Strategic Highway Research Program
Long Term Pavement Performance
North Central Region
SPS-3 Program

Effectiveness of Routine Maintenance Treatments on the Performance of Flexible Pavements

Summary of Project Construction Schedules and Section Properties

By
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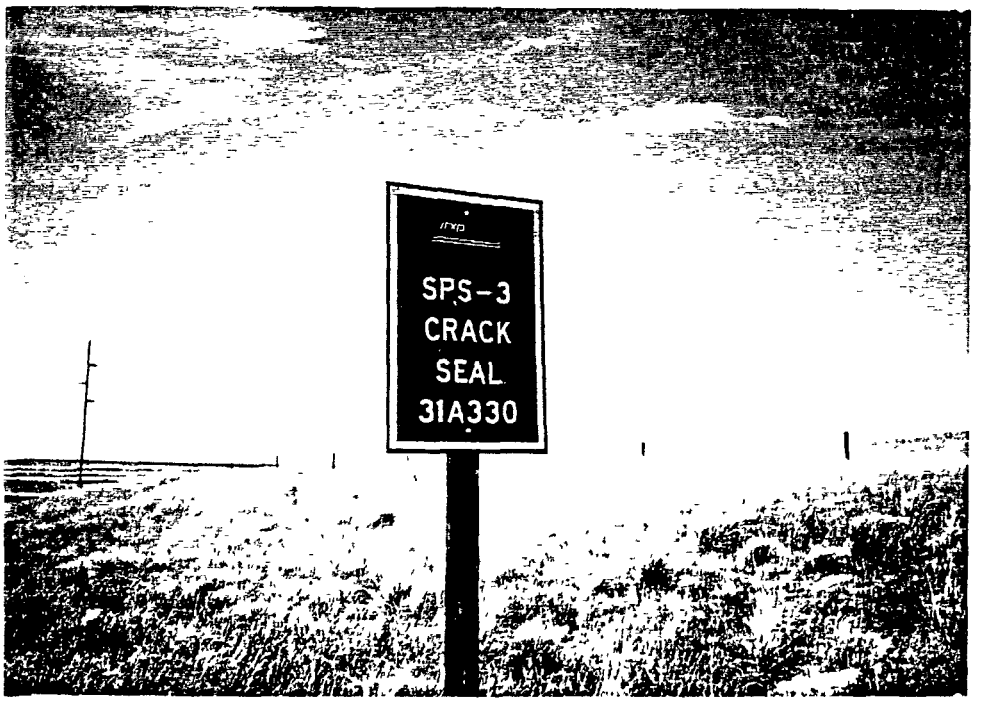

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The SPS-3 Experiment Design and Construction in the North Central Region

Introduction

The SPS-3 experiment has been developed to study the effectiveness of routine maintenance treatments on the performance of flexible pavements. The information obtained from this experiment will help determine the cost effectiveness and optimum timing of asphalt pavement preventative maintenance. The four types of maintenance treatments used are crack sealing, chip seal coat, slurry seal coat and thin asphalt concrete overlays. These treatments have been applied to asphalt pavements associated with GPS sections. The experimental design also includes the four environmental regions defined in the GPS experiment: fine and coarse subgrade, high and low traffic. In addition to these factors an evaluation was made whether the pavement section was considered adequate for the traffic predicted for the section. A structural number ratio of less than 1 represents an under-designed pavement and a structure number ratio greater than 1 represents a pavement thickness greater than the AASHTO design. The other factor is an evaluation of the level of condition of the pavement section. These have been evaluated as good, fair, and poor.

The experimental design is illustrated in Figure 1 with the twenty-two sections from the North Central Region entered in the appropriate cells.

The operation of the SPS-3 experiment in the North Central Region was guided by a regional task group. Table 1 is a listing of the people who have served on the regional task group. The chairman of the task group was Mr. Gerald Miner with the Missouri Highway and Transportation Department. The task group met on several occasions to determine specifications, construction and traffic control details, sampling and testing, and data collection needs.

In order to avoid construction variables such as workmanship and materials, all of the SPS-3 sites in the North Central Region were constructed by one contractor using the same equipment and the same materials for the crack seal, chip seal and slurry seals. The thin overlay was constructed by the respective agencies.

To carry out the contracting and construction work, the Central Federal Lands Highway Division of the Federal Highway Administration was contracted. The agencies agreed to reimburse FHWA for setting up the contracts and carrying them out.

A pre-bid meeting to provide potential bidders with details of the work and to introduce the clients and supervisory field staff was held in Denver in February 1990. Special information concerning the materials and logistics for operation within the various agencies and across the international border were discussed at this meeting.

The contract was administered using a two-stage bid process. Technical proposals received by FHWA were evaluated by a team consisting of Mr. Gerald Miner of the Missouri Highway and Transportation Department, Mr. Stanley Hilderman of the Manitoba Highways and Transportation Department, Mr. Richard Condon of Central Direct Federal Lands, and Mr. Richard Ingberg, North Central Regional Engineer. Three proposers were found acceptable and asked to provide a financial bid. The final negotiated price to do the SPS-3 sites was established and the contract awarded to Delta Asphalt of Council Bluffs, Iowa.

The twenty-two sites shown in Figure 1, in their appropriate cells, were then constructed. The characteristics of the twenty-two sites in the North Central Region are listed in Table 2. These include the GPS cell of the project, the structural number and the SPS-3 cell. A schedule was established in the contract and the location and order of construction is listed in Appendix B. Also included along with the location and the date of construction are the contact people within each of the agencies.

The construction plan includes a common aggregate source throughout the region and the same base asphalt source for the emulsions to be used for both the slurry seal and chip seal. Of the eight proposals received, three contractors were judged qualified to bid. Two contractors submitted bids for the work.

Delta Asphalt Company was awarded the contract and notice to proceed was given on May 23, 1990. The aggregate source for the chip and slurry seal coats was Meridian Aggregate of Granite Falls, Minnesota. The asphalt emulsion was supplied by JEBRO asphalt company of Sioux City, Iowa. The cost of construction plus the development and engineering costs incurred by Central Federal Lands Highway Division was approximately $44,000 per site. This cost did not include traffic control, the thin overlay and other specific costs borne by the agencies. Table 1 in Appendix B shows the schedule for construction of the sections. Mr. Howard Tingley of Central Federal Lands Highway Division and Mr. Ronald Urbach of Braun Intertec were on each of the projects for construction of each of the test sections. Their coordination efforts resulted in excellent execution of the work. The work was completed in ninety-two days. The ninety-two days included the time from the notification to proceed through the calibration process. The actual construction on the project in Iowa started on July 10, 1990. The last project was also the same one because the slurry seal section on that project had failed. The slurry seal was re-applied therefore on August 23, 1990. Figure 2 shows the location of the SPS-3 projects within the North Central Region.

One problem that did occur was that Type 10 Canadian cement did not react with the asphalt emulsion in the same way as Type 1 U.S.A. cement. This may have also been caused by the hardness of the water, however. Mr. Mike Kuebler of Delta Asphalt was the project coordinator for the contractor. The traffic control and scheduling of the traffic control operations by the agencies was very good. The contracting procedure developed and conducted by the Central Federal Lands Highway Division resulted in taking the risks out of the contracting process. The contractor was very happy that there were no unknown problems encountered. A computer controlled distributor, chip spreader and a slurry seal machine were leased by the contractor. A computer controlled the asphalt emulsion distributor; however, it had to be adjusted because initially it gave a non-uniform application. Generally the applications of aggregate and asphalt were somewhat lighter than normal at the beginning of the test sections.

The pilot application site near Council Bluffs, provided the practice needed to set-up the chip seal and slurry seal equipment and train the operators prior to starting the full scaled operations. The distributor, the chip spreader and the slurry machine were returned to the manufacturer after the project was completed.

The two-tiered bidding process worked well and the pre-approving of the aggregates made it possible to set-up and use the aggregates on a continuous basis throughout the region. A second possible source of aggregate near Sioux City, Iowa was rejected because of elongated particles which

resulted in too high of a flakiness index. The aggregates for both the chip seal and slurry seal coat were provided by Meridian Aggregate of Granite Falls, Minnesota.

Layout of the Projects

Each of the SPS-3 projects includes a control section which is to have no maintenance during the monitoring period. The control section will serve as the standard for which the performance of the preventative maintenance treatments will be evaluated. The GPS section which is part of each of the projects will have "normal" maintenance. The participants of each of the agencies were encouraged to add supplementary sections for additional treatments of their own choosing were installed. A number of agencies used seal coats with local aggregate and asphalt sources. A typical section layout is shown in Figure 3.

Pre-Construction Data Collection

Candidate sections were identified by the Texas Transportation Institute using data from approved GPS test sections. The Regional Coordination Office met with each of the agencies interested in participating in the SPS-3 program and laid out potential sites that had been suggested. Originally twenty-nine sites were identified; however, after attempting to layout sections on these various projects only twenty-two had the length and other characteristics needed for the SPS projects. Cores and stock piles of the samples of slurry and chip seal materials were sent to Western Technology.

Data collected at SPS-3 sites prior to construction were profile and FWD measurements, PASCO photos and manual distress surveys. Dates of these operations are shown in the regional spreadsheet.

Post-construction data collection included profile measurements, FWD tests and manual distress surveys of each SPS-3 section each year. The performance of all of the seal coats and crack sealing has been excellent throughout two winters with the exception of the slurry seal coat sections in Indiana. Dates of the monitoring tests since construction are also listed in the SPS spreadsheet. The results of the pre-construction and post-construction monitoring have been entered into the regional database and provided to the H-101 contractor for analysis. Tours of some of the SPS-3 projects are being scheduled for the spring and summer 1993.

SHRP / LTPP
SPS-3 EXPERIMENTAL DESIGN
NORTH CENTRAL REGION

MOISTURE		WET								DRY							
TEMPERATURE		FREEZE				NO FREEZE				FREEZE				NO FREEZE			
SUBGRADE		FINE		COARSE		FINE		COARSE		FINE		COARSE		FINE		COARSE	
TRAFFIC		LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH	LOW	HIGH
SN RATIO / CONDITION																	
G	<1	1 171003	7 211010	13	19	25	31	37	43	49 201010 311030	55	61	67	73	79	85	91
	>1	2	8 171002	14 261001	20 211034	26	32	38	44	50 831801	56	62	68	74	80	86	92
F	<1	3 261010 291002	9 181028	15 271019	21 271028	27	33	39	45	51	57	63	69	75	81	87	93
	>1	4 261012 196150	10 291005	16 276251	22 261013	28	34	40	46	52	58	64	70	76	82	88	94
P	<1	5	11	17 271016	23	29	35	41	47	53	59 901802	65	71 906405	77	83	89	95
	>1	6	12	18	24	30	36	42	48	54 201005	60	66	72	78	84	90	96

TABLE 1

Revised: April 18, 1991

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Table 2

SHRP/LTPP North Central Region
SPS-3 Test Project Characteristics

GPS Section	GPS Cell	Structural Number	SPS-3 Cell
171002	1-22	5.26	8
171003	1-10	5.06	1
181028	1-22	6.73	9
196150	2-1	4.16	4
201005	1-105	4.76	54
201010	1-105	3.26	49
211010	1-30	3.68	7
211034	1-9	6.04	20
261001	1-27	3.31	14
261010	1-3	3.77	3
261012	1-5	4.40	4
261013	1-42	5.00	22
271016	1-26	1.82	17
271019	1-29	2.79	15
271028	1-46	3.86	21
276251	1-29	4.25	16
291002	1-6	3.48	3
291005	1-23	9.38	10
311030	1-101	3.08	49
831801	1-103	4.08	50
901802	1-117	3.08	59
906405	1-133	2.02	71

SPS-3 Construction Report
SHRP North Central Region

EFFECTIVENESS OF VARIOUS MAINTENANCE PROCEDURES ON THE PERFORMANCE OF ASPHALT PAVEMENTS - Summary of Construction and Initial Evaluation of Test Sections

Construction

FHWA/CFLHD was asked to administer the contract for construction of the test sections.

