

**SPS-7 Construction Report
I-35 Near Ames, Iowa
Sections 190701 to 190710**

SHRP North Central Region

Report Prepared by:

**Ann M. Johnson, P.E.
Braun Intertec Corporation
1983 Sloan Place, Suite 10
St. Paul, MN 55117**

April 1994

**SPS-7 Construction Report
I-35 Near Ames, Iowa
Sections 190701 to 190710**

SHRP North Central Region

Report Prepared by:

**Ann M. Johnson, P.E.
Braun Intertec Corporation
1983 Sloan Place, Suite 10
St. Paul, MN 55117**

April 1994

Table of Contents

SPS-7 Experimental Design and Research Plan	1
Project Details	2
Sampling and Testing	4
Layout	4
Construction	5
Photos	8

List of Figures

Figure 1. Project Location	3
Figure 2. Section Layout	7

List of Tables

Table 1. Experimental Design for SPS-7	2
Table 2. Iowa SPS-7 Section Layout	5
Table 3. Construction Schedule	6

The SPS-7 Experimental Design and Research Plan

The SPS-7 experiment has been developed to study the performance of bonded portland cement concrete (PCC) overlays over existing PCC pavements. The proposed experimental design incorporates factors adapted from the General Pavement Studies on bonded concrete overlays originally described in the May 1986 *SHRP Research Plans*. The objective of the study is to determine the relative influence of the factors that affect the performance of bonded concrete overlays. The primary factors addressed in the study include surface preparation, bonding grout, and concrete overlay thickness. Other factors include type of existing pavement, and subgrade soil. Determining the interaction of the above factors with the influence of environmental factors of climate and traffic will provide substantially improved methods for design and construction of bonded concrete overlay pavements.

Some of the products of this experiment will help accomplish the objectives of the Long Term Pavement Performance project. The key products from the SPS-7 experiment will include an evaluation of the existing design methods, determination of the effects of specific design features on pavement performance, and development of a comprehensive data base for use by state and provincial engineers and other researchers.

Development of the national pavement data base is the first step to facilitate the analyses and produce the other products. This data base will permit centralized and efficient distribution of massive quantities of data to participating highway authorities and researchers. In addition, the data produced by this experiment will be used to evaluate existing design methods and performance equations. The AASHTO basic design equation for rigid pavements can be evaluated by comparing observed serviceability index, derived from profile and distress measurements on each test section against that predicted by the design equation. All of the inputs concerning the pavement structure, traffic, environment, drainage, and material properties will be quantified. Additionally, this experiment will permit the variability associated with each of the inputs to be quantified and allow evaluation of the reliability aspects of the model.

The proposed experimental design consists of the following specific pavement design features:

1. Surface Preparation
 - a. Cold Milling with Sand Blasting
 - b. Shot Blasting
2. Bonding Grout
 - a. Neat-cement Grout
 - b. No Grout
3. PCC Overlay Thickness
 - a. 3 Inches
 - b. 5 inches

Table 1 gives the basic experiment design for the SPS-7 experiment, Bonded Portland Cement Concrete Overlays.

Table 1. Experimental Design for SPS-7

PCC Overlay Factors Within Projects			Factors for Moisture, Temperature and Type of PCC Pavement								
			Wet				Dry				
Surface Prep	Grout	PCC (in)	Freeze		No Freeze		Freeze		No Freeze		
			Traffic Rate Approximately 200 ESAL/Year								
			JCP	CRCP	JCP	CRCP	JCP	CRCP	JCP	CRCP	
Cold Milling Plus Blasting	No	3									
		5									
	Yes	3									
		5									
Shot Blasting	No	3									
		5									
	Yes	3									
		5									

Project Details

The Iowa SPS-7 project was constructed in 1992 and is located in the northbound driving lane of Interstate 35, north of Ames, Iowa (see Figure 1 for project location).

