Bridge No. 12/915

Snake River Bridge Thin Overlay

WA-RD 101.1

Post-Construction Report
April 1987

Washington State Department of Transportation
in cooperation with the
United States Department of Transportation
Federal Highway Administration

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

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The study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. ABSTRACT
The Washington State Department of Transportation will be conducting experimental field testing of several selected polymer concrete thin overlays over a ten-year period. The polymer concrete material is manufactured by private industry firms and installed on selected bridge decks under standard WSDOT construction contracts. Approximately 14 bridges will be involved in the experiment.

The Snake River Bridge at Clarkston, Washington, Bridge No. 12/915, is the first bridge of the 14 to receive a thin overlay. The polymer concrete used is Flexogrid by Polycarb. The deck was repaired and overlaid in June of 1986.

Work on the thin overlay began on June 8 and was completed on June 20. A total of 6,477 S.Y. of overlay was involved. Traffic was accommodated at all times on the portion of the bridge not being overlaid. Construction progressed relatively smoothly per the inspector's report. The material permitted the contractor flexibility in the rate of installation and in starting and stopping the work. Width of installation was varied to accommodate temporary traffic lanes.

Pavement skid tests and bond tests all proved satisfactory. Ninety-one percent of the resistivity tests exceeded the minimum required by the specifications. The majority of the test points that did not meet the minimum specified occurred at the beginning of the work, where the contractor attempted to apply the material with spray equipment that apparently did not provide accurate proportionate mix of the epoxy components. Subsequent tests and reports will compare delamination, half-cell, chloride content, and rutting values to the original deck survey values.

17. KEY WORDS
Thin overlay, polymer concrete,
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SNAKE RIVER BRIDGE

THIN OVERLAY

Bridge No. 12/915

by
Tom H. Roper
Edward H. Henley, Jr.
Bridge and Structures Branch

POST CONSTRUCTION REPORT
EXPERIMENTAL PROJECT WA 86-02

Prepared For
Washington State Transportation Commission
Department of Transportation
and in cooperation with
U.S. Department of Transportation
Federal Highway Administration

1987

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SYNOPSIS

The Washington State Department of Transportation will be conducting experimental field testing of several selected polymer concrete thin overlays over a ten-year period. The polymer concrete material is manufactured by private industry firms and installed on selected bridge decks under standard WSDOT construction contracts. Approximately 14 bridges will be involved in the experiment.

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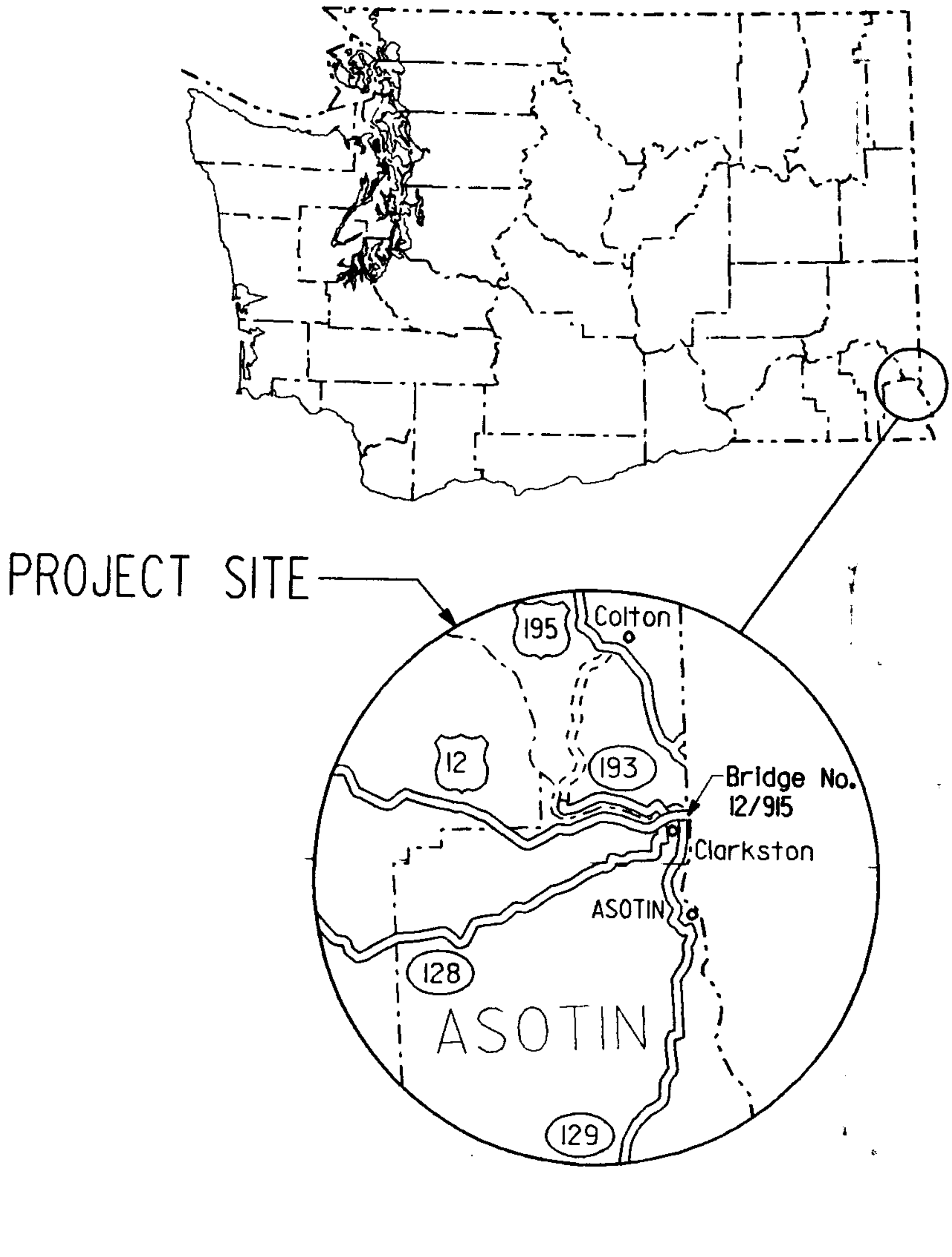
The effectiveness of the overlap will be monitored through skid tests, resistivity tests for determining permeability, and pull-off tests for verifying bond.

VICINITY MAP



TOTAL EXPERIMENTAL PROJECT DESIGN

General Background

Over time, the top few inches of a concrete deck can become contaminated with salt from a saltwater marine environment or from deicing agents used during the winter months. This condition destroys the passivity of the reinforcing steel and provides a favorable environment for the development of corrosive anode-cathode relationships on the surfaces of the reinforcing steel. The salt and moisture in the concrete serve as the electrolyte. A reinforcing bar will corrode at the anodes, with the rust expanding and cracking the concrete. Delaminations and spalls occur in the deck with resulting deterioration.

Latex modified concrete (LMC), low slump dense concrete (LSC), and asphalt concrete with waterproofing membranes are the most common systems being used for bridge deck overlays to restore deteriorated decks and to help prevent further penetration of chloride into the deck concrete. These systems add extra weight to bridges. In addition, the latex modified and low slump concrete overlays require careful quality control during construction, and generally require 96 hours of cure time before traffic can be restored to the structure.