After the FHWA accepted the challenge for the SPS-3 projects, Mr. Jerry Budwig, Division Engineer, appointed Mr. Larry Sellon as Project Manager and Mr. Howard Tingley as Project Engineer.

The contract was set up such that one contractor would be responsible for the placement of the three treatments consisting of crack sealing, chip seal and slurry seal. The respective agency placed the thin asphalt overlays.

Request for proposals were sent out to many potential contractors. After the qualifications of the contractors were received, they were reviewed by a panel appointed by SHRP. After the qualifications review was completed, the four contractors that met the qualifications were asked to submit bids for the project.

After the bids were received and reviewed, Delta Asphalt Paving of Council Bluffs, IA was awarded the contract. This contract covered the placement of the slurry seal, chip seal, and crack seal treatments.

For uniformity the project specifications required the aggregates used on the project be produced from the same pit at the same time and be stockpiled for use at all of the sites. The base asphalt to be used for the emulsions would be stored and used for each batch of emulsions produced. Also the same equipment, and if possible the same operators, would be used for the applications for all of the North Central SPS-3 projects.

The aggregates used for the chip seal and the slurry seal treatments were supplied by Meridian Aggregate from a pit at Granite Falls, MN. This aggregate was a crushed granite.

The emulsified asphalt was from Jebro, Inc. of Sioux City, IA. As indicated in the project specifications, the same base asphalt could by used for the emulsified asphalts for the slurry seal and the chip seal. When the emulsified asphalt was needed, Jebro was notified of the location. The emulsified asphalt was then trucked to the site and transferred to a backup distributor and a transport. When the emulsified asphalt was needed it was transferred to the distributor used for the chip seal operation and to the slurry seal truck.

The SPS-3 study addresses the question under the SHRP H-101 contract of cost effectiveness of preventative asphalt pavement maintenance. Four types of maintenance treatments are being evaluated for this study. They are:

1. Crack Sealing
2. Chip Seal

3. Slurry Seal
4. Thin Concrete Overlay

State/provinces were asked to present to SHRP candidate sites. Twenty-two sites were selected in the North Central Region. Agencies participating in SPS-3 are Iowa, Kansas, Nebraska, Minnesota, Illinois, Michigan, Indiana, Kentucky, Missouri, Saskatchewan and Manitoba.

Project Layout

Each of the SPS-3 projects include a control section which will have no maintenance performed on it during the monitoring period. This wills serve as a standard against the performance of the preventive maintenance treatments to be evaluated.

A GPS section is also associated with each of the SPS-3 projects. This section will have normal maintenance done on it. Additionally, in some areas supplementary sections were added by the agencies to evaluate treatments of their own choosing. Appendix A contains a summary of the SHRP sections including the date of construction. Distress survey dates, and FWD dates of the post-construction and pre-construction monitoring are also listed.

Construction of SPS Sites

Delta Asphalt supplied Braun Intertec Pavement, Inc. with a proposed schedule and routing prior to starting the project. Delta Asphalt proposed to work 7 days a week until the project was completed. Appendix B is a summary of the final work schedule for the SPS projects.

The aggregate was shipped to each of the SPS-3 project sites and stockpiled. This would be done a few days prior to the anticipated dated that the treatments would be applied. Delta Asphalt proposed that an advanced person be sent to each of the sites approximately two to three days prior to the scheduled date of application. This person checked that the aggregate was properly stockpiled. They also obtained samples for quality control checks for their information by a testing lab retained by Delta Asphalt.

Quality Control Sampling and Shipping

The H-101 contractor (Texas Transportation Institute) was responsible for preparing the responsibilities and the forms required for the SPS-3 study. Mr. Tom Freeman was the contact person at TTI. The sampling requirements were outlined in the responsibilities to the RCOC dated June 11, 1990.

Sample requirements:

- One quart of slurry seal mix
- Two* quarts of emulsion used for the slurry seal treatment
- Two* quarts of emulsion used for the chip seal treatment
- Approximately 20 lb of aggregate for the chip and slurry seal operation
- Two samples of the crack and joint sealing

After about 1/3 of the sections were completed, and after about 2/3 of the sites were completed, samples were shipped.

*As requested by Western Technologies, Inc. of Phoenix, AZ, after August 1, 1990 three quarts were shipped.

On July 23, 1990, after problems with the slurry seal placement, a small bag sample of the cement and a one quart sample of water that was used for the slurry seal operation was also shipped to Western Technologies.

Equipment Used for Construction

Chip Seal Operation
The equipment used for the chip seal operation was:
- Distributor 1990 ETNYRE Model SAM-HW
- Rollers-Bomag Model BW 12R (3 rollers)
- ETNYRE aggregate spreader
- Power broom sweepmaster Model 200

Slurry Seal Operation
The equipment used for the slurry seal operation was:
- 1990 ScanRoad Model SB804A
- Continuous flow mixing with a flexible rear strikeoff
- Spreader box with burlap drag

Crack Seal Operation
The equipment used for the crack seal operation was:
- CRAFCO Inc. Heating kettle EZPour Model 200
- CRAFCO Road Saver 221 sealant
- LA Hot Lance
- CRAFCO Model 200 Router (2)

As indicated previously, data information sheets supplied by TTI were completed for each of the 22 SPS-3 test sites. Copies of the data packets will be supplied to each of the agencies participating in the study for their projects.

Appendix C is a summary of the slurry seal, crack seal and chip seal applications site by site.

Appendix D is a synopsis of the construction activities that was prepared by Mr. Howard Tingley, FHWA/CFLHD Project Engineer.

Conclusion

After the proposed schedule was supplied by Delta Asphalt, the agencies were notified and construction was accomplished. The agency contact people arranged for traffic control for Saturday and Sunday. In all cases all they said was "what time and for how long". Thanks to the cooperation and coordination of the State and Provincial contact people, the contractor's representatives and Central Federal Lands Highway Division of FHWA it was possible to construct the SPS-3 projects most effectively and efficiently.

Appendix A
SPS-3 Test Sections and Initial Monitoring Schedule

SPS SHRP ID	SPS Exp	Highway	Treatment	Preconstruction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Preconstruction Monitoring: FWD Date	Constr Work Date	Post Construction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Post Construction Monitoring: FWD Date	Friction Data Date
171003		US 50 WB	GPS	E of St Louis - 4 Mi E of ST 160									
17A310	3	US 50 WB	Thin Overlay	07/26/90	PA	06/22/90	—	07/25/91	12/11/90	M	11/02/90	11/02/90	06/17/92
									12/18/91	PA	05/13/91	05/04/92	
									10/07/92	PA	12/09/91	09/16/92	
										M	07/26/91		
										M	09/16/92		
17A320	3	US 50 WB	Slurry Seal	07/26/90	PA	06/22/90	—	08/17/90	12/11/90	M	11/02/90	11/02/90	06/17/92
									12/18/91	PA	05/13/91	05/04/92	
									10/07/92	PA	12/09/91	09/16/92	
										M	07/26/91		
										M	09/16/92		
17A330	3	US 50 WB	Crack Seal	07/26/90	PA	06/22/90	—	08/17/90	12/11/90	M	11/02/90	11/02/90	06/17/92
									12/18/91	PA	05/13/91	05/04/92	
									10/07/92	PA	12/09/91	09/16/92	
										M	07/26/91		
										M	09/16/92		
17A340	3	US 50 WB	Control	07/26/90	PA	06/22/90	—	01/01/86	12/11/90	M	11/02/90	11/02/90	06/17/92
									12/18/91	PA	05/13/91	05/04/92	
									10/07/92	PA	12/09/91	09/16/92	
										M	07/26/91		
										M	09/16/92		
17A350	3	US 50 WB	Chip Seal	07/26/90	PA	06/22/90	—	08/17/90	12/11/90	M	11/02/90	11/02/90	06/17/92
									12/18/91	PA	05/13/91	05/04/92	
									10/07/92	PA	12/09/91	09/16/92	
										M	07/26/91		
										M	09/16/92		
171002		US 20 WB	GPS	N of Freeport - 1 25 Mi E of ST 26									
17B310	3	US 20 WB	Thin Overlay	06/12/90	PA	06/07/90	—	08/12/91	12/10/90	M	10/04/90	10/04/90	12/30/1899
									12/16/91	PA	06/07/91	09/16/92	
									09/15/92	M	08/29/91		
										M	09/16/92		
17B320	3	US 20 WB	Slurry Seal	06/12/90	PA	06/07/90	—	08/02/90	12/10/90	M	10/04/90	10/04/90	12/30/1899
									12/16/91	PA	06/07/91	09/16/92	
									09/15/92	M	08/29/91		
										M	09/16/92		
17B330	3	US 20 WB	Crack Seal	06/12/90	PA	06/07/90	—	08/02/90	12/10/90	M	10/04/90	10/04/90	12/30/1899
									12/16/91	PA	06/07/91	09/16/92	
									09/15/92	M	08/29/91		
										M	09/16/92		
17B340	3	US 20 WB	Control	06/12/90	PA	06/07/90	—	01/01/86	12/10/90	M	10/04/90	10/04/90	12/30/1899
									12/16/91	PA	06/07/91	09/16/92	
									09/15/92	M	08/29/91		
										M	09/16/92		
17B350	3	US 20 WB	Chip Seal	06/12/90	PA	06/07/90	—	08/02/90	12/10/90	M	10/04/90	10/04/90	12/30/1899
									12/16/91	PA	06/07/91	09/16/92	
									09/15/92	M	08/29/91		
										M	09/16/92		
181028		IH 64 EB	GPS	NW of Evansville - W US 231									
18A310	3	IH 64 EB	Thin Overlay	07/26/90	PA	06/28/90	—	Not Done	12/15/90	M	11/19/90	11/19/90	12/30/1899
									12/19/91	PA	05/09/91	05/01/92	08/25/92
									10/05/92	M	12/19/91		
										PA	10/05/92		
18A320	3	IH 64 EB	Slurry Seal	07/26/90	PA	06/28/90	—	08/16/90	12/15/90	M	11/19/90	11/19/90	08/28/91
									12/19/91	PA	05/09/91	05/01/92	08/25/92
									10/05/92	M	12/19/91		
										PA	10/05/92		
18A330	3	IH 64 EB	Crack Seal	07/26/90	PA	06/28/90	—	08/16/90	12/15/90	M	11/19/90	11/19/90	08/28/91
									12/19/91	PA	05/09/91	05/01/92	08/25/92
									10/05/92	M	12/19/91		
										PA	10/05/92		
18A340	3	IH 64 EB	Control	07/26/90	PA	06/28/90	—	01/01/75	12/15/90	M	11/19/90	11/19/90	08/28/91
									12/19/91	PA	05/09/91	05/01/92	08/25/92
									10/05/92	M	12/19/91		
										PA	10/05/92		
18A350	3	IH 64 EB	Chip Seal	07/26/90	PA	06/28/90	—	08/16/90	12/15/90	M	11/19/90	11/19/90	08/28/91
									12/19/91	PA	05/09/91	05/01/92	08/25/92