The project involved a bonded PCC overlay of an existing divided concrete interstate highway. The underlying pavement is 8-inch CRCP, which was patched prior to the project beginning. The SPS experiment consisted of 9 test sections and one Iowa DOT control section, and is built in the wet-freeze zone. Subgrade soils on the project are sandy clay.

The project included the nine standard sections and the Iowa DOT control section. No supplemental sections were constructed. The existing concrete pavement was patched with full depth PCC patches, cold milled and sand blasted or shot blasted alone, and a bonded PCC overlay applied.

Interstate 35 carries an average two-way ADT of 11,400, with 29 percent trucks. The estimated design 18K ESAL in the SHRP lane is 668,000 with a total of 17,949,427 18K ESAL applications over the 20-year design period at the present traffic growth rate of 3 percent.

There were no known deviations from project guidelines. All test sections were located between Iowa 175 and County Road D-41. There are no horizontal curves located in the SHRP areas and the vertical grade in the sections varies from +0.00 percent to +1.001 percent in the direction of travel. All sections are located on fill sections.

There are also several structures within the sections that are four or more feet below the surface.

- ▷ Section 190703 - Median Drain approx. 4 ft. below CL elevation
- ▷ Section 190706 - 12 inch Subdrain
- ▷ Section 190704 - 8 inch Subdrain

No weather station has been installed to date. A weigh-in-motion system was installed and is operating at station 548+00, by GK. The Toledo Model 9430 High Speed WIM System provides automatic high speed weighing, classifying and data collection. It is completely automatic, and reports and collected data are available on demand via a telephone modem or at the site.

Sampling and Testing

The Iowa DOT conducted their own sampling and testing, and also provided their own Resident Engineer. Vicki Dumdei, P.E. served as Construction Engineer and Charles Potter, P.E. coordinated all sampling and testing for the DOT. A listing of all people who were actively involved in the project is shown below:

Iowa Department of Transportation:

Charles Potter
Bernie Brown
Iowa DOT
800 Lincoln Way
Ames, Iowa 50010
(515) 239-1309

Vicki Dumdei
Ames Construction Residency
Iowa DOT
Hwy 30 East
Ames, Iowa 50010
(515) 239-1033

North Central Regional Coordination Office:

Gene Skok
Ann Johnson
Ron Urbach
Braun Intertec
1983 Sloan Place - Suite 10
St. Paul, MN 55117
(612) 776-7522

Richard Ingberg
FHWA
1983 Sloan Place - Suite 10
St. Paul, MN 55117
(612) 776-2210

Layout

Beginning at the south end of the project, sections were laid out according to overlay thickness and surface preparation method. The Iowa DOT control section was first, followed by the three-inch overlay. The five-inch overlay with cement grout was next, followed by the five-inch overlay with cold mill. A state experiment, consisting of a five-inch overlay with optional cold milling and a cement grout was next. The next two sections consisted of five-inch overlays with shot-blasted surface preparation, and the last two sections were also shot-blasted, with three-inch overlays.

Figure 2 shows the section layout, and Table 2 gives a description of the sections.

Table 2. Iowa SPS-7 Section Layout

Construction Station	SHRP ID	Surface			
		Thickness (Design)	Thickness (Actual)	Strength (Design)	Ave. Strength (Actual)
422+25 - 427+25	190701	0	0	NA	NA
461+50 - 466+50	190703	3	3.68	500	400
468+50 - 473+50	190702	3	3.61	500	540
501+00 - 506+00	190709	5	5.18	500	620
510+00 - 515+00	190708	5	5.57	500	490
527+00 - 532+00	190710	5	No data		
585+00 - 590+00	190707	5	6.36	500	540
595+00 - 600+00	190706	5	4.40	500	550
613+00 - 618+00	190705	3	4.43	500	460
621+85 - 626+85	190704	3	4.67	500	No data

Construction

The completed overlay was thicker than specified in several locations. Before the overlay was placed, the Iowa DOT decided that, because the original surface was rough, smoothness was the most important consideration for the finished overlay. Design thickness was established at six feet from the edge of pavement, but the stringline was mistakenly set to avoid any minimum thickness instead of design thickness. Actual thicknesses are shown in Table 2.