In recent years, polymer concrete (PC) in the form of thin bridge deck overlays has shown promise of providing a long-lasting, maintenance-free deck protection system. It is impervious to the penetration of salt, can be constructed in the field with relative ease and with relatively simple construction equipment, allows traffic to be restored within 1 to 12 hours, and provides good skid resistance. During construction, no scarifying is necessary; therefore, there is less potential for debonding and damage to rebars. These polymer concretes have a cross-linked polymer which replaces Portland cement as a binder in a concrete mix. Epoxy resins are commonly used in polymer concretes, but much attention has also been focused on the use of vinyl monomers such as polyester-styrene, methyl methacrylate, high molecular weight methacrylate, furane derivative, and styrene. Since the polymer constitutes the continuous phase, behavior of the PC will be determined by the specific polymer used.

Purpose

The purpose of the experimental project is to gain knowledge about field installation techniques and procedures, and to assess the performance and effectiveness of the PC thin overlays over time.

General Project Description

WSDOT will select approximately 14 bridges needing deck rehabilitation and protection. The normal delamination and spall repairs will be followed by the application of thin PC overlays (usually 1/4" to 1/2"). These PC overlays will be systems marketed by private industry. The work will be done under usual WSDOT contracts. It is anticipated that separate contracts will be necessary for each bridge. A number of different PC systems will be used on the bridges. Contract documents will specify what type of system each separate bridge will receive. A total of approximately 130,000 ft^2 of bridge deck will be involved in the total study.

Installation of the PC overlay for the bridge deck will be per the manufacturer's recommendations. Contract documents require that a supplier's field representative be present during installation of the system. Complete records of field observations, testing, and subsequent monitoring will be maintained for each installation with emphasis on the cause and resolution of problems which may occur during any phase of the project. The district will be asked to submit an end of construction report on the installation.

Annual inspections and testing of the experimental projects will be made over a ten-year period. The WSDOT Materials Laboratory will have responsibility for all field testing and for reporting on all field activities. See Appendix B for scheduled testing and reporting.

Control Section

The final performance evaluation report for each thin overlay application will include a comparison of the installation techniques and procedures with those for the latex modified and low slump concrete overlays. Likewise, the effectiveness of the permeability for deck protection and length of service life will be compared to the LMC and LSC overlays in similar environments and service conditions.

The current "Bridge Deck Program Development" includes research for "Evaluation of Concrete Overlays for Bridge Applications." It is intended to utilize to the fullest extent possible the data collected and analyzed in that research as the basis for comparative evaluation of the overlays in this experimental feature project.

Tests

Annual inspections and testing of each bridge will be made over a ten year period. The testing will include: 1) friction measurements for skid resistance of the overlay surface; 2) electrical resistivity for waterproofing effectiveness; 3) half-cell for corrosion activity; 4) chloride content for intrusion of corrosive chloride ions; 5) pachometer for rebar depth; 6) pull-off for bond strength; and 7) visual inspection for detection of surface deterioration such as cracks, spalls, or delaminations. The schedule upon which each of these tests will be performed is shown in Appendix B.

Reporting

A post-construction report will be issued within 90 days of the completion of the construction project. Annual Form 1461 reports will be submitted through the WSDOT Research Office to FHWA summarizing the performance of the overlay. The testing results for each year will be reported to the Research Office with a brief letter report summarizing any observations or conclusions that can be made at that point. A final report will be issued at the end of the evaluation period. This report will contain all of the observations, test results, and conclusions from the study along with any appropriate photographs.

SNAKE RIVER BRIDGE PROJECT DESCRIPTION

Existing Deck Condition

The deck has transverse cracks throughout. The average deck chloride content is 2.68 lbs. per cubic yard. Fifty-nine percent (59%) of the samples are greater than

2.0 lbs. per cubic yard. Delaminations are estimated at 1.73 percent of the deck area. Approximately 24 percent of the half-cell samples have negative values greater than 0.200 volts. Approximately 9 percent of the deck has less than one inch cover over the top mat of steel. The deck condition code is 4.

General Project Description

This bridge has a movable lift span. Benefits realized by the use of a thin overlay include less counterweight adjustment work, reduced traffic disruptions, less deck preparation, and a shorter contract time. The structure is 40 feet wide and 1,423.54 feet long for a total deck area of 56,940 sq. ft.

The normal delamination and spall repairs were followed by the application of a thin PC overlay (1/4 inch). This PC overlay was a system marketed by private industry. The work was done under usual WSDOT contract. Contract documents specified the type of system the bridge received.

FIELD INSPECTOR'S POST-CONSTRUCTION REPORT

Snake River Bridge Project Data

Inspector:	Gary Downs, WSDOT
Contract:	3107
State Route:	12
Description:	Snake River Bridge 12/915 Deck Repair
Prime Contractor:	David A. Mowat Company P.O. Box 1201 Bellevue, WA 98009

Deck preparation for the epoxy overlay was performed by:
Western Sandblasting
(Subcontractor to Mowat)

Thin epoxy overlay application was performed by:
David A. Mowat Company

Materials incorporated into the overlay:

1) Flexogrid
Manufactured by: Poly Carb
33095 Bainbridge Road
Solon, OH 44139

2) Aggregate
Source: Pit Site B1 (Steilacoom, WA)
Crushing performed by: Manufacturers Mineral
Renton, WA

Surface covered:

1) 6477 S.Y. which includes:
   a) Bridge deck surface after bridge deck repair
   b) Bridge approach slabs after ACP removal

Poly Carb representatives on site the first day of the epoxy overlay operation:
Frank Reagan - Distribution Manager
Mr. Sudarshan R. Sathe (also on site second day)

See attached report dated July 9, 1986 (Appendix C) for the results of the epoxy overlay testing for this project. In correspondence with the manufacturer's representative concerning the low reading on the resistivity test, he advised that this is similar to the results of a previous project on a bridge over the Chehalis River at Aberdeen. He advised that in four to five weeks, values approaching infinity should be attained, provided that there is no cracking in the epoxy overlay.

Description of the Installation Procedures

A. Deck Preparation
- Cleaning was performed using a portable shot blast cleaning system.
- Contractor covered the expansion joints and drains.

B. Epoxy Mixing Operation
- Ten gallons of Part A and five gallons of Part B were placed in a (1/2) 55 gallon drum.
- The 15 gallon batch was then mixed using an electric drill with an agitation paddle.

C. Epoxy Application Operation
- The 15 gallon batches were then rolled to where they were to be placed, using a cart.
- The mix was then spread on the deck.
- Laborers then spread the epoxy using squeegees.

D. Aggregate Application Operation
- 3000 pound bags of aggregate were transported to the application site by forklift.
- Laborers filled five gallon buckets with the aggregate and then broadcast the aggregate by hand - similar to "feeding chickens."

E. Removed excess aggregate from first lift of epoxy surface by sweeping.

F. Applied second application of epoxy and aggregate similar to B., C., and D. above.

Quality Control Performance of the Contractor

The contractor used two barrels of Component A and one barrel of Component B for serving his mixing operation. In this way he was able to fill three five gallon containers at the same time. This decreased the mixing time and also decreased the chances for proportioning mistakes.