SPS SHRP ID	SPS Exp	Highway	Treatment	Preconstruction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	FWD Date	Constr Work Date	Post Construction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	FWD Date	Friction Data Date
									10/05/92	M	12/19/91		
										PA	10/05/92		
196150		ST 196 NB	GPS	9 Mi S of Sac City - 2 Mi N of US 71									
19A310	3	ST 196 NB	Thin Overlay	06/17/90	PA	06/01/90	—	07/24/90	06/20/91	M	11/15/90	11/15/90	10/29/90
									05/12/92	M	05/02/91	10/19/92	07/03/91
									06/17/90	PA	05/18/91		12/30/1899
										M	10/15/92		
19A320	3	ST 196 NB	Slurry Seal	06/17/90	PA	06/01/90	—	08/23/90	06/20/91	M	11/15/90	11/15/90	10/29/90
									05/12/92	M	06/10/91	10/19/92	07/03/91
										PA	05/18/91		12/30/1899
										M	10/15/92		
19A330	3	ST 196 NB	Crack Seal	06/17/90	PA	06/01/90	—	07/10/90	06/20/91	M	11/15/90	11/15/90	10/29/90
									05/12/92	M	05/02/91	10/19/92	07/03/91
										PA	05/18/91		12/30/1899
										M	10/15/92		
19A340	3	ST 196 NB	Control	06/17/90	PA	06/01/90	—	01/01/66	06/20/91	M	11/15/90	11/15/90	10/29/90
									05/12/92	M	05/02/91	10/19/92	07/03/91
										PA	05/18/91		12/30/1899
										M	10/15/92		
19A350	3	ST 196 NB	Chip Seal	06/17/90	PA	06/01/90	—	07/11/90	06/20/91	M	11/15/90	11/15/90	10/29/90
									05/12/92	M	05/02/91	10/19/92	07/03/91
										PA	05/18/91		12/30/1899
										M	10/15/92		
201005		ST 68 EB	GPS	In Ottowa - 0.3 Mi W of I-35									
20A310	3	ST 68 EB	Thin Overlay	05/01/90	PA	07/09/90	—	10/30/90	03/31/91	M	04/18/91	11/30/90	05/13/91
									05/09/92	PA	12/15/91	02/24/92	12/30/1899
20A320	3	ST 68 EB	Slurry Seal	05/01/90	PA	07/09/90	—	07/12/90	03/31/91	M	04/18/91	11/30/90	05/13/91
									05/09/92	PA	12/15/91	02/24/92	12/30/1899
20A330	3	ST 68 EB	Crack Seal	05/01/90	PA	07/09/90	—	07/12/90	03/31/91	M	04/18/91	11/30/90	05/13/91
									05/09/92	PA	12/15/91	02/24/92	12/30/1899
20A340	3	ST 68 EB	Control	05/01/90	PA	07/09/90	—	01/01/72	03/31/91	M	04/18/91	11/30/90	05/13/91
									05/09/92	PA	12/15/91	02/24/92	12/30/1899
20A350	3	ST 68 EB	Chip Seal	05/01/90	PA	07/09/90	—	07/12/90	03/31/91	M	04/18/91	11/30/90	05/13/91
									05/09/92	PA	12/15/91	02/24/92	12/30/1899
201010		ST 154 NB	GPS	12 Mi SE of Dodge City - 16 Mi S of US 56 Ford, Kansas									
20B310	3	ST 154 NB	Thin Overlay	05/02/90	PA	04/29/91	—	11/05/90	04/04/91	M	04/29/91	11/28/90	06/19/91
									04/18/92	PA	10/26/91	03/17/92	12/30/1899
										PA	03/03/92		
20B320	3	ST 154 NB	Slurry Seal	05/02/90	PA	04/29/91	—	11/05/90	04/04/91	M	04/29/91	11/28/90	06/19/91
									04/18/92	PA	10/26/91	03/17/92	12/30/1899
										PA	03/03/92		
20B330	3	ST 154 NB	Crack Seal	05/02/90	PA	07/10/90	—	07/14/90	04/04/91	M	04/29/91	11/28/90	06/19/91
									04/18/92	PA	10/26/91	03/17/92	12/30/1899
										PA	03/03/92		
20B340	3	ST 154 NB	Control	05/02/90	PA	07/10/90	—	01/01/81	04/04/91	M	04/29/91	11/28/90	06/19/91
									04/18/92	PA	10/26/91	03/17/92	12/30/1899
										PA	03/03/92		
20B350	3	ST 154 NB	Chip Seal	05/02/90	PA	07/10/90	—	07/14/90	04/04/91	M	04/29/91	11/28/90	06/19/91
									04/18/92	PA	10/26/91	03/17/92	12/30/1899
										PA	03/03/92		
211010		ST 11 EB	GPS	0 6 Mi N of Booneville									
21A310	3	ST 11 EB	Thin Overlay	04/28/90	PA	06/28/90	—	11/07/90	12/16/90	M	10/19/90	10/19/90	08/08/91
									11/07/91	PA	05/09/91	08/18/92	
										M	07/09/91		
										M	08/17/92		
										PA	09/30/92		
21A320	3	ST 11 EB	Slurry Seal	04/28/90	PA	06/28/90	—	08/14/90	12/16/90	M	10/19/90	10/19/90	10/17/90
									11/07/91	PA	05/08/91	08/18/92	08/08/91
										M	07/09/91		
										M	08/17/92		
										PA	09/30/92		
21A330	3	ST 11 EB	Crack Seal	04/28/90	PA	06/28/90	—	08/14/90	12/16/90	M	10/19/90	10/19/90	10/17/90
									11/07/91	PA	05/09/91	08/18/92	08/08/91
										M	07/09/91		
										M	08/17/92		
										PA	09/30/92		
21A340	3	ST 11 EB	Control	04/28/90	PA	06/28/90	—	01/01/85	12/16/90	M	10/19/90	10/19/90	10/17/90

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									11/07/91	PA	05/08/91	08/18/92	08/08/91
										M	07/09/91		
										M	08/17/92		
										PA	09/30/92		
21A350	3	ST 11 EB	Chip Seal	04/28/90	PA	06/28/90	—	08/14/90	12/16/90	M	10/19/90	10/19/90	10/17/90
									11/07/91	PA	05/09/91	08/18/92	08/08/91
										M	07/09/91		
										M	08/17/92		
										PA	09/30/92		
211034		Cumbr EB	GPS	Near Glasgow									
21B310	3	Cumbr EB	Thin Overlay	04/29/90	PA	06/29/90	—	09/28/90	12/16/90	M	10/30/90	10/30/90	09/24/90
									11/06/91	PA	05/07/91	08/17/92	10/10/91
										M	07/10/91		
										M	08/17/92		
										PA	10/06/92		
21B320	3	Cumbr EB	Slurry Seal	04/29/90	PA	06/29/90	—	08/15/90	12/16/90	M	10/30/90	10/30/90	09/24/90
									11/06/91	PA	05/07/91	08/17/92	10/10/91
										M	07/10/91		
										M	08/17/92		
										PA	10/06/92		
21B330	3	Cumbr EB	Crack Seal	04/29/90	PA	06/29/90	—	08/15/90	12/16/90	M	10/30/90	10/30/90	09/24/90
									11/06/91	PA	05/07/91	08/17/92	10/10/91
										M	07/10/91		
										M	08/17/92		
										PA	10/06/92		
21B340	3	Cumbr EB	Control	04/29/90	PA	06/29/90	—	01/01/72	12/16/90	M	10/30/90	10/30/90	09/24/90
									11/06/91	PA	05/07/91	08/17/92	10/10/91
										M	07/10/91		
										M	08/17/92		
										PA	10/06/92		
21B350	3	Cumbr EB	Chip Seal	04/29/90	PA	06/29/90	—	08/15/90	12/16/90	M	10/30/90	10/30/90	09/24/90
									11/06/91	PA	05/07/91	08/17/92	10/10/91
										M	07/10/91		
										M	08/17/92		
										PA	10/06/92		
261013		US 131 NB	GPS	Near Howard City - 0 1 Mi N Tamarack Rd									
26A310	3	US 131 NB	Thin Overlay	05/18/90	PA	07/20/90	—	10/02/90	01/07/91	M	10/12/90	10/12/90	
									07/09/91	M	09/26/91	09/02/92	
									09/26/92	M	07/17/91		
										M	09/02/92		
26A320	3	US 131 NB	Slurry Seal	05/18/90	PA	07/20/90	—	08/07/90	01/07/91	M	10/12/90	10/12/90	
									07/09/91	M	09/26/91	09/02/92	
									09/26/92	M	07/17/91		
										M	09/02/92		
~~26A321~~	~~3~~	~~US 131 NB~~	~~Agency Slurry Seal~~	~~05/18/90~~	~~PA~~	~~07/20/90~~	~~—~~	~~08/08/91~~	~~01/07/91~~	~~M~~	~~10/12/90~~	~~10/12/90~~	
									~~07/09/91~~	~~M~~	~~09/26/91~~	~~09/02/92~~	
									~~09/26/92~~	~~M~~	~~07/17/91~~		
										~~M~~	~~09/02/92~~		
26A330	3	US 131 NB	Crack Seal	05/18/90	PA	07/20/90	—	08/07/90	01/07/91	M	10/12/90	10/12/90	
									07/09/91	M	09/26/91	09/02/92	
									09/26/92	M	07/17/91		
										M	09/02/92		
26A340	3	US 131 NB	Control	05/18/90	PA	07/20/90	—	01/01/80	01/07/91	M	10/12/90	10/12/90	
									07/09/91	M	09/26/91	09/02/92	
									09/26/92	M	07/17/91		
										M	09/02/92		
26A350	3	US 131 NB	Chip Seal	05/18/90	PA	07/20/90	—	08/07/90	01/07/91	M	10/12/90	10/12/90	
									07/09/91	M	09/26/91	09/02/92	
									09/26/92	M	07/17/91		
										M	09/02/92		
261012		US 131 SB	GPS	Near Big Rapids									
26B310	3	US 131 SB	Thin Overlay	07/24/90	PA	07/20/90	—	10/02/90	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	
									09/26/92	M	07/18/91		
										M	09/02/92		
26B320	3	US 131 SB	Slurry Seal	07/24/90	PA	07/20/90	—	08/08/90	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	

