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STRATEGIC HIGHWAY RESEARCH PROGRAM

SPECIFIC PAVEMENT STUDIES
CONSTRUCTION GUIDELINES FOR EXPERIMENT SPS-7, BONDED PORTLAND CEMENT CONCRETE OVERLAYS

STRATEGIC HIGHWAY RESEARCH PROGRAM
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SPECIFIC PAVEMENT STUDIES
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INTRODUCTION

This report describes guidelines for the construction of test sections included in the Specific Pavement Studies' experiment SPS-7, Bonded Portland Cement Concrete Overlays. These guidelines have been developed by SHRP in cooperation with state and provincial agency personnel participation in various meetings, including a working group meeting held in Ames, Iowa, on May 9, 1990. The recommendations of the participants and comments furnished by other highway agency personnel are incorporated in the guidelines outlined in this report. These guidelines will help participating highway agencies develop acceptable construction plans for test sections for this experiment.

The SPS-7 experiment, Bonded Portland Cement Concrete Overlays, requires the construction of multiple test sections with similar details and materials in each of the four climatic regions at existing jointed concrete pavements (JCP) and at existing continuously reinforced concrete pavements (CRCP). The experimental design and construction considerations for this experiment are described in the document, "Specific Pavement Studies: Experimental Design and Research Plan for Experiment SPS-7, Bonded Portland Cement Concrete Overlays," February 1990. The experiment has been developed as a coordinated national experiment to develop improved design and construction procedures that should benefit the entire highway community. Therefore, it is important to control construction uniformity at all test sites to reduce the influence of construction variability on test results. Consequently, the construction guidelines outlined in this report must be followed by all participating highway agencies to help accomplish the desired objectives of the experiment.

OBJECTIVE

The objective of this document is to provide guidelines for preparing and constructing SPS-7 test sections with the intent to maximize uniformity of these procedures across all projects. More specifically, the objectives are:

- To review the major construction features of the different test sections.
- To describe the details of the different experimental features included in the experiment.
- To provide specification for construction materials such as bonding grout and portland cement concrete (PCC) mix design.
- To provide specifications for typical design and construction details such as pre-overlay repairs and surface preparation.
- To describe the general construction operations and as-built requirements.

In addition, special considerations related to geometric corrections and treatments that should not to be performed on the test sections are addressed in this document.

EXPERIMENTAL DESIGN

The experimental design, as shown in Table 1, includes the following four study factors:

1. Existing Pavement Type - Jointed concrete pavement (plain or reinforced) and continuously reinforced concrete pavement

2. Overlay Thickness - 3 inch and 5 inch

3. Bonding Grout - Neat cement grout and no grout

Table 1. Experimental Design for SPS-7, Bonded Portland Cement Concrete Overlays

PCC OVERLAY FACTORS WITHIN PROJECTS			FACTORS FOR MOISTURE, TEMPERATURE, AND TYPE OF PCC PAVEMENT							
			WET				DRY			
			FREEZE		NO FREEZE		FREEZE		NO FREEZE	
			TRAFFIC RATE ≥ 200 KESAL/YR							
OVERLAY PREPARATION	GROUT (YES/NO)	PCC OVERLAY THICKNESS	JCP	CRCP	JCP	CRCP	JCP	CRCP	JCP	CRCP
Cold Milling Plus Sand Blasting	N	3"								
		5"								
	Y	3"								
		5"								
Shot Blasting	N	3"								
		5"								
	Y	3"								
		5"								

4. Surface Preparation - Cold milling plus sand-blasting and shotblasting

The experiment requires construction of eight test sections plus a control test section at each site. The control test section receives only routine type of maintenance and no overlay.

TEST SECTIONS

The experimental features of the different test sections at each test site is given in Table 2. The test section numbers indicated in this table are used to reference the test sections in the remainder of this document.

Each test section must be constructed as uniformly as practical over a length of 600 feet to allow 500 feet for monitoring and 50 feet at each end for destructive materials sampling.

The sequence of test sections at each test site should be arranged to accommodate site specific conditions and allow construction expendiency. Items to be considered in ordering test sections at a particular site include grouping of sections by thickness and by surface preparation type within a given group of thickness. An example of test section layout and the test section numbering is illustrated in Figure 1.

EXISTING PAVEMENT CONDITION

Each project proposed for the SPS-7 experiment should be in a relatively good structural condition, exhibit no significant surface deterioration, and be considered a good candidate for bonded concrete overlays based on current engineering judgement. Each potential project must be carefully evaluated to determine if a bonded overlay will extend the service life of the existing pavement. The type, severity, and extent of distress present in the existing

Table 2. Test section numbering scheme.

Section Number	Surface Preparation	Cement Grout	Overlay Thickness inches
01	Control Section	-	-
02	Milling	Yes	3
03	Milling	No	3
04	Shot Blasting	No	3
05	Shot Blasting	Yes	3
06	Shot Blasting	Yes	5
07	Shot Blasting	No	5
08	Milling	No	5
09	Milling	Yes	5
10	Supplemental	Open	Open