The contractor did not implement any other quality control measures.

Special Construction Procedures or Construction Problems and Any Remedial Actions Taken

The thin epoxy overlay was set up in the plans to be placed in three stages. This allowed two-way traffic to proceed during the epoxy overlay operation; however, it did not allow the contractor access to apply aggregate on the epoxy. To overcome this, the contractor completed only one half of the staged width at a time. This left a working area for his equipment and personnel to complete the aggregate application without stopping traffic.

The contractor attempted to use a spray system to mix the two epoxy components and apply them directly on the deck from the barrels. The contractor was unable to produce the correct proportions on the day they began the overlay. They had been able to produce the correct ratio on an earlier test section. The manufacturer's representatives expressed concern that the spray apparatus might not be capable of continuously furnishing a 2:1 epoxy mixture. The contractor then abandoned the spray concept and reverted to manual mixing and placing operations. The contractor was not allowed to revert back to the spray concept without providing appropriate gauges to insure the proper mixture at all times. Probably the reason the pump worked in one situation and not in the other is that the temperature of the epoxy components was different each time.

During the test section using spray apparatus, there was a potential overspray problem. The contractor did construct a plastic walled movable screen to protect against overspray problems. The contractor also prepared to protect his personnel from vapor hazards by providing extensive protective clothing (disposable coveralls, gloves, rubber boots, face masks, goggles, hoods, etc.).

The contract special provisions stated that, "Thickness of the overlay shall be determined prior to its initial set by using a measuring device provided by the manufacturer that can penetrate the overlay to determine the final thickness." The Poly Carb representatives on site advised that there is no particular instrument for doing this. The WSDOT purchased an awl to perform this measurement, but had little success and abandoned this check system. The rate of application of the manufacturer was adhered to.

The special provisions did not address weather limitations (such as rain, wind, etc.) relative to the epoxy overlay. There were differences of opinion between the contractor's field personnel and WSDOT personnel on a few occasions concerning this matter. A problem did not occur. Weather limitations should be addressed in future PC overlay contracts.

The special provisions left cure time of the overlay both between lifts and prior to traffic up to the manufacturer. The manufacturer's literature provided some guidelines on set time versus ambient temperature. The manufacturer's representatives on the job site on the first day of the overlay application gave verbal recommendations for much less time than indicated in the literature. This also caused confrontations between WSDOT and contractor personnel. With incentive pay involved, this can become a controversial issue.

The manufacturer's literature for the Mark-163 (Flexogrid) Overlay lists the following application rates:

Liquid

First Application:	40 square feet per gallon
Second Application:	30 square feet per gallon

Aggregate

First Application:	10 pounds per square yard
Second Application:	14 pounds per square yard

The contractor was unable to get over 20 square feet/gal. coverage on the second application due to the very coarse nature of the surface from the first application. Therefore, he applied the maximum coverage he could on the first lift which was 50-55 square feet/gal. He then applied the 20 square feet/gal. coverage on the second application. This seemed to work. However, these rates were directly related to temperature, in that when the temperature was higher the spread rate was high and when the temperature was lower the spread rate was lower.

The special provisions called for a 1/8 inch in 10 feet straight edge tolerance both parallel and transverse to centerline behind the epoxy overlay. Significant wheel rutting was present in the existing lanes. This could have caused a considerable overrun in the overlay materials needed to satisfy the 1/8 inch in 10 feet straight edge requirement transversely to centerline. The state prepared Change Order No. 1 to eliminate this requirement.

Operational Observations

A flatbed truck was used to carry 55 gallon barrels of epoxy. This truck traveled immediately ahead of the epoxy spreading operation. The contractor placed spigots in one barrel of "B" component and two barrels of "A" component. These barrels were laid on their sides at the end of the flatbed. A sheet of plastic was attached to the end of the flatbed and was allowed to trail behind the truck. This prevented unmixed epoxy components from contaminating the prepared deck ahead of the epoxy application.

Construction Time for the Installation and Complete Cure-Setting Time of the Polymer Concrete

The contractor's basic plan was to complete 1/2 of each stage on consecutive days. On the following day the contractor would implement the next staged traffic control plan and begin deck preparation for that stage. The next two days were intended to complete the epoxy overlay for that stage, and so forth. However, the scheduling and staged limits were revised to accommodate the specific situation. The following is an actual account of the times involved in the application of the thin epoxy overlay.

On June 9, 1986, the contractor began a test pass on Stage 1, the right 7 feet, from Sta. 1551+29 to 1552+84. They started at 3:30 p.m. and finished at 4:15 p.m.

On June 10, 1986, the contractor began work at 8:20 a.m. at Sta. 1550+39.5 on the right side of Stage 1 (7 feet wide) and continued to Sta. 1551+29. Then they skipped over the test pass they did the day before and resumed again at Sta. 1552+84. They then went 7 feet wide to the end of the approach slab at Sta. 1565+00. They finished this first lift at 11:33 a.m. The same day, they went back to Sta. 1550+39.5 at 1:15 p.m. and began the second lift. They finished it at Sta. 1565± at 6:45 p.m. The shot blasting had started at 7 p.m. Sunday, June 8, 1986 for the above section and was completed at about 10:30 a.m. on June 9, 1986.

On June 10, 1986, at about 7 p.m., they began to shot blast for a second pass 8 feet wide on Stage 1 which would be to the right of centerline 5 feet to 13 feet from Sta. 1550+39.5 to 1565±. They had a lot of trouble because of having to cut so deep to clean the surface. Delays in the deck preparation were also caused by an equipment breakdown, and because someone knocked down all the traffic control cones.

Because of the shot blaster's problems, the epoxy crew didn't get started until about 10 a.m. on June 11, 1986. They began at Sta. 1550+39.5 with the same 8-foot wide pass 5 feet to 13 feet right of centerline that the shot blaster had just finished. They epoxied to Sta. 1559+85 at 1:45 p.m. The shot blasters were in their way at that time and what they had just put down was not cured well enough to begin the second lift, so they waited until 2:37 p.m. Then they set back to start the second lift at Sta. 1550+39.5 and went to Sta. 1559+85 again. The shot blaster was done by then so they went straight ahead on the first lift 8 feet wide from Sta. 1559+85 to the end at 1565±. At this point, all of Stage 1 except for an 8-foot wide pass from Sta. 1559+85 to 1565± 5 feet to 13 feet right of centerline on the second lift was complete. The contractor went to work at 5 a.m. on June 12, 1986 without informing the state of the change in start time. When we arrived at 7 a.m., they were almost finished with what had been left off Stage 1 on the previous day. They finished it at 7:30 a.m. Traffic was allowed on this section at 5:30 p.m. the same day. The shot blasters came in to start on Stage II at 6:00 p.m. They were able to begin placing epoxy again at 10:06 a.m. on June 13, 1986 at Sta. 1550+39.5 on Stage II from 12 feet to 20 feet left of centerline. This was an 8-foot wide pass. They finished this pass at Sta. 1565+00 at 12:12 p.m. At 1:50 p.m. they began the second lift of the same area and finished it at 4:50 p.m.