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									09/26/92	M	07/18/91		
										M	09/02/92		
26B321	3	US 131 SB	Agency Slurry Seal	07/24/90	PA	07/20/90	—	08/08/90	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	
									09/26/92	M	07/18/91		
										M	09/02/92		
26B330	3	US 131 SB	Crack Seal	07/24/90	PA	07/20/90	—	08/08/90	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	
									09/26/92	M	07/18/91		
										M	09/02/92		
26B340	3	US 131 SB	Control	07/24/90	PA	07/20/90	—	01/01/80	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	
									09/26/92	M	07/18/91		
										M	09/02/92		
26B350	3	US 131 SB	Chip Seal	07/24/90	PA	07/20/90	—	08/08/90	01/07/91	M	10/15/90	10/15/90	
									07/09/91	PA	09/27/91	09/02/92	
									09/26/92	M	07/18/91		
										M	09/02/92		
261001		ST 61 EB	GPS	17 Mi SE of Cadillac - In Marion									
26C310	3	ST 61 EB	Thin Overlay	07/24/90	PA	07/21/90	—	10/03/90	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
									07/24/90	M	09/02/92		
26C320	3	ST 61 EB	Slurry Seal	07/24/90	PA	07/21/90	—	08/09/90	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
										M	09/02/92		
26C330	3	ST 61 EB	Crack Seal	07/24/90	PA	07/21/90	—	08/09/90	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
										M	09/02/92		
26C340	3	ST 61 EB	Control	07/24/90	PA	07/21/90	—	01/01/71	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
										M	09/02/92		
26C350	3	ST 61 EB	Chip Seal	07/24/90	PA	07/21/90	—	08/09/90	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
										M	09/02/92		
26C351	3	ST 61 EB	Agency Chip Seal	07/24/90	PA	07/21/90	—	09/07/90	01/08/91	M	10/16/90	10/16/90	
									07/10/91	M	09/27/91	09/02/92	
									09/25/92	M	07/16/91		
										M	09/02/92		
261010		ST 57 EB	GPS	13 Mi N of Flint - 2 85 Mi S of ST 54									
26D310	3	ST 57 EB	Thin Overlay	07/23/90	PA	07/23/90	—	10/11/90	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		
										M	09/02/92		
26D320	3	ST 57 EB	Slurry Seal	07/23/90	PA	07/23/90	—	08/10/90	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		
										M	09/02/92		
26D330	3	ST 57 EB	Crack Seal	07/23/90	PA	07/23/90	—	08/10/90	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		
										M	09/02/92		
26D340	3	ST 57 EB	Control	07/23/90	PA	07/23/90	—	01/01/75	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		
										M	09/02/92		
26D350	3	ST 57 EB	Chip Seal	07/23/90	PA	07/23/90	—	08/10/90	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		
										M	09/02/92		
26D351	3	ST 57 EB	Agency Chip Seal	07/23/90	PA	07/23/90	—	09/13/90	01/04/91	M	10/17/90	10/17/90	
									06/27/91	M	09/26/91	09/02/92	
									09/24/92	M	12/13/91		

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										M	09/02/92		
271016		US 71 SB	GPS	N of Bemidji - 2 Mi N of US 2									
27A310	3	US 71 SB	Thin Overlay	05/24/90	PA	05/27/90	—	09/13/90	07/13/91	M	11/08/90	11/08/90	
									10/30/92	PA	06/18/91	06/19/92	
27A320	3	US 71 SB	Slurry Seal	05/24/90	PA	05/27/90	—	07/27/90	07/13/91	M	11/08/90	11/08/90	
									10/30/92	PA	06/18/91	06/19/92	
27A330	3	US 71 SB	Crack Seal	05/24/90	PA	05/27/90	—	07/27/90	07/13/91	M	11/08/90	11/08/90	
									10/30/92	PA	06/18/91	06/19/92	
27A340	3	US 71 SB	Control	05/24/90	PA	05/27/90	—	05/01/90	07/13/91	M	11/08/90	11/08/90	
									10/30/92	PA	06/18/91	06/19/92	
27A350	3	US 71 SB	Chip Seal	05/24/90	PA	05/27/90	—	07/27/90	07/13/91	M	11/08/90	11/08/90	
									10/30/92	PA	06/18/91	06/19/92	
276251		US 2 WB	GPS	By Bemidji - 3 Mi N of S JCT US 2/US 71									
27B310	3	US 2 WB	Thin Overlay	05/23/90	PA	05/30/90	—	09/14/90	07/13/91	M	11/07/90	11/07/90	
									10/30/92	PA	06/18/91	06/18/92	
										M	06/18/92		
27B320	3	US 2 WB	Slurry Seal	05/23/90	PA	05/30/90	—	07/27/90	07/13/91	M	11/07/90	11/07/90	
									10/30/92	PA	06/18/91	06/18/92	
										M	06/18/92		
27B330	3	US 2 WB	Crack Seal	05/23/90	PA	05/30/90	—	07/27/90	07/13/91	M	11/07/90	11/07/90	
									10/30/92	PA	06/18/91	06/18/92	
										M	06/18/92		
27B340	3	US 2 WB	Control	05/23/90	PA	05/30/90	—	01/01/84	07/13/91	M	11/07/90	11/07/90	
									10/30/92	PA	06/18/91	06/18/92	
										M	06/18/92		
27B350	3	US 2 WB	Chip Seal	05/23/90	PA	05/30/90	—	07/27/90	07/13/91	M	11/07/90	11/07/90	
									10/30/92	PA	06/18/91	06/18/92	
										M	06/18/92		
271028		US 10 EB	GPS	SE of Detroit Lakes - 4 Mi E of ST 87									
27C310	3	US 10 EB	Thin Overlay	05/23/90	PA	05/14/90	—	08/28/90	08/08/91	M	11/13/90	11/13/90	
									11/01/92	PA	06/17/91	06/15/92	
27C320	3	US 10 EB	Slurry Seal	05/23/90	PA	05/14/90	—	07/30/90	08/08/91	M	11/13/90	11/13/90	
									11/01/92	PA	06/17/91	06/15/92	
27C330	3	US 10 EB	Crack Seal	05/23/90	PA	05/14/90	—	07/30/90	08/08/91	M	11/13/90	11/13/90	
									11/01/92	PA	06/17/91	06/15/92	
27C340	3	US 10 EB	Control	05/23/90	PA	05/14/90	—	01/01/72	08/08/91	M	11/13/90	11/13/90	
									11/01/92	PA	06/17/91	06/15/92	
27C350	3	US 10 EB	Chip Seal	05/23/90	PA	05/14/90	—	07/30/90	08/08/91	M	11/13/90	11/13/90	
										PA	06/17/91	06/15/92	
271019		US 169 NB	GPS	N of Princeton - 0 6 Mi N of ST 95									
27D310	3	US 169 NB	Thin Overlay	05/22/90	PA	05/30/90	—	8/__/92	08/08/91	M	09/24/90	09/24/90	
										PA	06/13/91	06/01/92	
										M	10/14/92	10/13/92	
27D320	3	US 169 NB	Slurry Seal	05/22/90	PA	05/30/90	—	07/31/90	08/08/91	M	09/24/90	09/24/90	
										PA	06/13/91	06/01/92	
										M	10/14/92		
27D330	3	US 169 NB	Crack Seal	05/22/90	PA	05/30/90	—	07/31/90	08/08/91	M	09/24/90	09/24/90	
										PA	06/13/91	06/01/92	
										M	10/14/92		
27D340	3	US 169 NB	Control	05/22/90	PA	05/30/90	—	01/01/80	08/08/91	M	09/24/90	09/24/90	
										PA	06/13/91	06/01/92	
										M	10/14/92		
27D350	3	US 169 NB	Chip Seal	05/22/90	PA	05/30/90	—	07/31/90	08/08/91	M	09/24/90	09/24/90	
										PA	06/13/91	06/01/92	
										M	10/14/92		
291005		US 54 WB	GPS	N of Lake of The Ozarks - 4 8 Mi W of Rte 52									
29A310	3	US 54 WB	Thin Overlay	04/30/90	PA	06/20/90	—	10/05/90	12/12/90	M	11/07/90	09/11/90	10/16/90
									02/15/92	M	04/17/91	11/07/90	08/26/91
												05/05/92	10/23/92
29A320	3	US 54 WB	Slurry Seal	04/30/90	PA	06/20/90	—	08/19/90	12/12/90	M	11/07/90	09/11/90	10/16/90
									02/15/92	M	04/17/91	11/07/90	08/26/91
												05/05/92	10/23/92
29A330	3	US 54 WB	Crack Seal	04/30/90	PA	06/20/90	—	08/19/90	12/12/90	M	11/07/90	09/11/90	10/16/90

SPS TRP ID	SPS Exp	Highway	Treatment	Preconstruction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Preconstruction Monitoring: FWD Date	Constr Work Date	Post Construction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Post Construction Monitoring: FWD Date	Friction Data Date
									02/15/92	M	04/17/91	11/07/90	08/26/91
												05/05/92	10/23/92
29A340	3	US 54 WB	Control	04/30/90	PA	06/20/90	—	01/01/74	12/12/90	M	11/07/90	09/11/90	10/16/90
									02/15/92	M	04/17/91	11/07/90	08/26/91
												05/05/92	10/23/92
29A350	3	US 54 WB	Chip Seal	04/30/90	PA	06/20/90	—	08/19/90	12/12/90	M	11/07/90	09/11/90	10/16/90
									02/15/92	M	04/17/91	11/09/90	08/26/91
												05/05/92	10/23/92
29A351	3	US 54 WB	Agency Chip Seal	04/30/90	PA	06/20/90	—	09/11/90	12/12/90	M	11/07/90	11/09/90	10/16/90
									02/15/92	M	04/17/91	11/07/92	08/26/91
												05/05/92	10/23/92
291002		Rte C WB	GPS	SW of Jefferson City - 11 Mi W of US 54									
29B310	3	Rte C WB	Thin Overlay	04/30/90	PA	06/20/90	—	10/05/90	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
29B320	3	Rte C WB	Slurry Seal	04/30/90	PA	06/20/90	—	08/18/90	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
29B330	3	Rte C WB	Crack Seal	04/30/90	PA	06/20/90	—	08/18/90	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
29B340	3	Rte C WB	Control	04/30/90	PA	06/20/90	—	01/01/86	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
29B350	3	Rte C WB	Chip Seal	04/30/90	PA	06/20/90	—	08/18/90	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
29B351	3	Rte C WB	Agency Chip Seal	04/30/90	PA	06/20/90	—	09/06/90	12/12/90	M	11/08/90	11/08/90	10/16/90
									02/15/92	M	04/17/91	05/06/92	08/26/91
										PA	12/10/91		10/23/92
311030		US 6 WB	GPS	Near Arapahoe - 3 5 Mi E of US 283									
31A310	3	US 6 WB	Thin Overlay	05/02/90		—	—	10/16/90	04/05/91	M	11/29/90	11/29/90	11/08/90
									08/15/91	M	08/07/92	08/10/92	
									05/06/92				
31A320	3	US 6 WB	Slurry Seal	05/02/90		—	—	07/17/90	04/05/91	M	11/29/90	11/29/90	11/08/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A330	3	US 6 WB	Crack Seal	05/02/90		—	—	07/17/90	04/05/91	M	11/29/90	11/29/90	11/08/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A340	3	US 6 WB	Control	05/02/90		—	—	01/01/82	04/15/91	M	11/29/90	11/29/90	11/08/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A350	3	US 6 WB	Chip Seal	05/02/90		—	—	07/17/90	04/05/91	M	11/29/90	11/29/90	11/08/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A351	3	US 6 WB	Agency Chip Seal	05/02/90		—	—	07/17/90	04/05/91	M	11/29/90	11/29/90	11/10/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A352	3	US 6 WB	Agency Chip Seal	05/02/90		—	—	07/17/90	04/15/91	M	11/29/90	11/29/90	11/10/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
31A353	3	US 6 WB	Agency Chip Seal	05/02/90		—	—	01/01/82	04/15/91	M	11/29/90	11/29/90	11/10/90
									08/15/91	M	08/07/92	08/07/92	
									05/06/92				
831801		TC 1 WB	GPS	W of Brandon - 3 8 Mi W of PTH 21									
83A310	3	TC 1 WB	Thin Overlay	05/27/90	M	04/12/90	06/06/90	08/31/90	07/16/91	M	10/22/90	10/22/90	09/17/90
					PA	05/24/90			08/27/92	M	05/09/91	07/22/92	09/21/92
										PA	06/21/91		
										M	07/22/92		
83A320	3	TC 1 WB	Slurry Seal	05/27/90	M	04/12/90	06/06/90	07/25/90	07/16/91	M	10/22/90	10/22/90	09/17/90
					PA	05/24/90			08/27/92	M	05/09/91	07/22/92	09/21/92
										PA	06/21/91		
										M	07/22/92		
83A330	3	TC 1 WB	Crack Seal	05/27/90	M	04/12/90	06/06/90	07/25/90	07/16/91	M	10/22/90	10/22/90	09/17/90
					PA	05/24/90			08/27/92	M	05/09/91	07/22/92	09/21/92
										PA	06/21/91		