After much consideration, the project was kept in the SPS program, with the thicknesses of the sections unmodified.

The general contractor for this project is listed below:

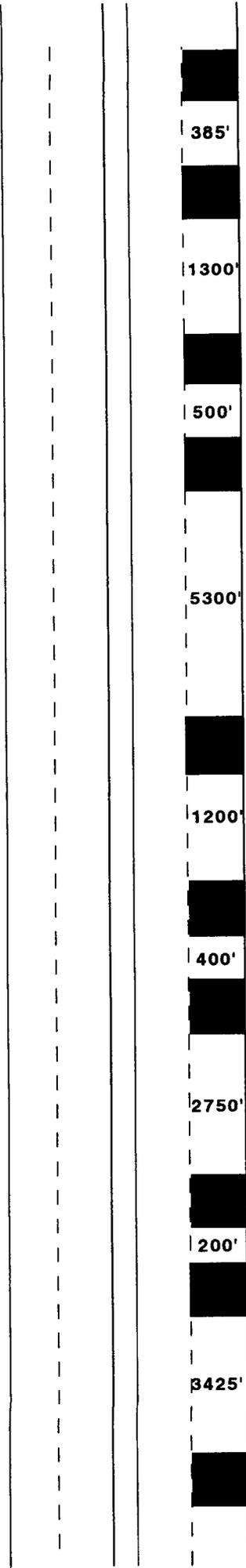
Irving F. Jensen Construction
P.O. Box 1618
Sioux City, Iowa 51102-1618

Phone: (712) 252-1891

They performed all paving work on the project. Table 3 outlines the construction schedule information.

Table 3. Construction Schedule

SPS: 7				Agency: Iowa	
Test Section		Construction		Range of Thicknesses (inches)	MST Completed
Layer	Designation	Start	Complete		
1A	3" Overlay	May 1992	October 1992	3.61 - 4.67	Yes
1B	5" Overlay	May 1992	October 1992	4.40 - 6.36	Yes
<p>Dates:</p> <p>Opened to Traffic: November 1992 WIM Installed: October 1992 WIM Operational: October 1992 Weather Station Installed: Not to date Weather Station Operational: No</p>					
Significant Factors Which May Affect Performance of Section					
<p>Environmental None</p>					
<p>Construction Contractor placed concrete overlay at a minimum thickness, not design thickness. Therefore, every section has overlay thickness out of tolerance from SHRP guidelines. Average thicknesses are shown above.</p>					



190704
 SHOT BLAST, 3" O.L.
 STA 621+85 - 626+85

190705
 SHOT BLAST, CEMENT GRT, 3" O.L.
 STA 613+00 - 618+00

190706
 SHOT BLAST, CEMENT GRT, 5" O.L.
 STA 595+00 - 600+00

190707
 SHOT BLAST, 5" O.L.
 STA 585+00 - 590+00

STATE EXP
190710
 COLD MIL(OPT), CEMENT GRT, 5" O.L.
 STA 527+00 - 532+00

190708
 COLD MILL, 5" O.L.
 STA 510+00 - 515+00

190709
 COLD MILL, CEMENT GRT, 5" O.L.
 STA 501+00 - 506+00

190702
 COLD MILL, CEMENT GRT, 3" O.L.
 STA 468+50 - 473+50

190703
 COLD MILL, 3" O.L.
 STA 461+50 - 466+50

190701
 CONTROL SECTION
 STA 422+25 - 427+25

IOWA SPS-7
I-35 NB.
20 MI. N. OF AMES, IA

8" ORIGINAL PCC
 SEPT 1992



Figure 2. Section Layout



Section 190701
Control Section



Section 190703
Prior to Milling



**Section 190704
Surface Condition Prior to Shotblast**



Full-depth Patch Prior to Surface Treatment



**Section 190707
Prior to Shotblast**



**Section 190705
Prior to Shotblast**