They had planned to work on Saturday, June 14, 1986 but rain prevented it. They didn't work Sunday, June 15, 1986.

On June 16, 1986 at 7:56 a.m., they started to epoxy the second half of Stage 2. The first lift began at Sta. 1550+39.5, four feet to 12 feet left of centerline (an 8-foot wide pass). They finished at Sta. 1565± at 10:06 a.m. At 12:10 p.m. they began the second lift in the same area and finished it at 3:25 p.m.

The shot blaster worked June 17, 1986.

Rain shut the contractor down on June 18, 1986.

On June 19, 1986, they began laying epoxy on Stage III. It was 56 degrees F. when they started at 9:14 a.m. They began at Sta. 1550+39.5 (from 5 feet right of centerline to 4 feet left of centerline) and finished the first lift at 12:15 p.m. at Sta. 1565±.

The second lift in this area was started at about 2:15 p.m. and was finished at 5:45 p.m. This finished all epoxy work on the contract. We opened this section to traffic at 7 a.m. on June 20, 1986.

CONCLUSIONS

General

The Snake River Bridge at Clarkston, Washington, Bridge No. 12/915, is the first bridge of the 14 to receive a thin overlay. The polymer concrete is Flexogrid by Polycarb. The deck was repaired and overlaid in June of 1986.

Work on the thin overlay began on June 8 and was completed on June 20. A total of 6,477 S.Y. of overlay was placed. Traffic was maintained at all times on the portion of the bridge not being overlaid. Construction progressed relatively smoothly per the inspector's report. The material permits the contractor flexibility as far as rate of installation and starting and stopping the work. Width of installation lanes could be adjusted to accommodate temporary traffic lanes.

Pavement skid friction tests and bond tests all proved satisfactory. Ninety-one percent of the resistivity tests were satisfactory. Subsequent reports will compare delamination, half-cell, chloride content, and rutting values to the original deck survey values.

The effectiveness of the overlays will be monitored through skid tests, resistivity tests for determining permeability, and pull-off tests for verifying bond.

Problem Areas

1. An instrument needs to be developed that can be used conveniently to determine the final overlay thickness. The on-site manufacturing representative advised that there is no specific tool or instrument for doing this.

2. Weather limitations that can affect the laying and curing of this overlay need to be spelled out more specifically in the contract. There were differences of opinion between the contractor's field personnel and WSDOT personnel on a few occasions concerning this matter.

3. The cure time of the overlay between lifts and prior to traffic use needs to be addressed more specifically in the contract. If incentive pay to the contractor is involved, this can become a controversial issue.

4. The contract should address whether wheel rut areas are to be filled to provide a level surface. Where leveling is warranted, it should be considered in developing quantities for bidding, or should be provided for in the payment provisions (e.g., force account).

7/BR-12

APPENDIX A

EXPERIMENTAL BRIDGE DECK

THIN OVERLAY PROJECTS

EXPERIMENTAL BRIDGE DECK THIN OVERLAY PROJECTS*

		FED. AID PROJECTS	DIST.	DECK AREA (FT.2)	DECK RATING	BID OPENING	CONT. NO.	SYSTEM TYPE	DOLLARS PER SQ. YARD
1.	403/7	GRAYS R. ROSBURG	4	5,360	7	02/05/86	3090	DEGUSSA	35
2.	12/915	SNAKE R. CLARKSTON	5	56,940	4	03/05/86	3107	FLEXOGRID	40
3.	82/114S	YAKIMA R.	5	11,370	3	05/07/86	3131	CONCRESSIVE 2020	77
4.	82/115S	NACHES R.	5	11,370	4	05/07/86	3131	CONCRESSIVE 3070	77
5.	900/12W	SR 5 OC	1	13,950	5	08/27/86	3189	FLEXOLITH	---
6.	900/13W	SR 5 OC	1	13,950	4	08/27/86	3189	SIKA PRONTO 19	---
7.	5/316	CUSTER WAY UC	3	6,190	4	---	---	EPI/FLEX 111	---
8.	5/523E	S. 154TH ST. OC	1	7,300	6	---	---	CONKRYL	---
		NON-FED. AID PROJECTS							
9.	167/102	THIRD AVE. SW OC	3	7,216	7	01/15/86	3078	FLEXOGRID	---
10.	167/104	ELLINGSTON RD. OC	3	7,172	7	01/15/86	3078	FLEXOGRID	---
11.	167/106	FIRST AVE. N OC	3	6,424	7	01/15/86	3078	FLEXOGRID	---
12.	161/10	SR 512 OC	3	11,120	7	02/26/86	3100	EPI/FLEX 111	40
13.	167/21	MILWAUKEE AVE. OC	---	---	---	---	---	---	---
14.	512/40	SR 167 OC	---	---	---	---	---	---	---

*A total of 14 bridges have presently been planned for the total study.

APPENDIX B

TESTING AND ANALYSIS COSTS

THIN OVERLAY EXPERIMENTAL PROJECT *
TESTING AND ANALYSIS COSTS PER 13,000 ft.^{2} BRIDGE ***

Responsible Unit	Work Item	Pre-Construct.	Post-Construct.	Year* 1	2	3	4	5	6	7	8	9	10	Totals
HQ ML	Friction Testing (x hrs) at $100/hr		(1 hr) $ 100	(1 hr) $ 100	(1 hr) $ 110	(1 hr) $ 121	(1 hr) $ 133	(1 hr) $ 146	(1 hr) $ 161	(1 hr) $ 177	(1 hr) $ 195	(1 hr) $ 215	(1 hr) $ 237	$ 1,695
HQ ML	Electrical Resistivity (x hrs) at $108/hr		(6 hrs) $ 648	(6 hrs) $ 648	(6 hrs) $ 713	(6 hrs) $ 784		(6 hrs) $ 948		(6 hrs) $1,147			(6 hrs) $1,527	$ 6,415
HQ ML	Half-Cell Testing (x hrs) at $108/hr	(8 hrs) $ 864				(1 hr) $ 131				(1 hr) $ 192			(1 hr) $ 255	$ 1,442
HQ ML	Chloride Testing (x hrs) at $108/hr	(2 hrs) $ 216				(1 hr) $ 131				(1 hr) $ 192			(1 hr) $ 255	$ 794
HQ ML	Rebar Depth (x hrs) at $108/hr	(2 hrs) $ 216												$ 216
HQ ML	Bond Testing (x hrs) at $108/hr		(2 hrs) $ 216	(2 hrs) $ 216		(2 hrs) $ 262							(2 hrs) $ 510	$ 1,204
HQ ML	Visual Observation (x hrs) at $108/hr		(2 hrs) $ 216	(2 hrs) $ 216	(2 hrs) $ 238	(2 hrs) $ 262		(2 hrs) $ 317		(2 hrs) $ 384			(2 hrs) $ 510	$ 2,143
**HQ Br. Branch & ML	Analysis & Report Writing (x hrs) at $27.50/hr		(40 hrs) $1,100	(8 hrs) $ 220	(8 hrs) $ 242	(8 hrs) $ 266	(4 hrs) $ 147	(8 hrs) $ 322	(4 hrs) $ 177	(8 hrs) $ 389	(4 hrs) $ 214	(4 hrs) $ 236	(40 hrs) $2,590	$ 5,903
	TOTALS	$1,296	$2,280	$1,400	$1,303	$1,957	$ 280	$1,733	$ 338	$2,481	$ 409	$ 451	$5,884	$19,812
TOTAL CONTRACT FUNDING			$3,576											-3,576
								TOTAL EXPERIMENTAL PROJECT FUNDING						$16,236

* 10% Annual Inflation Rate Assumed.