SPS SHRP ID	SPS Exp	Highway	Treatment	Preconstruction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Preconstruction Monitoring: FWD Date	Constr Work Date	Post-Construction Monitoring: Profile Date	Distress Survey Type	Distress Survey Date	Post-Construction Monitoring: FWD Date	Friction Data Date
83A331	3	TC 1 WB	Agency Crack Seal	05/27/90	M PA	04/12/90 05/24/90	06/06/90	08/31/90	07/16/91 08/27/92	M M PA M	07/22/92 10/22/90 05/09/91 06/21/91 07/22/92	10/22/90 07/22/92	09/17/90 09/21/92
83A340	3	TC 1 WB	Control	05/27/90	M PA	04/12/90 05/24/90	06/06/90	N/A	07/16/91 08/27/92	M M PA M	10/22/90 05/09/91 06/21/91 07/22/92	10/22/90 07/22/92	09/17/90 09/21/92
83A350	3	TC 1 WB	Chip Seal	05/27/90	M PA	04/12/90 05/24/90	06/06/90	07/25/90	07/16/91 08/27/92	M M PA M	10/22/90 05/09/91 06/21/91 07/22/92	10/22/90 07/22/92	09/17/90 09/21/92
83A351	3	TC 1 WB	Agency Chip Seal	05/27/90	M PA	04/12/90 05/24/90	06/06/90	08/31/90	07/16/91 08/27/92	M M PA M	10/22/90 05/09/91 06/21/91 07/22/92	10/22/90 07/22/92	09/17/90 09/21/92
901802		ST 9 SB	GPS	S of Whitewood - 14.2 Mi S of JCT 1									
90A310	3	ST 9 SB	Thin Overlay	05/31/90	PA	05/22/90	06/08/90	Done Date?	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 07/23/92	
90A320	3	ST 9 SB	Slurry Seal	05/31/90	PA	05/22/90	06/08/90	07/23/90	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 07/23/92	
90A330	3	ST 9 SB	Crack Seal	05/31/90	PA	05/22/90	06/08/90	07/23/90	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 07/23/92	
90A340	3	ST 9 SB	Control	05/31/90	PA	05/22/90	06/08/90	01/01/71	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 05/21/92 07/23/92	
90A350	3	ST 9 SB	Chip Seal	05/31/90	PA	05/22/90	06/08/90	07/23/90	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 07/23/92	
90A351	3	ST 9 SB	Agency Chip Seal	05/31/90	PA	05/22/90	06/08/90	01/01/71	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 05/21/92 07/23/92	
90A352	3	ST 9 SB	Agency Chip Seal	05/31/90	PA	05/22/90	06/08/90	07/23/90	07/17/91 08/28/92	M PA	09/28/90 06/21/91	10/23/90 07/23/92	
906405		ST 16 EB	GPS	W of Lantgan - 6 Mi E of Plunkett									
90B310	3	ST 16 EB	Thin Overlay	05/29/90	PA	05/16/90	—	Done Date?	07/18/91 08/29/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B320	3	ST 16 EB	Slurry Seal	05/29/90	PA	05/16/90	—	07/21/90	07/18/91 08/29/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B330	3	ST 16 EB	Crack Seal	05/29/90	PA	05/16/90	—	07/21/90	07/18/91 08/29/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B331	3	ST 16 EB	Agency Crack Seal	05/29/90	PA	05/16/90	—	07/21/90	07/18/91 08/28/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B340	3	ST 16 EB	Control	05/29/90	PA	05/16/90	—	01/01/69	07/18/91 08/29/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B350	3	ST 16 EB	Chip Seal	05/29/90	PA	05/16/90	—	07/21/90	07/18/91 08/29/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	
90B351	3	ST 16 EB	Agency Chip Seal	05/29/90	PA	05/16/90	—	07/21/90	07/18/91 08/28/92	M M PA	10/24/90 05/08/91 06/23/91	10/24/90 07/24/92	

Appendix B
Final Work Schedule
SPS-3 Pavement Maintenance Effectiveness

Appendix B

Date Revised:
March 1993

Final Work Schedule
SPS-3 Pavement Maintenance Effectiveness

State	SHRP ID Number	Highway	Proposed Date of Construction	Contact Person
Iowa	196150	ST196 NB	July 10 Tues	Dwight Rorholm 515-239-1589/Harry Fortney 515-239-1062
Iowa	196150	ST196 NB	July 11 Wed-Finished	Dwight Rorholm 515-239-1589/Harry Fortney 515-239-1062
Kansas	201005	ST68 EB	July 12 Thu	Ronald Shuberg 913-296-3576/Dean Steward 913-296-3576
Kansas	201005	ST68 EB	July 13 Fri-Finished	Ronald Shuberg 913-296-3576/Dean Steward 913-296-3576
Kansas	201010	ST154 NB	July 14 Sat	Ronald Shuberg 913-296-3576/Dean Steward 913-296-3576
Nebraska	311030	US6 WB	July 17 Tues	Laird Weishahn 402-479-4675/George Woolstrum 402-479-4791
Saskatchewan	906405	ST16 EB	July 21 Sat	Barry Martin 306-787-4859
Saskatchewan	901802	ST9 SB	July 23 Mon	Barry Martin 306-787-4859
Manitoba	831801	TC1 WB	July 25 Wed July 26 Thu-Finished	Stan Hilderman/Jim Johnstone/Fred Young 204-945-8982
Minnesota	271016	US71 SB	July 27 Fri	Gary Niemi 218-828-2468/Dave Redig 218-828-2472
Minnesota	276251	US2 NB	July 28 Sat	Gary Niemi 218-828-4268/Dave Redig 218-828-2472
Minnesota	271028	US10 EB	July 30 Mon	Gary Niemi 218-828-4268/Dave Redig 218-828-2472
Minnesota	271029	US169 NB	July 31 Tue	Gary Niemi 218-828-4268/Dave Redig 218-828-2472
Illinois	171002	US20 WB	Aug 2 Thu	Bill Wade 217-782-2984

Final Work Schedule
SPS-3 Pavement Maintenance Effectiveness
(continued)

State	SHRP ID Number	Highway	Proposed Date of Construction	Contact Person
Michigan	261013	US131 NB	Aug 5 Sun Aug 7 Tue-Finished	Paul Miller 517-394-8659
Michigan	261012	US131 SB	Aug 7 Tue	Paul Miller 517-394-8659
Michigan	261001	ST61 EB	Aug 9 Thu	Paul Miller 517-394-8659
Michigan	261010	ST57 EB	Aug 10 Fri	Paul Miller 517-394-8659
Kentucky	211010	ST11 EB	Aug 14 Tue	William Monhollon 502-367-6411
Kentucky	211034	CUMBR EB	Aug 15 Wed	William Monhollon 502-367-6411
Indiana	181028	IH64 EB	Aug 16 Thu	Becky McDaniel 317-463-1521
Illinois	171003	US50 WB	Aug 17 Fri	Billy Wade 217-782-2984
Missouri	291002	ROUT C WB	Aug 18 Sat	Bruce Loesch 314-751-1040
Missouri	291005	US43 WB	Aug 19 Sun	Bruce Loesch 314-751-1040
Iowa	196150	ST196 NB	Aug 23 Thu*	Dwight Rorholm 515-239-1589/Harry Fortney 515-239-1062

Delta Asphalt Paving, Inc.
FHWA (Larry Sellon) 303-236-3473
Braun Intertec Pavement, Inc. 612-776-7522
Soils and Materials Engineers 313-454-9900

*Slurry Seal Only

Appendix C
Construction Quantities

ILLINOIS

Highway	US 20 NB
County	STEPHENSON
GPS section number	171002

SLURRY SEAL SUMMARY

SPS - 3 section number	17B320
Length of application (feet)	676
Application rates	
% of emulsion	15.0
Aggregate (lbs/sq.yd.)	21.3
% of mineral filler (cement)	1.6

CRACK SEAL SUMMERY

SPS - 3 section number	17B330
Length of application (feet)	700
Approximate pounds of sealant used	480
Length of cracks sealed (feet)	697

CHIP SEAL SUMMERY

SPS - 3 section number	17B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.371
Aggregate (lbs./sq.yd.)	25.4

ILLINOIS

Highway	US 50 WB
County	CLINTON/WASHINGTON
GPS section number	171003

SLURRY SEAL SUMMARY

SPS - 3 section number	17A320
Length of application (feet)	705
Application rates	
% of emulsion	15.3
Aggregate (lbs/sq.yd.)	19.0
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	17A330
Length of application (feet)	700
Approximate pounds of sealant used	60
Length of cracks sealed (feet)	425

CHIP SEAL SUMMERY

SPS - 3 section number	17A350
Length of application (feet)	696
Application rates	
Emulsion (gal./sq.yd.)	.354
Aggregate (lbs./sq.yd.)	28.5

INDIANA

Highway	TH 64 EB
County	SPENCER
GPS section number	181028

SLURRY SEAL SUMMARY

SPS - 3 section number	18A320
Length of application (feet)	704
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	18.1
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	18A330
Length of application (feet)	700
Approximate pounds of sealant used	360
Length of cracks sealed (feet)	341

CHIP SEAL SUMMERY

SPS - 3 section number	18A350
Length of application (feet)	659
Application rates	
Emulsion (gal./sq.yd.)	.381
Aggregate (lbs./sq.yd.)	29.2