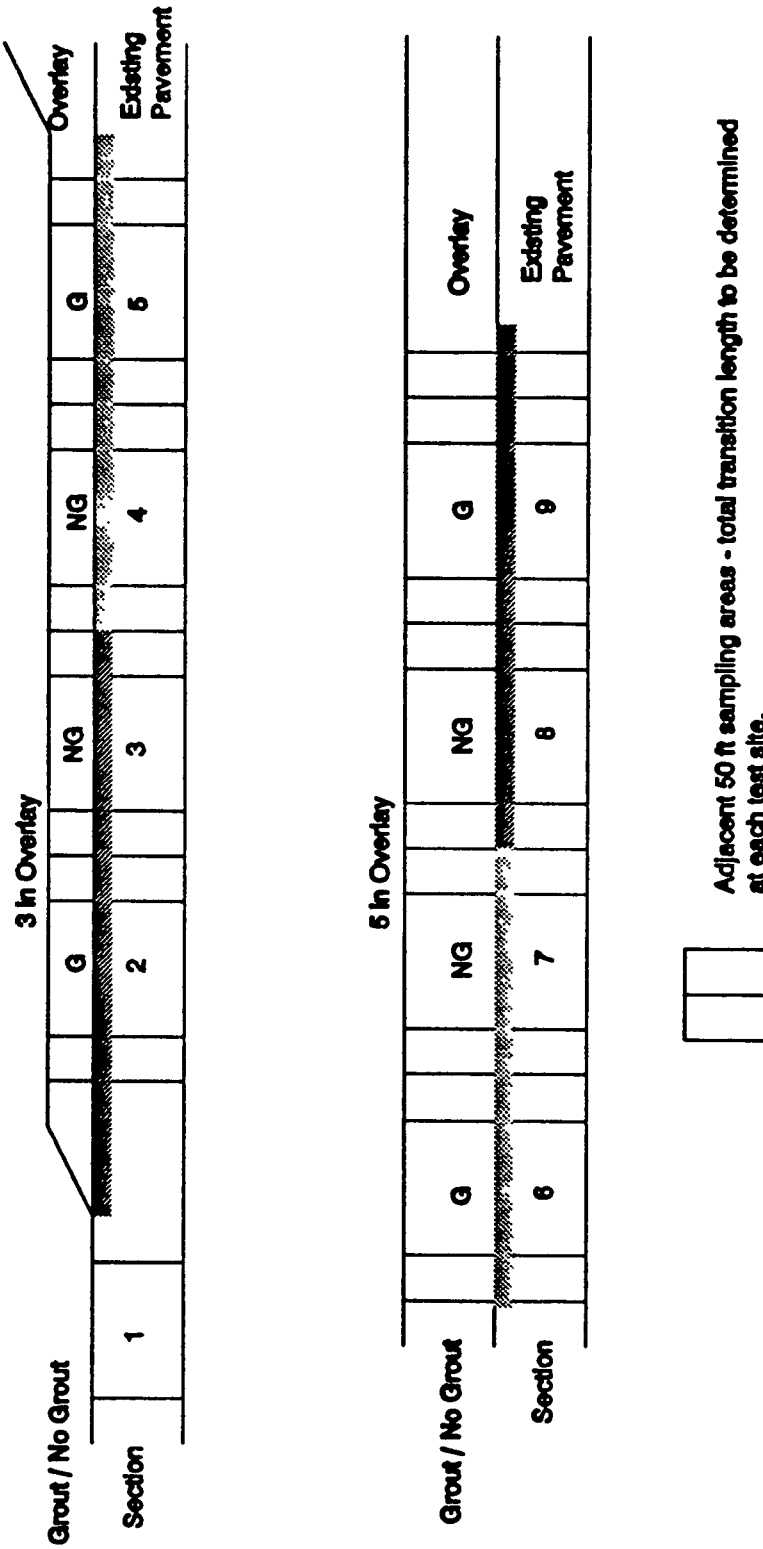


Figure 1. Typical Test Section Layout.

pavement must be carefully analyzed to determine if the project is a suitable candidate for a bonded concrete overlay. Table 3 lists the common distress types encountered in concrete pavements and the repair required before placing a bonded concrete overlay. Projects exhibiting "D" cracking or aggregate reactivity problems are not considered suitable candidates for the SPS-7 experiment. The candidate project must not have more than 5 percent of surface area requiring full depth repairs to correct structural failures.

ACTIVITIES ON CONTROL SECTION

Repairs and other maintenance operations on the control test section should be limited to only those activities needed to keep the section in a safe and functional condition. These activities should be performed in accordance with the standard practices and procedures of the participating highway agency. The change in the condition of the control section will be used as an indicator of the change that might be expected in the other test sections if they had not been rehabilitated.

PRE-OVERLAY REPAIR OF EXISTING PAVEMENT

Pre-overlay repair shall include all repair operations necessary to bring the existing pavement to a condition suitable for overlay. Pre-overlay repairs include the following operations:

- Partial-depth patching
- Full-depth patching
- Reflective crack control
- Joint sealing
- Load transfer restoration
- Undersealing
- Edge drainage installation

Table 3. Distress Types and Pre-Overlay Repair Requirements.

Distress Type	Pre-Overlay Repair Procedure
Pumping	Undersealing
Faulting	Undersealing, Load transfer restoration
Corner Break	Full-depth patching
Punch-outs (CRCP)	Full-depth patching
Joint Spalling	Full-depth patching, Partial-depth patching
Transverse Cracking	Full-depth patching, Reflective crack control
Longitudinal Cracking	Full-depth patching, Reflective crack control
Scaling*	None (part of surface removal operation)
Wheel Path Rutting	None (part of surface removal operation)

*If scaling is severe and wide-spread, the suitability of the project for this experiment should be evaluated.

Partial-Depth Repair

Partial-depth repair shall consist of the removal of localized areas of deteriorated concrete material. Partial-depth repairs will generally be required only along spalled joints and cracks where the depth of repair shall not extend beyond the upper one third of the slab thickness. If asphalt concrete patches exist, they shall be removed to expose sound concrete. When the depth of removal exceeds 2 inches, the area removed shall be filled with repair concrete material prior to surface removal operation. Repair concrete must achieve a minimum compressive strength 3,000 psi at the time of surface preparation activity to prevent damage during the preparation operations. No organic compound (asphalt concrete, epoxies, etc.) shall be used for the partial-depth repair. When the depth of removal is less than 2 inches, the area removed shall be filled during the overlay paving operation. Compressible inserts shall be placed in all working cracks and joints for the entire depth of the partial-depth repair. Reinforcing steel (deformed bars) shall be used over working cracks for reflective crack control as described in this report under, "Reflective Crack Control".