** Field data reporting will be by Mats Lab (ML).
Analysis of data and final report by Bridge Branch.

*** Multiply all costs shown on this sheet by 7.8 (101,388/13,000 = 7.8) to obtain estimated costs for the Hood Canal Bridge East Half 104/5.2 thin overlay project.

1:BR-12

APPENDIX C

TEST RESULTS

DOT

Washington State
Department of Transportation

INTRA-DEPARTMENTAL COMMUNICATION

JUL 1986
Dept. of Trans.
Mailroom
Dist. 5

DATE: July 9, 1986

FROM: A.J. Peters/R. Schultz

PHONE:

SUBJECT: Contract 3107
Snake River Bridge 12/915
Epoxy Overlay Testing

TO: J. Buss/K. Lockwood

Attached are the test data required by the special provisions on the above subject project concerning the epoxy overlay.

The friction testing required an average of 50 for tire test in each lane. Our results show 70 in lane 1, 69 in lane 2, 74 in lane 3 and 77 in lane 4.

The bond tests required an average of 5 tests in each lane to be 300 psi or break in the old concrete. All of the bond tests except one broke with greater than 40% of the break in old concrete. The one test that had 5% breaks in the old concrete had a bond strength of 350 psi. Therefore we consider the tests to either have broken in the old concrete or are greater than 300 psi.

The waterproofing effectiveness required 70% of readings to be greater than 250,000 Ω with no single reading below 100,000 Ω. We had a total of 77% of the readings above 250,000 Ω but we had 94 single readings out of a total of 1008 readings less than 100,000 Ω.

If we can be of further assistance please let us know.

AJP:tlw
RLS
Attachments

T32/010

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

Project Cont. 3107 Snake River Bridge 12/915 Sheet No........ of........ sheets

S.R. 12 Made by R.L. Schultz Check by.................. Date 6-26-86 / 6-26-86 Supv...............

Bond Pull Off Tests

Sta.	Offset	Thickness	Load	P.S.I.	Comments
1552+25	15 5/' Lt. ℄	1/4"	1000 lbs	318	100% Break in old conc.
1553+75	15' Lt. ℄	1/4"	1400 lbs	446	100% ″ ″ ″ ″
1556+15	15' Lt. ℄	1/4"	750 lbs.	239	100% ″ ″ ″ ″
1558+75	15' Lt. ℄	1/4"	1000 lbs	318	100% ″ ″ ″ ″
1561+25	15 5' Lt. ℄	1/4"	600 lbs	191	70% ″ ″ ″ ″
1563+75	15' Lt. ℄	1/4"	250 lbs.	80	85% ″ ″ ″ ″
1554+02	16' Rt. ℄	1/4"	1400 lbs.	446	100% ″ ″ ″ ″
1556+57	16' Rt. ℄	1/4"	750 lbs	239	100% ″ ″ ″ ″
1559+82	16' Rt. ℄	1/4"	1100 lbs	350	5% ″ ″ ″ ″
1561+67	16' Rt. ℄	1/4"	700 lbs.	223	100% ″ ″ ″ ″
1564+12	16' Rt. ℄	5/16"	750 lbs.	239	75% ″ ″ ″ ″
1553+17	8' Rt. ℄	1/4"	1100 lbs	350	100% ″ ″ ″ ″
1555+72	8' Rt. ℄	1/4"	450 lbs.	143	broke in epoxy bond to cap
1558+27	8' Rt. ℄	1/4"	750 lbs.	239	100% Break in old conc.
1560+82	8' Rt. ℄	1/4"	875 lbs.	279	40% ″ ″ ″ ″
1563+27	8' Rt. ℄	1/4"	700 lbs.	223	75% ″ ″ ″ ″
1552+32	4' Rt. ℄	1/4"	500 lbs	159	100% ″ ″ ″ ″
1554+87	4' Rt. ℄	1/4"	800 lbs.	255	100% ″ ″ ″ ″
1557+42	4' Rt. ℄	1/4"	450 lbs.	143	100% ″ ″ ″ ″
1559+97	4' Rt. ℄	1/4"	650 lbs.	207	90% ″ ″ ″ ″
1562+52	4' Rt. ℄	1/4"	1100 lbs.	350	100% ″ ″ ″ ″

PAVEMENT SKID TESTER

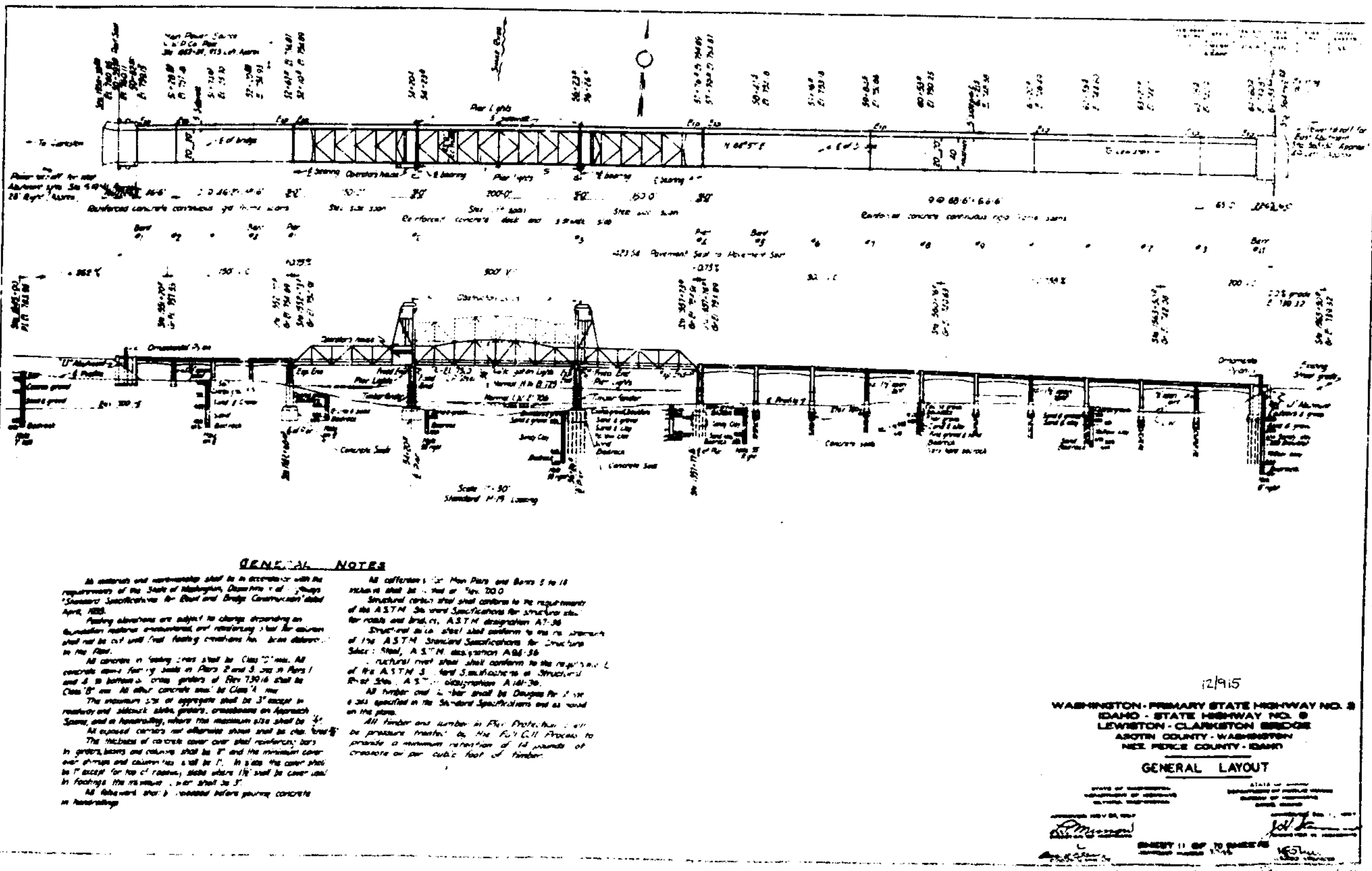
DISTRICT CONTROL SECTION ROUTE 12 WEATHER 1 6/26/86