IOWA

Highway	ST 196 NB
County	Sac
GPS section number	196150

SLURRY SEAL SUMMARY

SPS - 3 section number	19A320
Length of application (feet)	700
Application rates	
% of emulsion	15.1
Aggregate (lbs/sq.yd.)	18.7
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	19A330
Length of application (feet)	700
Approximate pounds of sealant used	360
Length of cracks sealed (feet)	723

CHIP SEAL SUMMERY

SPS - 3 section number	19A350
Length of application (feet)	699
Application rates	
Emulsion (gal./sq.yd.)	.366
Aggregate (lbs./sq.yd.)	20.8

KANSAS

Highway	ST 68 EB
County	FRANKLIN
GPS section number	201005

SLURRY SEAL SUMMARY

SPS - 3 section number	20A320
Length of application (feet)	695
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	17.3
% of mineral filler (cement)	1.7

CRACK SEAL SUMMERY

SPS - 3 section number	20A330
Length of application (feet)	700
Approximate pounds of sealant used	1260
Length of cracks sealed (feet)	1541

CHIP SEAL SUMMERY

SPS - 3 section number	20A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.366
Aggregate (lbs./sq.yd.)	23.4

KANSAS

Highway	ST 154 NB
County	FORD
GPS section number	201010

SLURRY SEAL SUMMARY

SPS - 3 section number	20B320
Length of application (feet)	702
Application rates	
% of emulsion	15.4
Aggregate (lbs/sq.yd.)	21.0
% of mineral filler (cement)	1.7

CRACK SEAL SUMMERY

SPS - 3 section number	20B330
Length of application (feet)	700
Approximate pounds of sealant used	30
Length of cracks sealed (feet)	12

CHIP SEAL SUMMERY

SPS - 3 section number	20B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.367
Aggregate (lbs./sq.yd.)	25.6

KENTUCKY

Highway	ST 11 EB
County	OWSLEY
GPS section number	211010

SLURRY SEAL SUMMARY

SPS - 3 section number	21A320
Length of application (feet)	710
Application rates	
% of emulsion	15.3
Aggregate (lbs/sq.yd.)	19.3
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	21A330
Length of application (feet)	700
Approximate pounds of sealant used	150
Length of cracks sealed (feet)	122

CHIP SEAL SUMMERY

SPS - 3 section number	21A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.374
Aggregate (lbs./sq.yd.)	26.8

KENTUCKY

Highway	CUMBERLAND PKWY. EB
County	BARREN
GPS section number	211034

SLURRY SEAL SUMMARY

SPS - 3 section number	21B320
Length of application (feet)	690
Application rates	
% of emulsion	15.3
Aggregate (lbs/sq.yd.)	19.1
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	21B330
Length of application (feet)	700
Approximate pounds of sealant used	90
Length of cracks sealed (feet)	225

CHIP SEAL SUMMERY

SPS - 3 section number	21B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.338
Aggregate (lbs./sq.yd.)	27.5 +/-

MANITOBA

Highway	PTH 1
Parish	SIFTON
GPS section number	831801

SLURRY SEAL SUMMARY

SPS - 3 section number	83A320
Length of application (feet)	700
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	20.2
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	83A330
Length of application (feet)	700
Approximate pounds of sealant used	90
Length of cracks sealed (feet)	260

CHIP SEAL SUMMERY

SPS - 3 section number	83A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.306
Aggregate (lbs./sq.yd.)	26.0

MICHIGAN

Highway	US 131 NB
County	MENTCALM
GPS section number	261013

SLURRY SEAL SUMMARY

SPS - 3 section number	26A320
Length of application (feet)	710
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	17.3
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	26A330
Length of application (feet)	700
Approximate pounds of sealant used	600
Length of cracks sealed (feet)	545

CHIP SEAL SUMMERY

SPS - 3 section number	26A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.355
Aggregate (lbs./sq.yd.)	32.7

MICHIGAN

Highway	US 131 SB
County	MECOSTA
GPS section number	261012

SLURRY SEAL SUMMARY

SPS - 3 section number	26B320
Length of application (feet)	709
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	16.7
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	26B330
Length of application (feet)	700
Approximate pounds of sealant used	120
Length of cracks sealed (feet)	403

CHIP SEAL SUMMERY

SPS - 3 section number	26B350
Length of application (feet)	699
Application rates	
Emulsion (gal./sq.yd.)	.335
Aggregate (lbs./sq.yd.)	24.4

MICHIGAN

Highway	ST 61 EB
County	CLARE
GPS section number	261001

SLURRY SEAL SUMMARY

SPS - 3 section number	26C320
Length of application (feet)	709
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	17.3
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	26C330
Length of application (feet)	700
Approximate pounds of sealant used	780
Length of cracks sealed (feet)	1048

CHIP SEAL SUMMERY

SPS - 3 section number	26C350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.294
Aggregate (lbs./sq.yd.)	26.8

MICHIGAN

Highway	ST 579 EB
County	CLARE
GPS section number	261010

SLURRY SEAL SUMMARY

SPS - 3 section number	26D320
Length of application (feet)	713
Application rates	
% of emulsion	15.4
Aggregate (lbs/sq.yd.)	18.4
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	26D330
Length of application (feet)	700
Approximate pounds of sealant used	1440
Length of cracks sealed (feet)	2057

CHIP SEAL SUMMERY

SPS - 3 section number	26D350
Length of application (feet)	697
Application rates	
Emulsion (gal./sq.yd.)	.339
Aggregate (lbs./sq.yd.)	25.6

MINNESOTA

Highway	US 71 SB
County	BELTRAMI
GPS section number	271016

SLURRY SEAL SUMMARY

SPS - 3 section number	27A320
Length of application (feet)	708
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	17.1
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	27A330
Length of application (feet)	700
Approximate pounds of sealant used	1710
Length of cracks sealed (feet)	3173

CHIP SEAL SUMMERY

SPS - 3 section number	27A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.358
Aggregate (lbs./sq.yd.)	23.9

MINNESOTA

Highway	US 2 NB
County	BELTRAMI
GPS section number	276251

SLURRY SEAL SUMMARY

SPS - 3 section number	27B320
Length of application (feet)	711
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	15.7
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	27B330
Length of application (feet)	700
Approximate pounds of sealant used	630
Length of cracks sealed (feet)	1399

CHIP SEAL SUMMERY

SPS - 3 section number	27B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.307
Aggregate (lbs./sq.yd.)	28.2

MINNESOTA

Highway	US 10 EB
County	OTTER TAIL
GPS section number	271028

SLURRY SEAL SUMMARY

SPS - 3 section number	27C320
Length of application (feet)	718
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	16.8
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	27C330
Length of application (feet)	700
Approximate pounds of sealant used	1500
Length of cracks sealed (feet)	1652

CHIP SEAL SUMMERY

SPS - 3 section number	27C350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.307
Aggregate (lbs./sq.yd.)	24.5

MINNESOTA

Highway	US 169 NB
County	MILLE LACS
GPS section number	271019

SLURRY SEAL SUMMARY

SPS - 3 section number	27D320
Length of application (feet)	704
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	18.5
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	27D330
Length of application (feet)	700
Approximate pounds of sealant used	900
Length of cracks sealed (feet)	1210

CHIP SEAL SUMMERY

SPS - 3 section number	27D350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.331
Aggregate (lbs./sq.yd.)	25.1

MISSOURI

Highway	US 54 WB
County	MILLER
GPS section number	291005

SLURRY SEAL SUMMARY

SPS - 3 section number	29A320
Length of application (feet)	701
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	19.7
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	29A330
Length of application (feet)	700
Approximate pounds of sealant used	480
Length of cracks sealed (feet)	923

CHIP SEAL SUMMERY

SPS - 3 section number	29A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.373
Aggregate (lbs./sq.yd.)	31.8

MISSOURI

Highway	ROUTE C WB
County	COLE
GPS section number	291002

SLURRY SEAL SUMMARY

SPS - 3 section number	29B320
Length of application (feet)	704
Application rates	
% of emulsion	15.5
Aggregate (lbs/sq.yd.)	19.0
% of mineral filler (cement)	1.9

CRACK SEAL SUMMERY

SPS - 3 section number	29B330
Length of application (feet)	700
Approximate pounds of sealant used	30
Length of cracks sealed (feet)	31

CHIP SEAL SUMMERY

SPS - 3 section number	29B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.344
Aggregate (lbs./sq.yd.)	28.8

NEBRASKA

Highway	US 6 WB
County	FURNAS
GPS section number	311030

SLURRY SEAL SUMMARY

SPS - 3 section number	31A320
Length of application (feet)	705
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	17.0
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	31A330
Length of application (feet)	700
Approximate pounds of sealant used	60
Length of cracks sealed (feet)	

CHIP SEAL SUMMERY

SPS - 3 section number	31A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.370
Aggregate (lbs./sq.yd.)	23.9+/-

SASKATCHEWAN

Highway	ST 16 EB
Parish	Moose Mountain
GPS section number	906405

SLURRY SEAL SUMMARY

SPS - 3 section number	90B320
Length of application (feet)	704
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	19.8
% of mineral filler (cement)	1.7

CRACK SEAL SUMMERY

SPS - 3 section number	90B330
Length of application (feet)	700
Approximate pounds of sealant used	600
Length of cracks sealed (feet)	950

CHIP SEAL SUMMERY

SPS - 3 section number	90B350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.340
Aggregate (lbs./sq.yd.)	24.1

SASKATCHEWAN

Highway	ST 9
Parish	Moose Mountain
GPS section number	901802

SLURRY SEAL SUMMARY

SPS - 3 section number	90A320
Length of application (feet)	706
Application rates	
% of emulsion	15.2
Aggregate (lbs/sq.yd.)	19.5
% of mineral filler (cement)	1.8

CRACK SEAL SUMMERY

SPS - 3 section number	90A330
Length of application (feet)	700
Approximate pounds of sealant used	630
Length of cracks sealed (feet)	1068

CHIP SEAL SUMMERY

SPS - 3 section number	90A350
Length of application (feet)	700
Application rates	
Emulsion (gal./sq.yd.)	.329
Aggregate (lbs./sq.yd.)	26.8

Appendix D
Project Synopsis and Application Summaries

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
CENTRAL DIRECT FEDERAL DIVISION
555 ZANG ST., P.O. BOX 25246
DENVER, COLORADO 80225

September 5, 1990

IN REPLY REFER TO:
HCO-16

Mr. Richard C. Ingberg
SHRP Regional Engineer
1404 Concordia Avenue
St. Paul, MN. 55104

Dear Mr. Ingberg,

Subj: NCSHRP H-101 SPS-3 Program
Project Synopsis and application summaries.

I have just completed my write-up on the subject project's construction performance. This synopsis is forwarded for your information and for utilization as you see fit. Tom Freemean called early last week and we briefly reviewed project status. I told him that I was preparing a synopsis for you, and of which he requested a copy. He was advised that you would have to make a decision as to the disemination of this data. I thought however, that you would not mind sharing it with TTI.

I also enclose a brief summary of the three applications by test site. I am sure that all of this information has been collected by Braun (in accordance with the protocals requested by TTI); I merely forward them because they are a part of my project summary and they do present them in a more comparable format.