Partial-depth concrete removal by cold milling is required for the test sections where cold milling is specified for surface preparation (Sections 2, 3, 8, and 9). Partial depth concrete removal by cold milling may also be used for the test sections where shotblasting is specified for surface preparation (Sections 4, 5, 6, and 7) if it is consistent with the agency's practice. If chipping hammers are used to remove unsound concrete, they should be limited to the 30 pound category.

Full-Depth Repair for Jointed Concrete Pavements

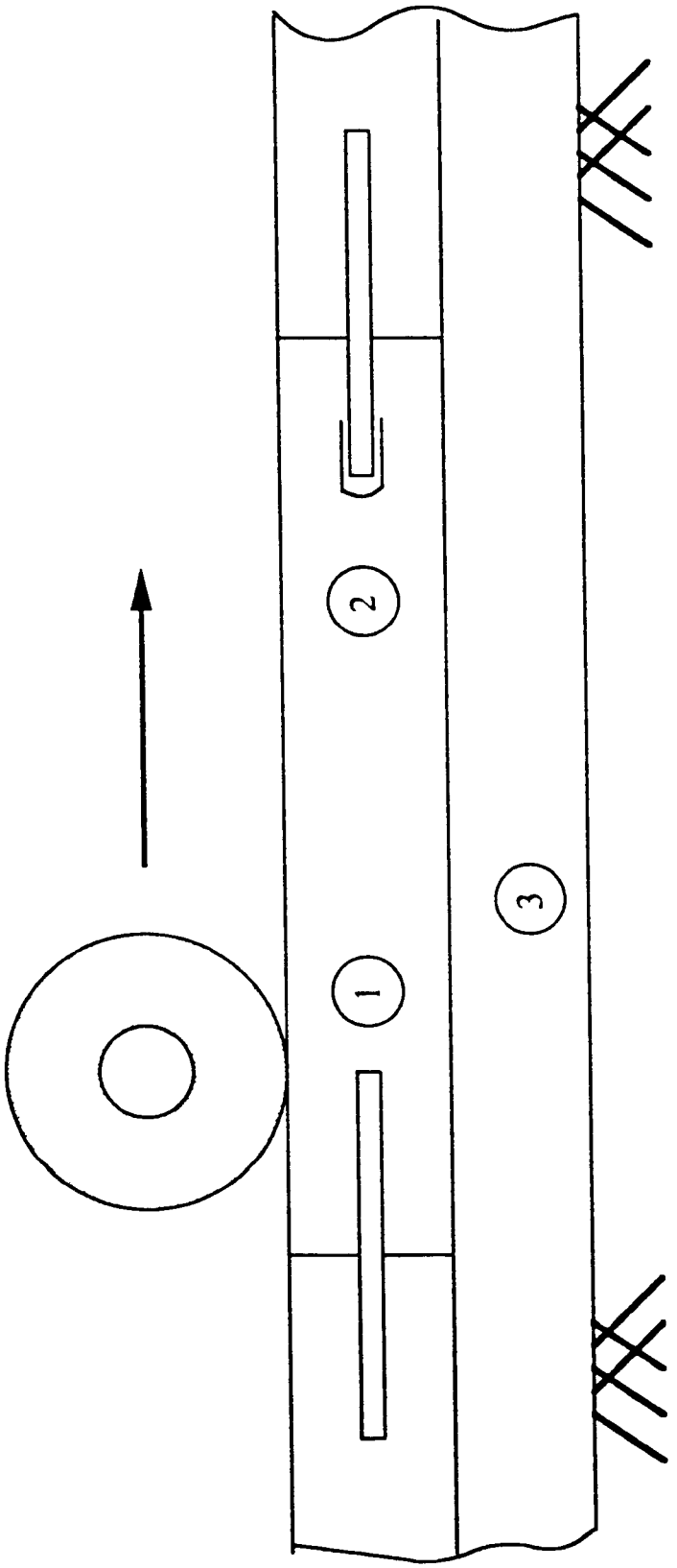
When an existing jointed concrete pavement exhibits serious joint or crack deterioration problems, such as severe spalling and corner cracks, then full-depth repair is warranted. Full-depth repair requires removal and replacement of existing concrete pavement for its full depth at the specified locations. Full-depth repair shall be performed in accordance with the following guidelines:

- Patches shall be a minimum of 6 feet in length and full lane width.
- Only portland cement concrete patching material should be used.
- After removal of the deteriorated pavement section, the exposed subbase must be restored to a suitable condition. Undercuts must be replaced to the existing grade level with similar materials. Patch thickness must be equal to that of the adjacent slabs.
- Deformed tie bars or smooth dowels shall be used along the transverse edges of the patch, as shown in Figure 2, and spaced according to agency requirements. Deformed tie bars and dowels should be used for the approach and leave joints of the full-depth patch, respectively. At least 4 bars should be used per wheel path at each joint. Eighteen inch long, epoxy-coated dowels with 1 1/4 inch (1 1/2 inch preferred) diameter and spaced 12 inches on centers are recommended.
- Full-depth patches shall be installed prior to surface preparation operations allowing adequate time for curing of the concrete patch and attaining a compressive strength of at least 3,000 psi prior to commencement of such operations.
- All working joints in the full-depth repair shall be treated (filled or covered) to minimize intrusion of the overlay concrete into the joint space. This can be achieved by using the appropriate size backer rod or other compressible material at the joint surface.