PATH	POSTD	LANE	# LNS	SURF	MISC	DIRCT	INCLN	TEMP	TF RO AR CC TE	VF EO RR TC E	AS DK JI D	US NK AI DD J	SPEED	TO ED SO TM	FLOW	LA AC TC RE LL	CASST	ERRS
2	35	1	2	6	1	3	-131	48	712	1041	682	685	36	039	249	01		
2	35	1	2	6	1	3	-131	48	726	1013	712	717	35	071	238	01		
2	35	1	2	6	1	3	-131	48	721	1016	705	710	35	101	228	01		
2	35	1	2	6	1	3	-131	48	713	1028	692	695	36	132	238	00		
2	35	1	2	6	1	3	-131	48	699	1010	689	692	36	163	237	01		
2	35	1	2	6	1	3	-131	48	714	1030	693	694	37	195	237	00		
2	35	1	2	6	1	3	-131	48	716	1009	710	711	37	232	238	01		
2	35	1	2	6	1	3 4	-131	44	710	1050	676	677	37	264	238	00		
2	35	1	2	6	1	4	-131	44	666	1016	651	656	35	967249	237	01		
2	35	1	2	6	1	4	-131	44	681	1013	667	673	34	967217	229	02		
2	35	1	2	6	1	4	-131	44	696	1004	687	693	34	967188	218	00		
2	35	1	2	6	1	4	-131	44	706	1014	691	697	34	967156	218	00		
2	35	1	2	6	1	4	-131	44	745	1002	738	744	35	967126	228	02		
2	35	1	2	6	1	4	-131	44	723	1029	702	703	37	967094	238	00		
2	35	1	2	6	1	4	-131	42	704	1030	684	684	38	967062	251	01		
2	35	2	2	6	1	3	737	44	791	1035	766	765	39	1023	252	01		
2	35	2	2	6	1	3	737	44	738	996	736	742	35	1055	237	01		
2	35	2	2	6	1	3	737	44	746	1007	729	741	31	1083	216	00		
2	35	2	2	6	1	3	737	44	792	1018	770	779	33	1110	210	01		
2	35	2	2	6	1	3	737	44	738	1008	731	733	37	1140	231	01		
2	35	2	2	6	1	3	737	44	783	1012	768	774	35	1171	235	00		
2	35	2	2	6	1	3	737	44	700	1002	692	698	34	1201	229	01		
2	35	2	2	6	1	3	737	44	750	1002	741	748	34	1230	229	01		
2	35	2	2	6	1	3	737	43	717	1010	703	711	33	1259	218	00		
2	35	2	2	6	1	4	380	43	762	1012	747	754	34	984	203	00		
2	35	2	2	6	1	4	380	43	768	1004	762	766	36	955	231	00		
2	35	2	2	6	1	4	380	43	772	994	772	778	35	924	238	02		
2	35	2	2	6	1	4	380	43	766	996	763	770	34	895	227	01		
2	35	2	2	6	1	4	380	43	744	1006	734	740	35	866	223	00		
2	35	2	2	6	1	4	380	43	813	1003	809	811	37	835	238	01		
2	35	2	2	6	1	4	380	43	757	1003	755	756	38	803	251	00		
2	35	2	2	6	1	4	380	43	750	999	750	751	38	770	263	01		

Lane 1 Avg. 69.5 $\sigma = 1.30$
Lane 2 Avg. 69.3 $\sigma = 2.76$
Lane 3 Avg. 74.3 $\sigma = 2.72$
Lane 4 Avg. 76.6 $\sigma = 2.18$