If you have any questions, please feel free to forward them to me at our Lakewood office.

Best Regards

Howard E. Tingley, P.E.

cc: Project files

NCSHRP H-101, SPS-3
SYNOPSIS OF CONSTRUCTION ACTIVITIES
HOWARD E. TINGLEY, PROJECT ENGINEER

The following observations are those of the Project Engineer only, and should not be construed to be from FHWA/CFLHD or from other members of the contract administration team.

During the course of work, meaning the three applications to each of the 22 test sites, I found certain elements/activities to be of interest or of beneficial help in the prosecution of construction activities. These are enumerated below and are presented for your information and consideration.

1. I feel it was most helpful to have a full practice run of applications at the Underwood check site. I would certainly encourage any one who is initiating a test program such as the SPS-3 project to consider such a dress rehearsal. It not only gave the contractor an opportunity to check out his equipment and procedures, but also afforded the Project Engineer and others the chance to get familiar with construction operations and to effect changes which may be desired prior to actual test site applications. Further, it gave the team members (meaning the contractor's team, the Project Engineer, SHRP's representative, and other interested participants) the opportunity to get acquainted prior to actual site construction involvement.

2. During the check run of crack sealing I determined that the hot air lance compressed air feature did not adequately clean out the routed crack. Accordingly, the contractor was directed to broom the surface following routing, then using the air compressor he would blow out the cracks to eliminate any grit or fines left in the cracks which was followed with the hot air lance and application of crack sealant material.

3. During the check run of chip seal, I determined that 3 passes by the rollers on the freshly applied chips were not adequate to obtain a good set. Accordingly, the contractor was directed to use 5 passes of the three rollers, which procedure was accomplished at each test site.

4. Weather, both humidity and temperature, had a significant impact on set-up times for the chip seal and slurry seal applications. Generally, what was good for one was not good for the other. Heat would help the slurry seal to dry out, but would delay adhesion of the chips in an emulsion which remained tacky. (Comments were addressed to FHWA personnel suggesting that an AC-5 base was too soft a stock and that an AC-10 would have performed much better. This comparison certainly deserves some consideration.) Cooler temperatures seemed to quicken chip setting, but would delay evaporation and setting of the slurry seal application. I couldn't determine if a high humidity had any significant impact on

chip seal setting, but it certainly held up slurry seal set-up. The specified 2 hour set time for the slurry seal was seldom observed. This time limit may have worked for laboratory conditions, but field conditions were something else. Although we were never faced with temperature conditions too high for safe/sensible applications, I feel certain that upper temperature limits should be addressed by the specifications in order to prevent attempts at applications when the situation obviously should dictate otherwise.

5. It was the intent of the specifications, and of the Project Engineer, to complete each test site in it's entirety during one day. In most cases, this may not have been in the best interest of good research efforts. As noted above, ideal conditions for one application did not necessarily suit the requirements of another application. I would have preferred to place the chip seal applications and then allow controlled, low speed traffic to work this application prior to brooming. I believe a much better setting of the chips would have been obtained and much less chip displacement experienced as caused by an early brooming. However,the slurry seal application was seldom ready for traffic as soon as the chip seal application. I determined that 2 hours was generally the time allowed for chip seal set-up, this being the time specified for slurry seal. Too often this required an early brooming of the chip seal. Fortunately the slurry seal was not sufficiently dried out in 2 hours to allow traffic on it, in which case chip seal brooming was delayed also. Ideally if we could have had controlled speed traffic over these treatments it would have been beneficial to both slurry seal and chip seal. The traffic would have helped to set the treatments. In fact, I believe that traffic could have sped up the required set time for both treatments. (It is worth mentioning that one site, 171003, did utilize low speed traffic over the chip seal prior to brooming. Traffic control at this site provided pilot car operation which was utilized to help set-up the chip seal. Following approximately 45 minutes of traffic, the chip seal was broomed with positive results regarding lower chip displacement. Follow-up monitoring of this site may establish benefits for this method of operation.)

6. Paint striping seems to encourage surface cracking of the pavement. Apparently the differing expansion/contraction rates of the painted surface relative to unpainted surface facilitates this feature. In most cases, these cracks are thin surface cracks which, when routed, gave no expression of a crack to be sealed. I'm sure these thin cracks have a potential for problem, but wonder if the full crack routing and sealing process is the solution. Also, the 1/8th inch and 12 inch parameters defining cracks to be routed remains a little ambiguous. When should these cracks be measured, dead of the winter or heat of the summer? (I chose to be quite lenient in

this area, and solicited the concerns of local D.O.T. representatives when defining the cracks to be treated.) Further, some areas of extensive alligator cracking left it difficult as to where to start and where to stop. Often times I felt that full crack routing and filling could make a situation worse instead of better. (You may end up creating small areas outlined by crack sealant which leaves them more suceptible to pitting and evantually to cratering.) Extensive alligatoring may be better cured by patching than by crack sealing.

7. The slurry seal machine used on this project had no means for monitoring the amount of water added to the slurry seal mix. This was left up to the practiced eye of the operator. However, most operators may not have the extensive knowledge at hand required to make finite adjustments as necessary to obtain a good application. I believe it would be helpful if you could determine what percentage of water is used in a mix and to monitor success of an application with knowledge of this variable too. During the course of applications, we experienced some problems with slurry mix; after the fact, we can pretty well establish what the causes were, but at the time we struggled for solutions. One element of question was the impact of hard water (still potable, and meeting specification requirement) on a mix and it's set-up time. I wonder if some rather hard water, pumped from a R.V. park well, may have contributed to some of the premature set problems experienced. (The two sites in Saskatchewan were both impacted by portland cement problems. The contractor purchased common "Canadian Type 10" portland cement thinking it was equivalent with U.S. Type I. Local checks seemed to support this feeling, but further check with a Canadian cement manufacturer showed that Canadian Type 2 was equivalent to U.S. Type I and that Canadian Type 10 was their Type 2 with additional limestone rock added. Site 906405 was impacted with a very small amount of Type 10 Canadian cement as the contractor had sufficient Type I to nearly finish the slurry seal, but site 901802 was completed exclusively with the Type 10 cement. The slurry seal application at this site set-up almost as soon as it hit the spreader box and the operator had to increase water to the pug mill as well as to add water by spray into the spreader box. It was only with a lot of hard labor that the slurry seal application was completed. Observation later seemed to indicate an acceptable application, but the site deserves extra concern due to this cement problem). It became obvious this summer that slurry seal is not a science, but more nearly an art. When solicitng bids for this kind of work, it should be considered appropriate to require a certain minimum level of experience for the slurry machine operator; thereby avoiding many of the problems associated with selecting a mix design and fine tuning a slurry mix.

8. Another element of crack sealing difficult to promote was the centering of routing along the crack. The routing machines have no readily adapted means of following cracks. Often the cracks to be routed had 90 degree turns and generally did not conform to a nice even straight line. Most longitudinal cracks wander significantly which made routing them, while keeping the crack centered, a matter of luck as much as anything else. I don't know what the answer is, but certainly a more effective means of routing should be available. Also, how level the road surface is makes a major impact on the depth of routing. The machines had stops whereby a 3/8th inch deep cut could be prepositioned, however, uneven surfaces as encountered on most lanes prevented the contractor from presetting a cut depth. I directed the contractor to use a 3/8" minimum cut, which provided routed cracks to average depths of more nearly 5/8". Another element of crack sealing, introduced by the contractor, was the use of single-ply toilet paper as a blotter. This procedure was most helpful and I appreciated the contractor's input and utilization of the toilet paper which was applied with the use of a long handled paint roller stick. As work progressed on crack routing, the router cutters wore to the outside edge. Routed cracks tended towards a trapazoidal shape. I did not consider this to be a serious breach of construction quality however, at the suggestion of Larry Sellon, I had the contractor replace the cutters for the last two sites. These sites, 291002 and 291005, can be compared with sites just preceeding them (211010, 211034, 181028, & 171003) to see if any significant performance difference results from the change in crack routing shape.

9. I found that wherever the road had super elevation built into a test section, slurry seal spreader box was more difficult to manage. Slurry seal worked best where the road section was level and without too great of grade. Another problem was discovered when the spreader box overhung the shoulder and there was a change of grade, or vertical break at the shoulder. Slurry seal mix would evacuate from underneath the squeegee, again making it difficult to maintain a full spreader box and to manage an even spread to the road surface. Accordingly, I directed the contractor to maintain the slurry spreader box at the edge of the driving lane, and not to overlap the shoulder in an effort to avoid additional application problems.

10. Crack sealant accounting depended primarily on the tar kettle operators eye. Accounting for quantities less than 30 lbs were not considered practical (1/2 box). As material was added, we would keep track of box count, and judge by ending level of material in the tar kettle. In most cases the operator tried to maintain the same level at the beginning of each application and keep track of material required to gain that beginning level. I felt comfortable with this method of

crack sealant use count, and feel we have a good representation of how much material was added to each site. Crack sealant use on the project was very close to that estimated originally.

11. Several organizations took a great deal of interest in this research effort. Some of these organizations tried to discourage implementation of the SPS-3 research programs test site applications; then enlisted individuals who demanded the right to observe construction operations, and to sample and test emulsions, aggregates and slurry mixes. In some cases they did not seem to be sure what they would be testing or how samples would be handled. It was unfortunate that an earlier cooperative effort didn't promote and insure an on-going dialogue and sharing of concerns. To the contrary, several representatives of I.S.S.A., and A.E.M.A. did offer valuable constructive criticism, considerations and insights to the Project Engineer which were most helpful and appreciated.

These are a scattering of concerns which surfaced during the prosecution of this project. I am sure that they are, by no means, the only ones nor the most important. In the brief time allotted to review the project work, they are the ones which came to mind. Of more importance to me, regarding the success of test applications placed, is the concern that an application or site is determined a failure when this failure could more importantly be subscribed to one of the specification/construction constraints mentioned above. I truly hope that the efforts of your construction team have left SHRP with some valuable sites to monitor and have in no manner denigrated the potential value of your research efforts.