Full-Depth Repair for Continuously Reinforced Concrete Pavements

For existing continuously reinforced concrete pavements (CRCP), full-depth patching may be warranted for repair of areas exhibiting punch-out distress. This full depth repair of existing CRCP should be performed in accordance with the following guidelines:

- Patches shall be a minimum of 10 feet in length and full lane width.
- After removal of the deteriorated pavement section, the exposed subbase must be restored to a suitable condition. Undercuts must be replaced to the existing grade level with similar materials. Patch thickness must be equal to that of the adjacent slabs.



1. Deformed bar - Agency practice
2. Smooth dowel grouted in old pavement capped or debonding agent in patch
3. Subbase restored to proper condition

Figure 2. Full-Depth Patch.

- Reinforcing steel in the patch area must be replaced to provide continuity of reinforcement. The continuity is provided by splicing or mechanically connecting the reinforcing steel in the patch area to that in the existing pavement. When using mechanical connectors, only one end of the steel bars in the patch area will be connected to the steel bar in the existing pavement. Continuity of the reinforcing steel in the patch area will be provided by lapping the appropriate pairs of steel bars. Steel bars in the patch area shall be of the same grade and size as those in the existing pavement.
- Lap length for splicing shall be at least 25 times the diameter of the reinforcing steel. The length of overlap for mechanical connectors will be that required by the agency's normal practice. Mechanical connectors should provide a minimum yield strength of 125% that of the reinforcing steel.
- Only portland cement concrete patching material should be used. The concrete in the patch area shall be adequately consolidated around the steel bars by internal vibration. Placement of concrete in the patch during late evening is recommended to minimize the crushing of the patch concrete by adjacent existing concrete pavement expansion.
- Concrete in the full depth patches shall have attained a compressive strength of at least 3,000 psi at the time of surface preparation operations so that the patch will not be damaged by such operations.

Reflective Crack Control

Reflective crack control procedures should be used for all working cracks. However, cracks which have low load transfer efficiency (indicating a loss of aggregate interlock), severely spalled, faulted, or exhibit pumping should be corrected by full-depth patching. Reflective crack control consists of placing deformed steel bars (tie bars) across the crack. The deformed bars shall be epoxy-coated and firmly placed and fastened above a crack in the existing pavement. The bars may be placed on chairs or directly over the pavement surface. In any case, a minimum of 2 inches of concrete cover must be provided.

The deformed steel bars shall be No. 4 or 5 bars centered at right angles to the crack, and spaced 30 inches on centers. Minimum bar length should be 24 inches. To achieve the minimum cover requirement, the deformed bars may be placed in recessed areas or slots along the length of the crack. A typical arrangement for deformed bar placement is shown in Figure 3.

Longitudinal cracks in jointed concrete pavements may alternatively be treated by using the cross-stitching technique. Cross-stitching prevents crack opening and pavement separation at the longitudinal crack. The cross-stitching procedure requires drilling of holes at a 35-degree angle through the crack. The holes intersect through the crack at mid-depth. Number six deformed bars are then inserted into the holes and grouted. Hole spacing should not exceed 30 inches. Cross-stitching is illustrated in Figure 4.

Joint Treatment

All existing pavement joints must be protected to keep the bonding grout and the overlay concrete from penetrating into the unsealed joint reservoir. This will help eliminate problems associated with the compressive stresses caused by thermal expansion. The use of an appropriate size of backer rod or other compressible material at the joint surface should provide the necessary protection.

Load Transfer Restoration

Restoration of load transfer across joints without load transfer devices and working cracks shall be performed when the load transfer across these discontinuities is less than 70%. Load transfer should be measured with a heavy load (~ 9,000 lb) in early morning or during cool weather. Air temperature at time of testing should not be greater than 70° F. Load transfer is computed as follows:

$$LT = A^* \delta_{ul}/\delta_l * 100$$

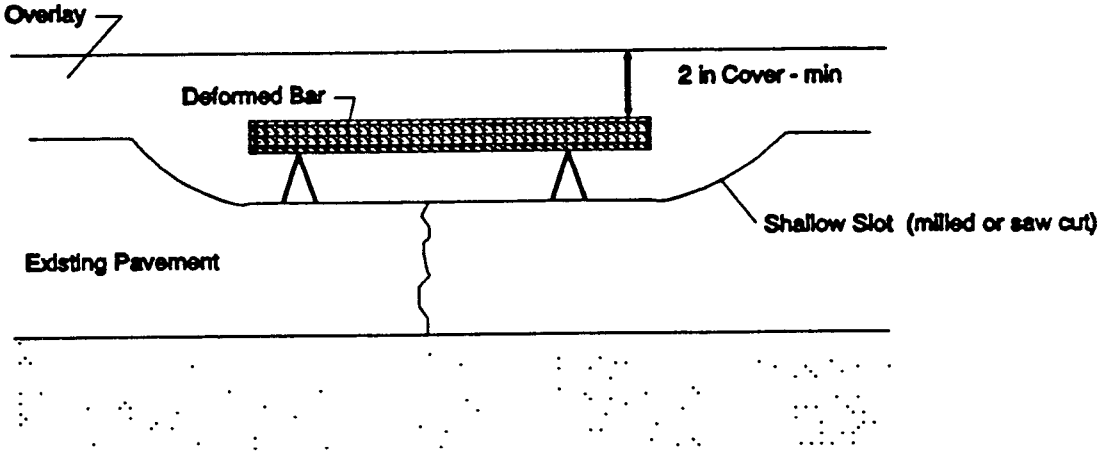


Figure 3. Reflective Crack Control

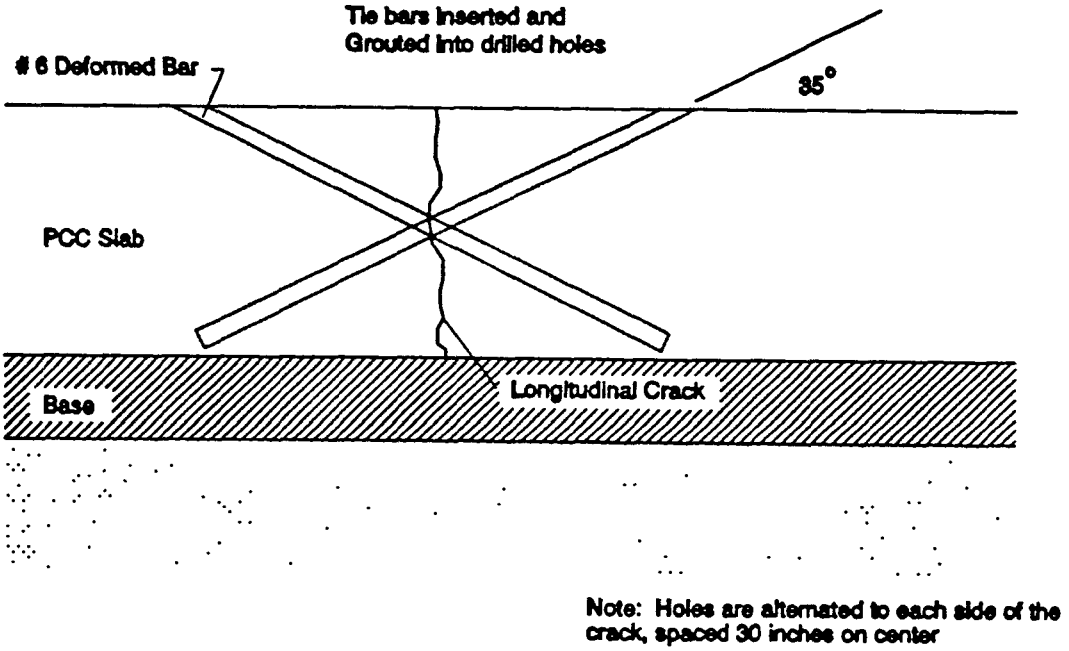


Figure 4. Schematic of Cross-Stitching Repair

where

LT = percent load transfer

A = 1 if X $\leq$ 12"

A = δ_o/δ_x if X > 12"

X = distance between deflection measurements points δ_o and δ_x, and δ_l and δ_{ul}, inches (it is preferred that X$\leq$ 12")

δ_o = center load deflection for mid-slab test (at same load level as δ_l)

δ_x = mid-slab deflection measured X distance from δ_o

δ_l = center load deflection for test at edge of crack or joint

δ_{ul} = deflection of the surface of the unloaded slab X distance from δ_l

Load transfer at joints and working cracks shall be restored by means of full depth patching or by use of retrofitted dowel bars. The following guidelines should be observed when performing load transfer restoration by means of retrofitted dowel bars:

- Retrofit smooth round dowels are installed in slots cut into the pavement surface.
- Only epoxy coated, smooth, round dowel bars, with a minimum diameter of 1.25 inches (1.5 inches preferred), 18 inch long, shall be used.
- Dowel bars should be spaced according to agency requirements. However, a minimum of 4 bars should be used per wheel path.
- Portland cement concrete or other suitable material shall be used to back-fill around dowels.

Undersealing

The intent of undersealing is to fill small voids between the slab and subbase in an effort to restore full support to the slab and seal interface water flow channels. Undersealing should not be used to adjust the vertical profile of the slabs. Undersealing procedures should be based on acceptable participating agency's practice. However, the following guidelines should be observed when performing undersealing:

- Undersealing should be performed only where the existence of voids beneath the concrete slab can be demonstrated according to current engineering practice used by the agency.
- Undersealing should be performed prior to any surface preparation operation.
- Only pozzolanic-cement grouts (natural or synthetic) or limestone-cement grouts are permitted. Fly ash shall conform to ASTM designation C 618 for either Class C or Class F fly ash.
- Limestone and crystalline structures used in the grout shall be spherical with a gradation of 95% passing No. 30 sieve and 30% passing the No. 200 sieve.
- Additives and admixtures may be used if proven to work successfully.
- Injection grout holes shall be placed at least three feet away from existing subsurface drainage structures.
- An inspection hole should be located near pavement edge to monitor the entry of grout into any existing edge drainage system.
- Grout pumping shall be stopped if any of the following conditions occur:

  - Vertical movement of the slab or shoulder is detected.
  - Grout is observed coming out of observation holes or subsurface drainage structures.
  - A rapid increase in pumping pressure occurs.

- Any grout entering pavement joints shall be removed to maintain proper joint openings.
- Any cracks developed due to the subsealing operations must be sealed by epoxy injection (structural repair) or repaired by full-depth patches.
- Traffic should be kept off the area until the grout cures or for a minimum of 2 hours.
- Undersealing should be performed before installing edge drainage.

Follow-up testing should be performed to assess undersealing effectiveness using participating agency's procedure. Alternately, undersealing effectiveness may be evaluated by measuring slab deflection at the joints under truck loading before and after undersealing using the procedure described in AASHTO Guide Specifications for Highway Contruction, 1988.

Edge Drainage Installation

Edge drainage installation is not required for this experiment. However, edge drainage may be installed if its use represents the practice normally followed by the agency. If edge drainage is installed, it shall be installed for all test sections, including the control section. Agency practice shall be followed for specifying and installing edge drainage.