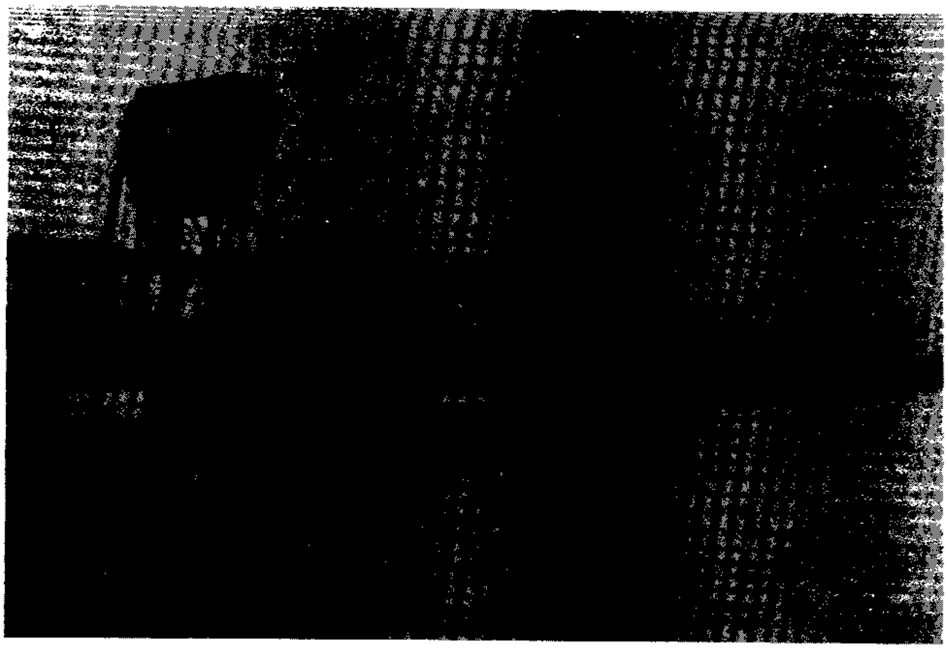
APPENDIX D

GENERAL LAYOUT

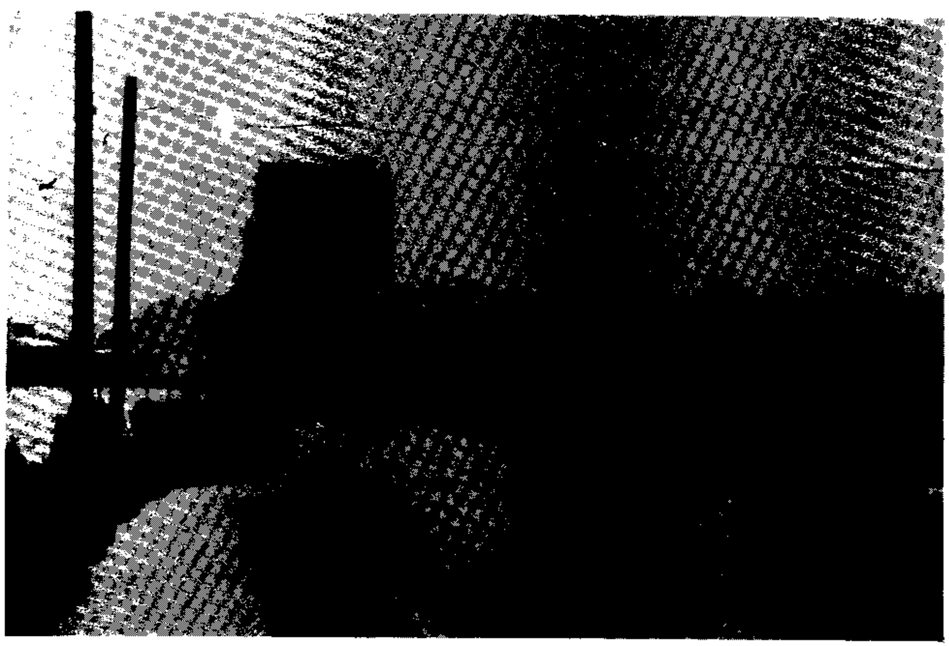

GENERAL NOTES
Scale 1" = 30'
Standard H-15 Loading
Concrete Seals
Pier Lights
Operators House
Reinforced concrete continuous rigid frame spans
12/915
WASHINGTON - PRIMARY STATE HIGHWAY NO. 3
IDAHO - STATE HIGHWAY NO. 9
LEWISTON - CLARKSTON BRIDGE
ASOTIN COUNTY - WASHINGTON
NEZ PERCE COUNTY - IDAHO
GENERAL LAYOUT

