03 ran 55' into section 4 and RAP section is flushed. Rest of section 4 is O.K.
240507	Virgin	5" Int.	NBL – same as section 4 – no flushing
240508	30/70 RAP	5" Int.	NBL – medium flushing – SBL – rutting
240506	Virgin	2" Int.	NBL – no flushing, same as 4 and 7
240509	30/70 RAP	2" Min.	NBL – medium flushing, medium rutting
241991	Virgin State	W/L SC	NBL – no flushing – state virgin is the same as SHRP virgin

All of the SMA mixes are performing well. There is no evidence of flushing at this time. There are little pockets of rich asphalt here and there but these were noted during construction.