PREPARATION OF EXISTING PAVEMENT SURFACE

A clean and sound concrete surface is necessary to the development of adequate bond strength between the overlay and the existing pavement. Surface preparation involves three basic steps as follows:

1. Surface Removal - performed to remove foreign matter and contaminants from the surface and exposing sound concrete. For this experiment, surface removal is to be accomplished using cold milling equipment or shotblasting equipment.
2. Secondary Cleaning - performed to remove all dust and other debris before placing the overlay. Secondary cleaning is not required if shotblasting procedure is used for surface removal.
3. Final Cleaning - performed to remove dust and other particulate matter just ahead of the overlay paving operations.

Surface Removal by Cold Milling

Cold milling equipment shall be a power-operated mechanical scarifier capable of uniformly scarifying or removing the existing pavement surface to a depth of at least 1/4 inch. The contractor should supply a means to collect and

dispose of dust and other particulate matter produced from the use of this equipment. Where surface distress such as joint spalling and scaling exist, then these areas may be prepared during the milling operation. At such localized distressed areas, deeper milling should be used to remove the deteriorated concrete and thus expose the sound concrete.

Surface Removal by Shotblasting

Shotblasting equipment shall be a mechanical unit that propels steel shot against the pavement surface and capable of removing all surface contaminants and up to 1/8 inch of the existing concrete surface. The equipment must contain a means for collection of used shot so that it may be recycled. The contractor shall provide a means of collecting and disposing of dust and other particulate matter produced from this procedure. It is recommended that the shot blasting equipment provides a wide coverage. Since multiple units (or passes) will be required to provide full-width coverage, care must be taken to ensure that no portion of the pavement is left untreated.

Secondary Surface Cleaning

Secondary cleaning is required after cold milling but not necessarily after shotblasting. Secondary cleaning may not be required after shotblasting operation if it can be demonstrated that the shotblasting equipment will provide a suitable surface for overlay placement.

Secondary cleaning shall be performed by using at least one of the following procedures:

Sandblasting - Sandblasting shall be capable of loosening and removing all particulate matter from the surface of the pavement after surface removal operations.

High-Pressure Water Blasting with Abrasives - High-pressure water blasting with sand or other abrasives shall be capable of removing all particulate matter and surface contaminants.

High-Pressure Water Blasting - High-pressure water blasting with pressures in excess of 6,000 psi shall be capable of cleaning the surface of oil, dirt, paints, and other contaminants.

Final Cleaning

Final cleaning must be performed to remove dust and other particulate matter just ahead of the overlay placement operation. Airblowing equipment or mechanical sweepers can be used for this purpose. Airblowing equipment should be equipped with filters that prevent compressor oil from being sprayed with the air.

The prepared existing concrete pavement surface shall not be wetted before grout and overlay concrete are placed. The prepared surface shall be dry to allow absorption of the grout or the concrete paste.

GROUT REQUIREMENTS

This experiment requires use of a bonding grout for Test Sections 2, 5, 6, and 9. The bonding grout shall be a neat cement grout consisting of two parts portland cement and one part water by weight. The grout shall be agitated prior to and during use. Grout that is not placed within 90 minutes after mixing shall not be used. Bonding grout shall not be used on Test Sections 3, 4, 7, and 8.

OVERLAY CONCRETE MIX DESIGN

The quality of concrete as delivered and as-placed and the subsequent strength development in concrete are critical factors in concrete pavement performance. Although only the strength property (flexural strength) is normally considered in evaluating the structural behavior of concrete pavements, durability related properties (entrained air content, aggregate type, degree of consolidation) also influence the long-term performance of the pavement.

For this experiment, only one concrete strength level is to be used. The concrete mix shall be designed for a 14-day nominal flexural strength (third point loading) of 500 to 700 psi. The concrete mix shall be designed according to the procedures and specifications followed the participating agency. It is recommended that a slip-form method be used for placement of the concrete overlay. In such a case, slump of the as-delivered concrete shall not exceed 2 1/2 inch. The general requirements for the overlay concrete are as follows:

- Flexural strength - 500 to 700 psi at 14 days
- Slump (slip-formed paving) - 1 to 2 1/2 inch
- Air Content - 6 1/2% $\pm$ 1 1/2 %

Materials

Material requirements for the overlay concrete should be based on the normal practice of the participating agency. Many agencies have specific requirements for coarse and fine aggregates based on durability concerns as well as availability of quality aggregates within the locality. However, it is necessary to maintain a high degree of uniformity and consistency in the construction of the test sections to achieve the objectives of this coordinated national experiment. Therefore, concrete materials must conform to certain minimum requirements to insure consistency in the overlay concrete quality at the different test sites.

Portland Cement - Only Type I or Type II portland cement shall be used (Type III portland cement shall not be used). The cement used shall meet the requirements of AASHTO Specification M85.

Fly Ash - Fly ash may be used as substitute for a portion of the portland cement. The amount of substitution shall not exceed 15% by weight of cement. The fly ash replacement amount shall be determined through laboratory trial mix investigations, using the same materials proposed for the project. Use of either Class C or Class F fly ash meeting the specific requirements of the agency is permitted. Participating agency's

practice concerning the use of fly ash in concrete in certain months of the year should be observed.

Fine Aggregate - Fine aggregate (passing the No. 8 sieve) shall consist of natural sand, manufactured sand, stone screenings, slag screenings, or a combination thereof, and meet the quality requirement of AASHTO M6. The fineness modulus of the fine aggregate shall not be less than 2.3 and shall not be greater than 3.1.

Coarse Aggregate - Coarse aggregate (retained on the No. 8 sieve) shall consist of crushed gravel or crushed stone particles meeting the requirements of AASHTO M80. It is recommended that the coarse aggregate gradation conforms to AASHTO 57 gradation, as follows:

Sieve Size	Percent Passing
1 1/2 in.	100
1 in.	95-100
1/2 in.	25-60
No. 4	0-10
No. 8	0-5

Coarse aggregate with a 1-inch maximum size aggregate may be used if such use represents the common practice of the participating agency.