APPENDIX E

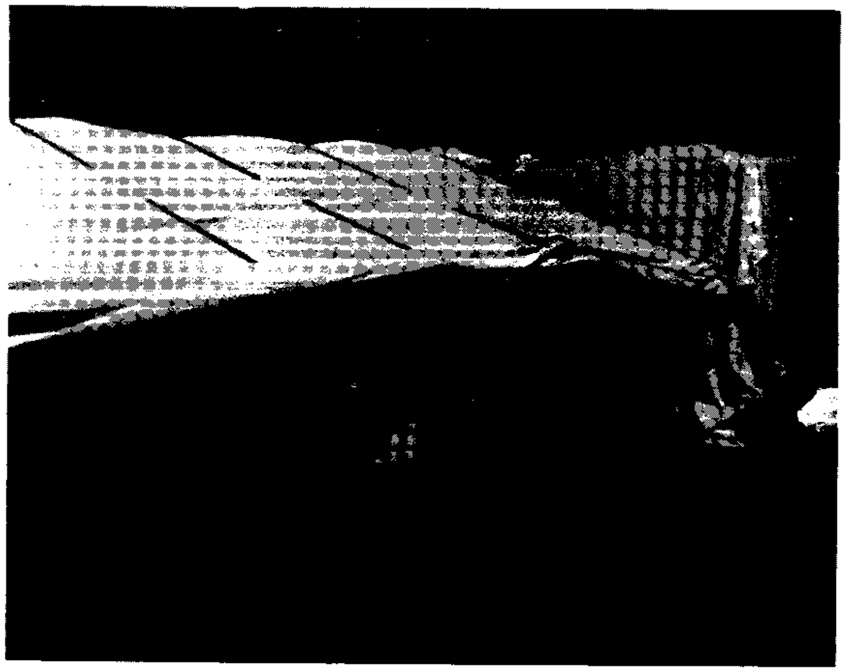
SNAKE RIVER PROJECT PHOTOGRAPHS



Elevation View, Snake River Bridge Lift Span

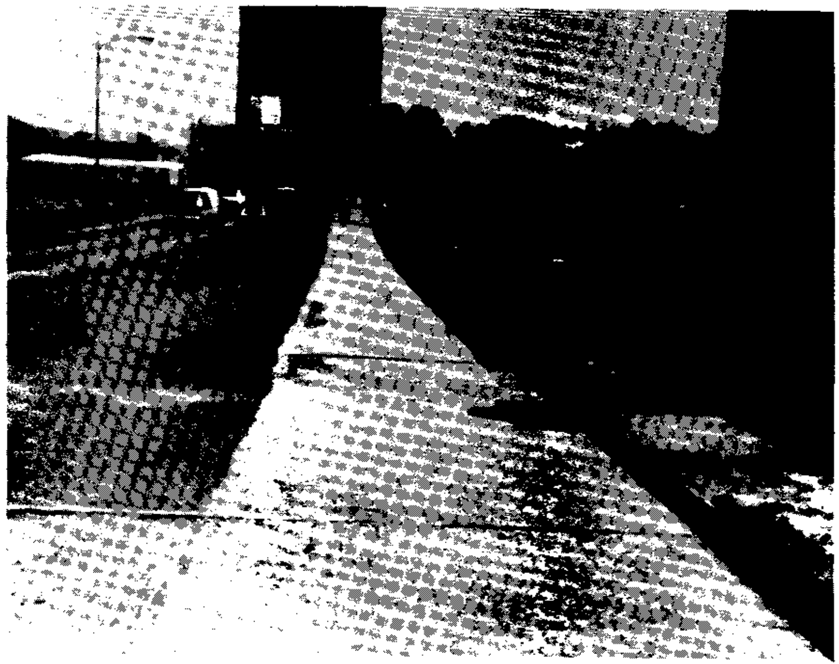


Longitudinal View of Bridge Showing Traffic Control

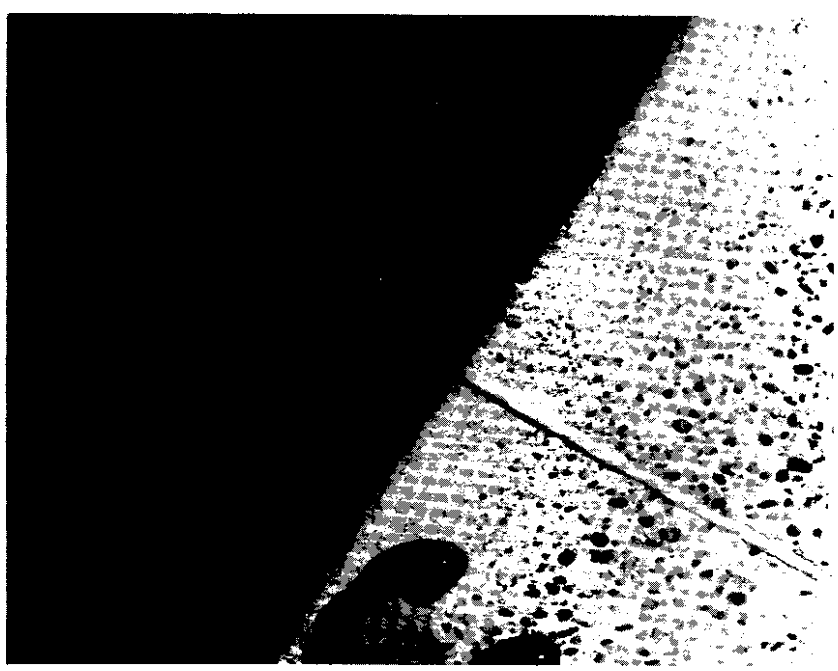


Epoxy Storage on Job Site

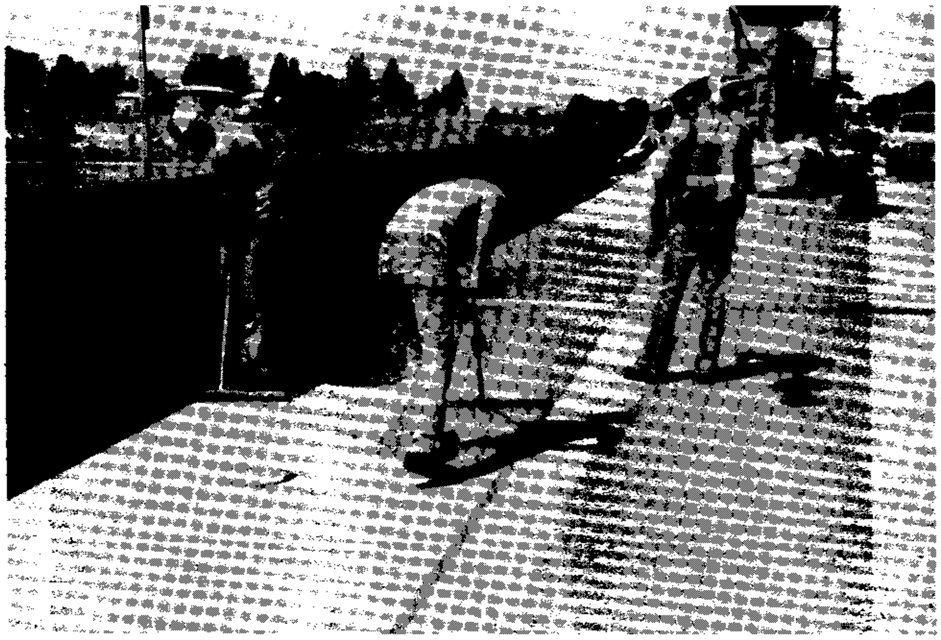
Aggregate Delivered to Job in Large Bags



1/2 Stage 1 After Shot Blasting

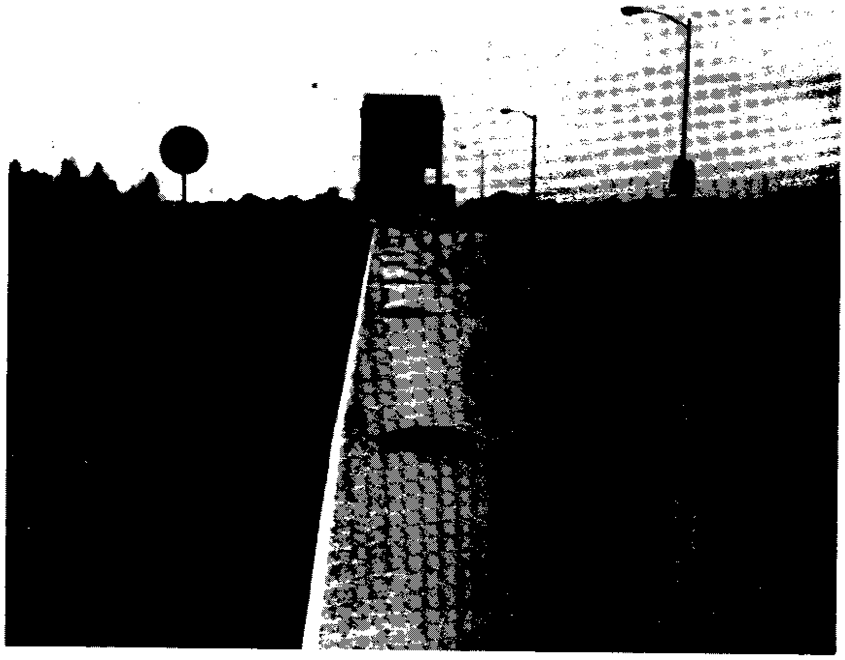


Joint and Surface After Shot Blasting

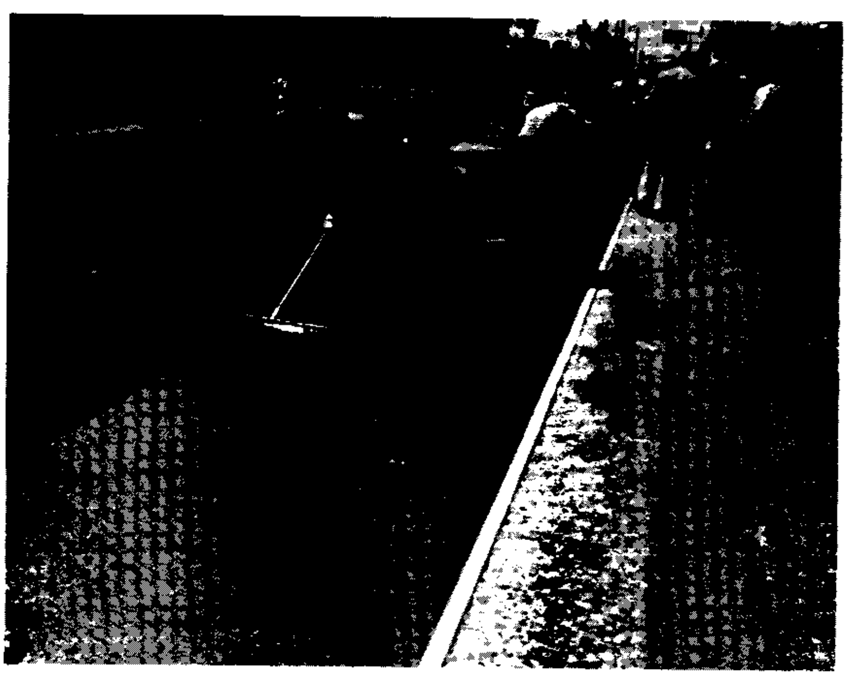


Stage 1 Epoxy Spreading by Squeegee

Stage 1 Epoxy Spreading and Aggregate
Spreading by Hand



First Lift Complete on 1/2 of Stage 1
(Note Tape Edge and Surplus Aggregate)



Beginning Second Lift of Epoxy Application

Shows Final Texture