Signed: _____
Project Engineer

Date: 5 Sept '90

[redacted]SHRP H-101, SPS-5 [redacted] CHIP SEAL SUMMARY

SITE NO.	SPRAY BAR WIDTH	RUN LNGTH	EFF. SPRAY S.Y.	TNK STICK BEF	TNK STICK AFTR	'GALS USED TOTALIZER	G/S.Y.	AGGREGATE SPREAD RATE WHL PATH	AGGREGATE SPREAD RATE C/L	AGGREGATE SPREAD RATE AVG.
196150	12'0"	699'	984	1043	700	342	.348	20.7	20.8	20.8
201005	13'4"	700'	1089	1435	1025	399	.366	21.7	25.8	23.4
201010	12'0"	701'	987	650	325	339	.343	25.8	23.1	24.4*
311030	13'0"	700'	1063	1180	780	398	.374			24.2
906405	13'0"	700'	1063	1650	1300	345	.324	23.7	24.5	24.1
901802	12'8"	698'	1034	1530	1180	340	.329	25.9	27.8	26.8
831801	12'4"	695'	1004			306	.305	25.8	26.1	26.0
271016	13'4"	701'	1090	800	410	390	.358	23.3	24.5	23.9
276251	13'4"	698'	1086	750	400	333	.307	28.7	27.8	28.2
271028	13'0"	696'	1031	820	450	360	.349	25.2	24.9	25.0
271019	13'4"	699'	1094	1045	690	364	.333	31.2	27.7	29.4
171002	12'0"	698'	983	525	160	362	.368	24.5	26.2	25.4
261013	12'8"	697'	1032	1525	1160	366	.355	35.9	29.5	32.7
261012	13'4"	699'	1087	725	360	364	.335	25.1	23.7	24.4
261001	12'4"	700'	1033	1340	1035	309	.299	26.2	27.4	26.8
261010	12'8"	697'	1032	735	375	350	.339	27.1	24.1	25.6
211010	12'0"	699'		1050	700	362	.368	26.7	26.9	26.8
211034	12'0"	699'		1325	1010	315	.333	25.6	29.4	27.5
181028	14'0"*	659'		625	250	400	.381	29.0	29.3	29.2
171003	12'8"	696'		1225	850	365	.354	29.9	27.1	28.5
291002		699'		?	1160	341	.347	31.7	25.8	28.8
291005	13'0"	696'		675	275	394	.373	36.4	27.3	31.8
MEAN							.345			26.5
ST'D DEV							.023			2.84

* = Practice side application

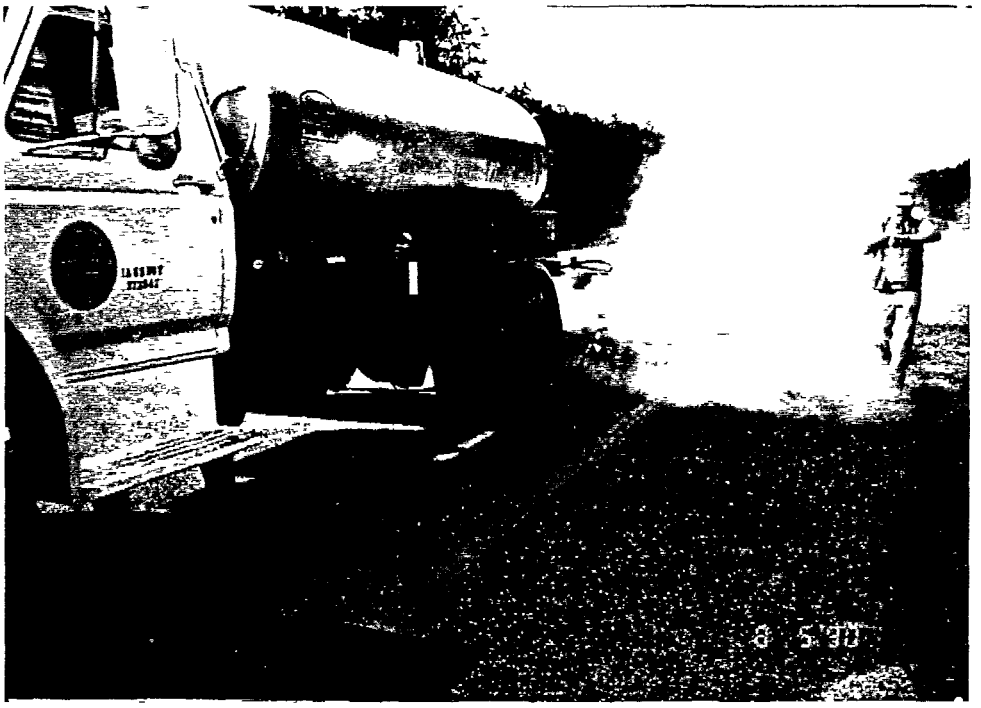
Appendix D

NCSHRP H-101, SPS-3 SLURRY SEAL SUMMARY

SITE NO.	BOX WIDTH	RUN LENGTH	EMULSION PARAMETERS LBS	GALS	PERCENT	CEMENT PARAMETERS LBS	PERCENT	AGG. PARAMETERS LBS	LBS/S.Y.
196150	12'	670'	2572	302.5	15.5	282	1.7	16,560	18.9
201005	12'	695'	2401	282.4	15.2	262	1.7	15,783	17.3
201010	12'	702'	2969	349.2	15.1	333	1.7	19,657	21.5
311030	13'	705'	2629	309.2	15.2	294	1.7	17,262	17.2
906405	12'	704'	3018	355.0	15.2	339	1.7	19,815	19.8
901802	13'	700'	3032	356.6	15.2	339	1.7	19,903	20.0
831801	12'	700'	2918	343.2	15.5	343	1.8	18,833	20.5
271016	13'	708'	2662	313.1	15.5	320	1.9	17,172	17.1
276251	13'	711'	2503	294.4	15.5	300	1.9	16,156	16.0
271028	13'	746'	2775	326.4	15.5	333	1.9	17,957	17.0
271019	13'	704'	2922	343.7	15.5	351	1.9	18,851	18.9
171002	13'	706'	3185	374.6	15.0	338	1.6	21,418	21.3
261013	13'	710'	2711	318.9	15.5	327	1.9	17,457	17.3
261012	13'	709'	2649	311.6	15.5	318	1.9	17,089	17.0
261001	12'	708'	2492	293.1	15.2	299	1.8	16,362	17.6
261010	13'	711	2918	343.2	15.4	349	1.8	18,899	18.7
211010	12'	710'	2788	327.9	15.3	335	1.8	18,257	19.6
211034	12'	690'	2688	316.2	15.3	321	1.8	17,531	19.4
181028	12'	705'	2636	310.0	15.5	316	1.9	16,991	18.4
171003	12'	705'	2732	321.3	15.3	327	1.8	17,852	19.3
291002	12'	704'	2768	325.6	15.5	332	1.9	17,880	19.4
291005	12'	701'	2790	328.2	15.2	335	1.8	18,372	20.0
196150*	12'	700'	2588	304.4	15.1	312	1.8	17,111	18.7
MEAN									18.7
ST'D DEV.									1.47

* = SITE REDONE DUE TO FAILURE OF INITIAL TREATMENT

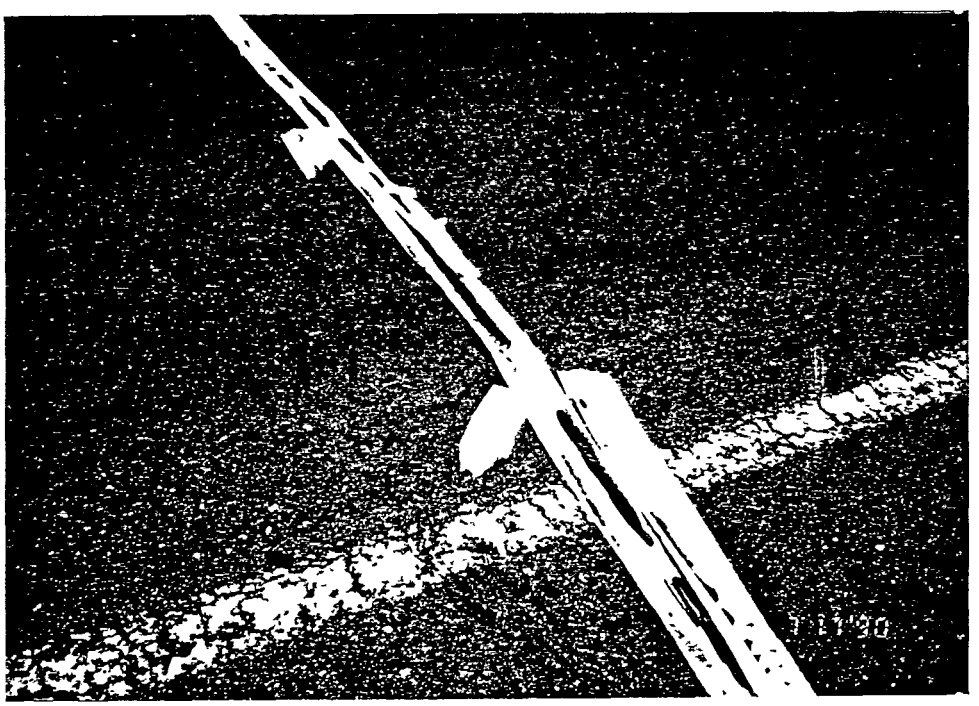
Appendix E
Photographs



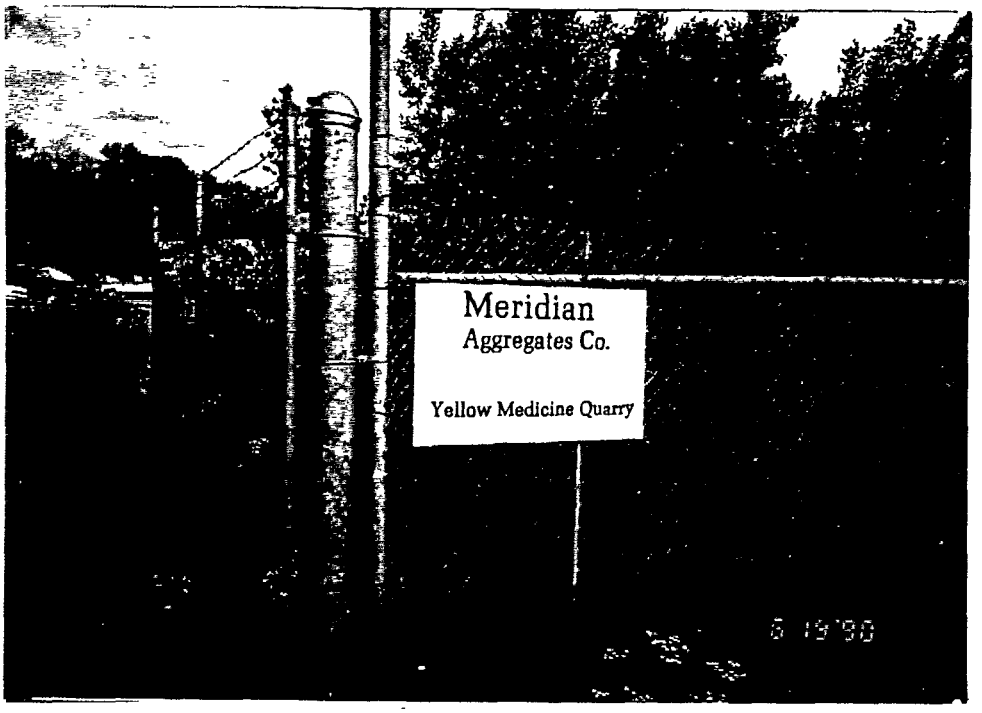
1990 Etnyre Distributor Model SAM_HW was used to apply emulsified asphalt for the chip seal treatment.

Chip spreader applying aggregate at the test section.

Crack seal operation.
Removing loose material after routing and before the heat lance treatment.



Completed crack seal treatment. CRAFCO Road Saver 221, hot-pour sealant was used.
Single-ply toilet tissue was used as a blotter.



Meridian Aggregates Company, Granite Falls, Minnesota.
Aggregate supplier for chip and slurry treatments.

Aggregate in stockpile to be used for chipseal treatments.