The coarse aggregate shall conform to the following specific requirements:

	Value
1. Abrasion Loss, Maximum %	50
2. Magnesium Sulfate Soundness, Maximum %	12
3. Thin and Elongated Pieces, Maximum %	15
4. Crushed particles, Minimum %	55
5. Total of deleterious materials including chert, shale, and friable particles, Maximum %	3

It is important that the coarse aggregate meet the highest standard of durability specified by the participating agency. Coarse aggregate

must be obtained from a source approved by the agency and be reasonably free from deleterious substances such as chert, gypsum, iron sulfide, amorphous silica and hydrated iron oxide. Use of aggregate similar in mineralogy to that used in the original pavement is recommended to minimize the effect of possible differences in thermal expansion properties.

Coarse aggregate intended for use in concrete that will be subject to wetting, extended exposure to humid exposure, or contact with moist ground shall not contain any materials that are deleteriously reactive with alkalies in the cement in an amount sufficient to cause excessive expansion of mortar or concrete. However, if such materials are present in injurious amounts, the coarse aggregate may be used with a cement containing less than 0.6 percent alkalies calculated as sodium oxide equivalent or with the addition of a material that has been shown to prevent harmful expansion due to the alkali-aggregate reaction. The potential reactivity should be determined in accordance with the procedures given in AASHTO M80.

Other Items - Other items used in the production of concrete such as water and admixtures shall conform to the requirements normally specified by the agency for interstate concrete pavement construction. Use of micro-silica (silica fume) as an additive is not permitted. Use of additives to accelerate the strength gain of the overlay concrete is not permitted for this experiment.

OVERLAY CONCRETE CONSTRUCTION OPERATIONS

After the final cleaning operation is completed, the existing pavement is ready to be overlaid. The overlay placement operation requires the following activities:

1. Placement of bonding grout, where specified
2. Overlay concrete placement
3. Finishing and texturing of the overlay concrete

4. Curing
5. Jointing - sawing of joints
6. Joint sealing

Grout Application

The neat cement grout shall be applied to the prepared surface of the existing pavement just immediately before placing the overlay concrete. The existing pavement surface must be dry when the grout is applied. The grout should be applied at a rate so that only a thin coat covers the existing pavement surface. If grout puddles or a thick coat forms, then excess grout must be brushed/broomed off.

The grout may be applied through brooming or pressure spraying. If brooming is used, then the grout must be scrubbed on to the surface. Sufficient numbers of broomers must be present to insure that the brooming is done just ahead of overlay concrete placement and distributed evenly over the full width of the pavements. Whether the grout application is done by brooming or by pressure spraying, the length of the pavement treated with the grout shall not exceed 10 feet ahead of the spreader or the slip form paver.

The grout application rate should be such that the grout does not become dry and powdery before it is covered with the overlay concrete. In areas where the grout becomes thoroughly dried, the dried grout shall be removed by sandblasting and fresh grout applied.

Overlay Concrete Placement

The overlay concrete shall be placed full-depth (3 inch or 5 inch nominal thickness) and full-width. At localized areas with deeper surface removal, the overlay concrete should be placed in a single pass. The temperature of the fresh concrete must not exceed 90° F at the time of placement.

Slipform paving equipment shall be used to place the overlay concrete. The slipform equipment shall spread, consolidate, screed, and float-finish the

pavement so that a minimum of hand finishing will be necessary and a well consolidated and homogenous pavement is produced. The machine shall vibrate the concrete for full-width and depth of the concrete.

Steel Reinforcement for Crack Control

Where steel reinforcement is used for reflection crack control, the reinforcement shall be properly supported and held in place to assure a minimum of 2 inch of cover over the reinforcement. The time of placement of the reinforcement shall be such that it does not interfere with the paving operations.

Finishing and Texturing

Finishing and texturing of the overlay surface shall follow the procedures and specifications normally followed by the participating highway agency for concrete pavements.

Curing

Proper curing is very critical for bonded concrete overlays. Immediately after the overlay surface has been textured, the concrete shall be cured using a white-pigmented curing compound, applied at the rate of one gallon per 100 sq. ft. Curing compound shall be applied to the overlay surface within 15 minutes after surface texturing and within 45 minutes after overlay concrete placement.

Jointing

For jointed concrete pavements, transverse joints shall be sawed in the overlay directly over existing joints and over active joints formed by full-depth repairs made during the pre-overlay repair activities. All transverse joints, irrespective of overlay thickness, shall be sawed full-depth of the overlay including any additional milling depth at joints, plus 0.5 inch. The width of the transverse joint shall be equal to or greater than the width of the underlying joint. The sealant reservoir for transverse joints shall be sawed

in accordance with the agency's practice. The centerline longitudinal joint shall be sawed directly over the existing longitudinal joint and shall have a sawcut depth of half the overlay thickness.

It is critical that joints in the overlay be positioned right over the joints in the existing pavement. The mis-match between the joints in the overlay and those in the existing pavement shall not exceed 1 inch. It is therefore required that the locations of joints in the existing pavement be clearly established before placement of the overlay.

Timing of initial saw-cut significantly influence the performance of bonded overlays. To reduce occurrence of secondary cracking, sawing should begin as soon as the concrete is strong enough to both support the sawing equipment and to prevent excessive raveling of the overlay surface. Longitudinal sawing shall be initiated at the same time as the transverse sawing. All sawing shall be completed within 24 hours of concrete placement.

Joint Sealing

Joint sealing shall be accomplished using silicone sealants only. The sealant should be a tooled, no-slump material proven by the agency to work satisfactorily. Neither new or experimental sealants nor field-poured liquid sealants shall be used for test sections. All pavement joints shall be sealed before opening to traffic.

Thickness Tolerance

It is necessary that every effort be made to obtain overlay thickness as close to the target values of 3 and 5 inches as possible. Neither a deficiency nor an excess in thickness is desired. Final overlay thickness shall be within 1/4 inch of the target value as determined from cores and rod and level suvey elevation changes based on before and after measurements. Figure 5 illustrates the locations for elevation measurements to be taken at intervals of 50 foot or less within the test sections, both before and after overlay construction.

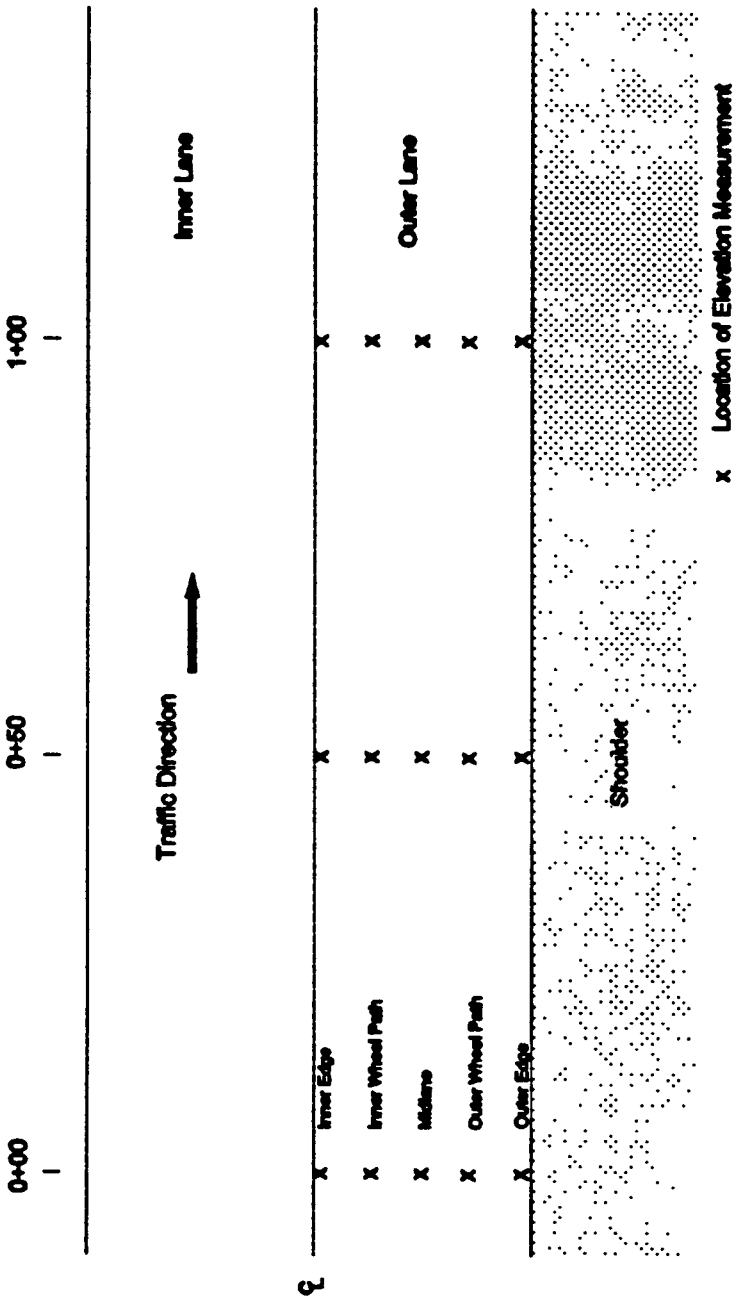


Figure 5. Location of Elevation Measurements.

Pavement Smoothness

The surface of the finished overlay shall be tested with a California-type Profilograph. Profiles shall be made 3 feet from and parallel to each edge of the pavement and from the approximate location of the planned longitudinal joint. The pavement shall have a Profile Index of less than 10 inches per mile over the length of the test section, when evaluated in accordance with California Test 526. The contractor shall remove high pavement areas with vertical deviations greater than 0.4 inch in 25 feet by grinding or multiple-saw devices as approved by the agency.

Shoulder Rehabilitation

Agencies should perform routine repair, maintenance and level up of the existing shoulders as required.

To ensure uniformity between test sites, lane widening and use of tied-concrete shoulder are not permitted in this experiment.

Opening to Traffic

The test sections shall not be opened to traffic until 14 days after concrete placement or until field-cured strength specimens have attained flexural strength of 500 psi, whichever occurs first. No construction traffic will be allowed on the test section until that time. Joints must be sealed prior to opening to traffic.

Construction Operations

Construction operations shall be performed in compliance with the guidelines and specifications established by the participating agency for "Road and Bridge" construction. The agency's high quality construction practice should be enforced for this experiment. Adequate attention should be given to details and control of the mix plant, hauling, placement, and consolidation operations is to prevent construction practices which are known to result in

poor pavement performance. In addition, care should be taken to ensure that the construction of test sections is performed in a manner consistent with normal highway construction.

DEVIATIONS FROM GUIDELINES

An agency that desires to participate in the SPS-7 experiment but finds it necessary to deviate from some of the guidelines described in the report should review these deviations with the SHRP Regional Office or SHRP headquarters. SHRP will assess the implications of these deviations on the study objectives. If the implications of the non-compliance appear minimal, the deviations will be accepted, otherwise SHRP will suggest alternatives for consideration by the participating agency.